Drivers of behavioral change and non change in transition times

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Groupe International d'Experts sur les
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Drivers of behavioral change and non change in transition times

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Foreword
Why the IpBc/GIECo? Why now?

Jacques Fradin
IpBc/GIECo Chairman & Co-Founder

Dear Reader,

Welcome to the first volume of the first report by the IpBc/GIECo, the International Panel on Behaviour Change (Groupe International d'Experts sur les Changements de Comportement.) This text that you are about to read is much more than the first instalment of our first main report: it marks the birth of a genuine scientific ambition for transdisciplinary integration, on the one hand, but also for societal impact, on the other. The aim is to establish a genuine benchmark 'institution' dedicated to the Human Factor on a societal scale, and more specifically in the service of the major Transitions of our time.

Even though the idea of the need for our human ecosystem to have a genuine "IPCC of Behaviour" to accompany the Transition had been obvious to me since the early 2000s, it was only in 2018 that I understood, if not admitted, that someone had to "decide to take action" to initiate the movement. So, I suggested to relatives to put together a scientific collective to draw up a "Manifesto for an IPCC on Behaviour", and was soon joined by Dr Camille Lefrançois, Stéphane La Branche, Patrick Légeron, Didier Naud and Professors Philippe Van Den Bosch and Alain Berthoz. A huge thank you to them for their active contribution and invaluable notoriety, if not celebrity, in convincing and engaging our readers. This Manifesto was more specifically intended to attract the attention of behavior sciences researchers from all disciplines from all over the world and to bring them together.

But its signature was open to as many people as possible, in order to underline the interest and active support of all stakeholders to better understand and promote the conditions for the emergence of more sustainable behaviors and more broadly the conditions for making the Human Factor a key factor for the success of all transitions (ecological, of course, but also social, societal, professional, etc.).

Less than a year later and with over a thousand signatures from scientists and experts from all behavioural disciplines and beyond, in 76 countries on 5 continents, we invited an international and interdisciplinary representative group of behaviour scientists to Paris.

This group met twice, in October 2019 and February 2020. These meetings were hosted and invited by UNEP (United Nations Environmental Program, Paris). Further than a simple Manifesto to obtain an institutional response, the IpBc/GIECo was created at that moment, as an international association, its basic objectives and operating modes created.

From then on, the mission assigned to the fledgling IpBc/GIECo was to use the many different behavioural sciences to shed light on the conditions that need to be put in place to initiate such changes on a global scale, involving all sectors of activity and all stakeholders, at individual, collective and organisational levels.

Our initial priorities were to:

1/ Draw inspiration from the ambitions, organisations and operating methods, as well as the strengths and weaknesses, of comparable institutions such as the IPCC, IPBES and the WHO.

2/ Create the IpBc/GIECo structures to guarantee its success and sustainability:

- To ensure its attractiveness not only to scientists but also to all other stakeholders, without whom we would have neither relevance nor impact.

  But also to securise its independence, through an associative framework allowing a large collection of donations all around the world, to give it the total freedom of thought, production and publication ("unfiltered") necessary for serene and objective work, all the more so as the subject (us) is very "sensitive".

  To share our own ability to extricate ourselves from our own (inevitable) cultural and methodological biases. Transdisciplinary governance will be a source of self-regulation, within a framework of scientific rigour and openness to different schools of thought.

  To design process of transparency and ethics.

  To offer free and open access to all citizens and stakeholders to all its productions and publications, which can be downloaded from its own website.

  And finally to build its credibility and position as a 'reference' on the Human Factor in Transitions, recognition that will be essential to facilitate and secure the action and position of decision-makers who wish to implement such large-scale actions in our societies.

- To this end, we set up the "constituent" structures of our governance (Board of Directors and various committees, executive governance), defined the conditions for being a voter, including the required scientific or expert status, that of being an active member or former active member of the IpBc/GIECo, according to procedures that will guarantee the sustainability of the IpBc/GIECo's ambitions.

  We have defined the group of authors/writers/co-ordinators of the reports, on the one hand, and the members of the future transdisciplinary research group, which will in particular carry out meta-analyses of a totally unprecedented cross-disciplinary nature, in order to bring out robust and early indicators and trajectories enabling research or investment strategies to be directed with a better knowledge of the facts (in terms of probabilities). Together, they form Working Group 1 (WG1) of the IpBc/GIECo.

- To ensure and sustain our development, we quickly created an "Alliance for the IpBc/GIECo", open to all stakeholders in all countries.

Its primary role is to establish a structured channel of communication with WG1, to draw its attention to issues, challenges or operational experiments already being carried out in the field, while having no power to veto or exert pressure on WG1. We already have or are going to set up various working groups (WG2 for economic players, WG3 for institutions and NGOs, WG4 for health players, WG5 for players in the fields of culture, education, training, information, etc.), to share difficulties/experiments/expectations, or even enable them to take part in territorial or organisational experiments proposed by the WG1 scientists.

The Alliance's second role is, of course, to support the IpBc/GIECo, providing it with sustainable and diversified resources for its work as much as for the Alliance itself, through financial and/or operational levers such as the provision of human or technological resources.

Through tax exemption schemes in as many countries as possible (as we develop).

3/ Clarify our ambitions and make them intelligible, desirable and unavoidable: in terms of our productions, how can they be defined in terms of what and why?

- To build up a state of the art including, in an evolutive way, all the disciplines of behaviour, from the most fundamental to the most applied, from the most directly dedicated to this study to the most indirectly linked (but where the H.F. has, in fact, a major impact on the functioning of things... and dysfunctions).

- However going well beyond simple multidisciplinary capitalisation/aggregation (a kind of one-stop-shop for behavioural sciences in relation to transitions for all players and citizens in society), i.e. in the sense of true integration (transdisciplinarity, meta-disciplinarity). This changes the way each discipline looks at the others (methodologies, concepts, tools, impacts, feedback), leading to convergence and the emergence of vast meta-disciplines, themselves under the umbrella of THE «Science of Behaviour». Just as there is Medicine, Physics, Chemistry, Biology or more recently Climate, etc...
  Which reminds us that the division of reality into disciplines is a methodological and pedagogical artifice, designed to enable us to simplify the issues studied and then taught, initially. Artificial fragmentation of problems, which then needs to be overcome (at least in research and operational or even programmatic strategy) to return to what might be the 'continuous reality' that underlies them (systemic vision, which reminds us that 'the map or even all the integrated maps are not the territory').
  The history of knowledge and science illustrates that no major conceptual (r)evolution has ever taken place without crossing fields of knowledge.

- And to create the appropriate organisation to enable this qualitative/quantitative, if not 'quantum', leap to emerge and be shared (a change of nature... in fact, a simple return to the nature of things, as an old Japanese adage springs to mind:
  "*the common man sees the mountain, the student does not see the mountain, the wise man sees the mountain*")!

Understandably, the aim of this is to change as quickly and profoundly as possible the way we research, understand, model, share and use knowledge about ourselves (knowing that we are at the centre of everything and the final recipient of everything) in the real world.

To put an end once and for all to the 'shoemaker in the wrong shoes' syndrome! Or the famous "***Bloody Human Factor***" invoked by Hubert Reeves!

So let's summarise the institutional context in which we are trying to place the IpBc/GIECo.

The IPCC deals with climate and climate change, including anthropogenic change... but is clearly not the best placed to study the human factor that produces it, even if we can only welcome the fact that it is trying to include a working group on the subject!
The IPBES deals with biodiversity and its evolution, including anthropogenic evolution... with the same legitimate difficulties in studying, understanding and changing the human behaviours implied.

The WHO is concerned with the health of individuals and populations... but this does not yet include the study of the health of societies and organisations since it considers societies only as organisations but not as a sum of individuals.

All three (and many others) come up against the same 'glass ceiling': their respective prescriptions... are insufficiently followed up, and they don't really understand why, or how to solve the problem. It's not their area of study.

So what we really need is an IpBc/GIECo to finally study the health and agility of our human societies as a collective and an organisation (in much the same way as a 'good' football team is not just the sum of 'good' players and a 'good' film is not just the sum of 'good' actors).

4/ Clarifying our fields of action: let's sketch out what could be the major fields of exploration of our human social behaviour, its determinants and modalities in the context of transitions (which, incidentally, increasingly occupy our entire living environment).

How can we really explore the mechanisms that produce the observable variations in our individual and collective behaviour?

In medical epidemiology, for example, we know that 90% (on average) of the causes of health or disease are due to interaction with our environment (in the broadest sense of the term, everything that is not genetic). And even 95%, because a further 5% are due to epigenetics, which certainly modulate gene expression, but does so as a function of our early environment.

That leaves just 5% of true genetic determinism! And these figures apply to both physical and mental health.

The role of the IpBc/GIECo, as a transdisciplinary scientific group dedicated to studying our collective capacity to adapt and develop in a context of major and complex change, will undoubtedly include a comparable hierarchy of causes and strategies for dealing with them, ranging from 'deep' actions, from the most symptomatic, superficial and yet more costly and/or restrictive (a wide-ranging debate on what is currently blocking support for and commitment to sustainability), or to put it more precisely:

- **Primary Prevention actions**: how to create the conditions for the emergence (i.e. "spontaneous") of such collective capacities, by facilitating, from early childhood and throughout life, learning, experience but also aptitudes or agility to cooperate, innovate and adapt (rather than persevering in the face of failure by doing "more of the same" such as denial, conflict, predation...). In this first case, the thinking and action methods would stem from the identification of factors favourable or unfavourable to the emergence of societies capable of interacting proactively with their environment, in the very broad sense of the term (environmental, societal, technological).
- **Secondary or Tertiary Prevention**: that of collective capacities for adaptation, more targeted at specific (vulnerable) populations, in terms of "collective maturity" in relation to issues that pose a particular threat to them.
- **Curative actions**: this could involve developing "resilience"-type skills (led by professionals trained in these approaches) on collectively difficult issues. Including a knowledge base on Daniel Kahneman's Systems 1 and 2 or Olivier Houdé's System 3, which address the way we learn, at all ages, mobilising our brains in the direction of rather "automatic" actions such as the acquisition of routines or skills (System 1) or, on the contrary, "adaptive/creative" actions (System 2) and, more specifically, inhibiting our self-evident beliefs first, i.e. the emergence of the critical mind (System 3, which is in fact a sub-entity of System 2).
- **Symptomatic actions**: these include facilitating behaviours considered compatible with the Transitions through positive incentives (rewards, recognition, etc.) or effort-reducing facilitations, in other words of the ergonomic type (of the nudge or choice architecture type, for example). It's a bit like prescribing ergonomic attitudes to people who are physically fragile, but in this case the focus will be on cognitive, emotional or social aspects.
- **Palliative actions**: these are aids and other forms of assistance or, conversely, taxes and other constraints or standards (tax, regulatory, legal and police enforcement, etc.). It is clear that our society all too often opts for this ultimate approach, intended (in principle) for incurable and/or terminal cases! It's hardly surprising that there's no support or enthusiasm for them.

And to make the framework of trans-disciplinarity a little more precise, we will include the following sciences:

- evolution and, more specifically, the adaptive value of behaviour and its selection context (genetics, phylogenesis/ontogenesis, ethology, etc.). This is particularly crucial for understanding from where our predispositions come and their limits (biases, etc.).

- neuro-psycho-medical, in the broadest sense of the term, ranging from the biology of neuronal interactions to functional imaging, from neurology to psychiatry, from psychology to neuropsychology, not only in terms of knowledge but also in terms of tools for individual and collective care (and their intersection, capable of bringing about real changes in the way we function, at all ages).
- social and applied, including/associating all levels of interaction (education, training, information, management, behavioural economics, philosophy, history, etc.).

Finally, to make this complex and multi-layered subject a little more concrete, it would undoubtedly be useful to develop a few illustrative examples:

- For Primary Prevention: an example is empathy classes in Scandinavian schools, which take the form of discussion groups for entire classes, many of which do not have any notable difficulties. The aim is to teach them how to share their weaknesses and particularities, which until now have been considered as intimacy or even hidden/shamed, and then to develop their empathy and their capacity for dialogue and cooperation, among themselves and even with adults.

  This reduces their hostility and violence, while increasing their commitment to their studies and professional projects. There's every chance that it also encourages the emergence of other motivations for the common good, particularly environmental ones.

- For Secondary or Tertiary Prevention, we can mention the field of safety, where HF is involved in more than 75% of incidents and accidents. But this HF, which used to be accepted as fate, has been transformed into a lever for improvement by RETEX or REX (Feedback from Experience), initially in military aviation, then in civil aviation. Then in the high-risk nuclear and chemical industries. Then in health and road safety. To cut a long story short, all we had to do was change the paradigm: we no longer saw mistakes as something to be corrected (and the 'blooper book' on a collective scale) or even punished, but as an opportunity to learn (part of the dialogue with reality, in fact) and improve the process. Overall result of this approach: the "heavier than air" – aircrafts – (almost) no longer fall (around 500 deaths a year in civil and commercial aviation worldwide) and have even become the safest means of transport!

- On the curative side, developing cognitive ergonomics (i.e. for more results with less effort) could be based on a much larger scale on the nudges approach or the architecture of choices and well-thought-out public policies with the HF.

So, will we succeed (and how/with whom) in transmuting lead into gold?

In other words, turn the "bloody Human Factor" into the **precious Human Factor**?

Let's not forget that an unsolvable problem is first and foremost poorly defined. And that is precisely what we are pursuing. Define it properly so that we can finally solve it properly.

5/ Gathering/mobilising for real: because to succeed, beyond slogans, we must, like Nelson Mandela, succeed in mobilising and engaging all stakeholders, even the hostile ones... otherwise we won't be up to the challenge!

We plan to produce the following on a recurring basis:

- Main or thematic reports.
  Then derived deliverables designed jointly by scientists and experts in the field, and targeted by sectors of activity, professions, functions, for players and decision-makers, citizens, NGOs, institutions, rating agencies, etc.
- Leading a truly transdisciplinary research group across the whole spectrum, capable of bringing to light, notably through meta-analyses of unprecedented breadth, trajectories suited to making scientific, educational, training, information and organisational strategies and more predictable orientations, therefore more relevant, with the vision of creating a truly more sustainable, desirable and equitable society.

But what would you do with it, what would we do with it, each in our own corner?

This is why the IpBc/GIECo has set itself the task of initiating an **alliance of unprecedented scale**: beyond the necessary scientific transdisciplinarity, it is an invitation to all stakeholders and all countries to cooperate.

An alliance based on high standards (of science) and openness to all, on long-term usefulness as much as immediate efficiency, individual and collective, economic, environmental, societal and ethical. We won't succeed by opposing. We need to associate, facilitate and promote cooperation and inclusion in the broadest sense.

We must embody this ourselves. Not by means of a 'soft consensus' but by sharing the (very specific) conditions for a genuine ('hard') consensus, as is done in science.

And, with the IpBc/GIECo, , we will do so for the first time at a level of H.F. coverage that truly reflects the scale of the global challenges and issues facing us today and tomorrow.

We hope that reading this report will inspire you, make you want to take action, and even fascinate you. Of course, we look forward to your reactions and contributions of all kinds, because we're going to need a lot of them, in many different forms. Please help us to bring this new institution to life and make it a success on a global scale, as part of a new social project based on science rather than ideology.

It is dedicated to all of you, present and future.

With gratitude,

Also, my most sincere thanks to all the team who produced this first volume and those who are already working on the second, and to all the other volunteers, players and supporters of the IpBc/GIECo who are helping to make this project a reality.

Introduction

Beyond rationality: a view from behavioral sciences applied to ecological transition

Stéphane La Branche
IbPc/GIECo Scientific Coordinator

"Man is not a rational animal; he is a rationalizing animal." [1]
R. A. Heinlein, 1953

Once upon a time, on a planet at once very far and very close to ours, there was climate. Not "climate change", just "climate". At the time, the Great Scientists studying climate were little known and few, basically limited to atmospheric chemistry and physics. But a few scientists rose above the others by understanding that the blanket protecting us from the cold of space was made of greenhouse gases, especially one: CO^2. But one of these scientists did not delve into the mysteries of the upper atmosphere for, he loved... ice! He, Lorus, was a glaciologist who foresaw one possible consequence: if the quantity of these gases in the upper atmosphere increased, so would global average temperature. Two fundamental questions arose: who or what is responsible for this? Is it a natural phenomenon (on earth or the sun's activity) or are we, humans at the source of this? For us, common mortals, the question has rather been: what is +2°, +3° or even +4° in one's daily life or for living species? A little less cold in the winter, a little warmer in the summer, so what's the problem?

60 years after Lorus (plus 6 IPCC Reports and hundreds of national and territorial strategies and thousands of scientific studies and publications), the word "climate" just does not appear anywhere anymore without its brethren: "*change*". And this new word has entered our language and myths far faster than the understanding and the stories related to the dire consequences for us humans. Lorus, the first climate storyteller was right; it is human induced and the consequences of a +3° (or even +4°!) are going to be deeply felt, stretching our adaptation capacities, everywhere on our amazing tiny living jewel called earth in many different ways. Climate change is not a just a problem for us humans, but for Gaia's entire living tissue.

The story of how this legend entered (or not!) our imagination, social representations, values, behaviors and policies and economic system, is far more complicated than it seems. Especially, when humans become part of the story, with its heroes and its culprits, which we are all, at the same time.

1. Heinlein, R. A. (1953.) Assignment in Eternity. Fantasy Press, Reading, Pa.

Once upon a time, on a planet at once very far and very close to ours, there was biodiversity. Not the "biodiversity crisis", just "biodiversity", the global living tissue, Gaia... But this story is different and more complex that the previous one. Indeed, sciences related to 'ecology' (the sciences of inter-relationships and consequences as Frank Herbert would put it) have existed for a long time and are numerous; they literally go back thousands of years with biology. These sciences explain how life came about, how it works, living networks and interactions, proposing identification and nomenclatures. Modern biodiversity heroes are many and emerged years before climate ones, raising alarms that we were destroying our planet's living tissue - Gaia. Perhaps Lovejoy was himself influenced by the Great Storyteller several years before, Carlson, who told us how our springs have become silent, without bird songs [2]... Thus, 'crisis' was apposed to biodiversity well before 'change' was to 'climate'. Yet, in the Land of biodiversity, things have not progressed as much in terms of making impacts, importance and issues around biodiversity. Gaia is still suffering more and faster from attacks on its biodiversity than from climate. Yet, as for climate, for ecological sciences as well, something happens, a change: biodiversity becomes an ecological issue because of us, humans.

Well, a story is not a good one unless there is adversity, heroes and anti heroes, good guys and bad guys and their feminine equivalent. So, "O villain, where art thou"? Well, it is not as simple as a blockbuster movie. As natural sciences have been telling us for many years now: we, humans, are responsible for climate change caused disasters and even for a potential 6th mass extinction. So, we are the bad guys and worse, we may be leading ourselves to our own destruction. The anthropic origins of both crises raise a fundamental question: what are we going to do about it (or not), how, and why? Why do not we seem to be able to do what needs to be done about it? We can all be heroes – as Bowie sang? For us behavioral scientists, can we develop eco-behavioral sciences?

For the idea that we might be the cause opens the door for a new protagonist, a new type of scientists in the 'ecological' crisis: behavioral scientists. At this point, for those sciences, a quasi transmutation occurs: the climate and biodiversity crises become a ***socio***ecological issue.

Natural sciences, which aim at resolving these crises, face a major problem: they are not equipped methodologically and theoretically to address human behavior and all the incredibly complex factors that play a role. These can be summarised as: "what are the drivers of human behavioral (individual, collective, organisational) change and non change?" This is the core of the IpBc's mission and *raison d'être*: understanding human behaviors and all the factors that contribute to it. While there are several differences, both epistemological and methodological between natural and behavioral sciences, there is one that is more important than the others: we take into consideration human subjectivity. By this is meant the way we live a situation, the meaning we appose on events, on our lives, but also our emotions, our values, our implicit cognition and on a daily level, our tiredness, hopes, desires and so on. We are also rational beings, but not only, and more importantly, not *mostly*.

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2. Carson, R. (1962). Silent Spring. Houghton Mifflin Company.

First, **we are multi-rational beings**: it is rational to want to rest when we are tired and to resist attempting changes that only add to it; sometimes we do pay way too much for something that gives us a lot of immediate pleasure and comfort or just because it looks good..., even while all along knowing that it is not good for us nor for the planet. Second, we are also **non rational beings, filled with emotions and subjectivity**. Whether one thinks this is good or bad is beside the point, it is just the way it is. Looking at humans in only rational terms is akin to Lorus limiting himself to analysing the tip of the iceberg, the surface of the ice shelf, in his efforts to understand the deep working of ice, in its relationship to the atmosphere and the ground on which it sits and moves. Doing so, he would have entirely missed the point.

We are only starting to realise what it really means to be part of the living tissue, but it is not coming easily and with good news. We are learning this the hard way. My first several meetings in the land of transition sciences were not obvious, the sociologist that I am sometimes feeling like a stranger in the strange land of natural sciences. Between 2003 and 2010, when I was working on climate change from a behavioral perspective (mostly with psychosociology, in France), I was bewildered by a general attitude underlying natural scientists' reaction to my presence:

- "Erm, you're a sociologist, how can you work on climate change?!" in a tone that was not critical most of the time, just bewildered (well, at times quite skeptical).

My answer was:

- "Well, if climate change is indeed induced by human activities, then, fundamentally, it is even more a question for behavioral sciences than it is for natural ones, no?"

At the time, my fellow social scientists asked the same question, which was less bewildering:

- "Erm, you're a sociologist, how can you work on climate change?!" in a tone that was quite bewildered (and more critical than the previous ones...).

Guess what my answer was? The same I gave to fellow natural scientists...

At the time, this reaction was understandable (and dozens of discussions with other social scientists in the following years confirmed this): climate change, its analysis, its slow entry on the public, political and economic agendas came from natural sciences. Its language, its presentation and argumentation modes were heavy with chemical formulas, probabilistic languages and hypotheses on atmospheric gases behavior. For high priests of science only. But by the middle of the 2000-decade, there was mounting agreement and evidence within natural sciences that climate change was induced by human activities. Admittedly, as-a-whole, apart from a few exceptions, behavioral sciences were indeed slow in getting interested and in delving into the human psyche and in our individual, collective and institutional behaviors as it relates to climate change – and even more allergic to biodiversity issues.

This started changing from 2012 onward, (in France anyway, but there are indications that this was widespread, as shown by the IPCC's specific goal of integrating more human sciences in its 5th report) as the demand for more behavioral sciences on the part of those who tried to implement measures and public policies were not getting the success they were counting on. The human factor kept '*interfering*' with scientific based solutions and on-paper sound climate policies. *Interfering* from the point of view of natural science-based recommendations. From a behavioral science standpoint, this is entirely natural, to be expected and entirely analysable! The question was: why? Or rather, which human factor does not seem interested in changing our "lifestyles", daily practices and general economic production and consumption system? To these questions, every behavioral discipline has its own answer, its method and its recommendations. But not one has a complete picture. Everyone of us is grasping at different parts of the proverbial elephant and telling others that what they perceive is the answer. But if there is one thing we have learned from transition efforts is that not one answer ever works well enough on its own. This is also true of scientific disciplines. Not one can offer all the answers we need. Humans are far more complicated than climate change and only slightly more than biodiversity, some of my biologist colleagues would say. Hence, the need to engage in transdisciplinary research, analyses, publications and recommendations, which is a common call from all authors in this volume of our first Report.

With regard to climate sciences, the IPCC took several years to understand the need to cross sciences. But climate scientists (in the very large sense of the term, including glaciologists, ocean chemistry, atmospheric sciences, etc.,) came to realise that each individual discipline can only touch one part of that elephant. They came to understand that the only way to have a complete picture of the earth system was to work together, share methods, confront results, until they got it right. The IPBES, on biodiversity, did not take as long to engage in transdisciplinary work: the nature of biodiversity requires it, and it probably attracts more scientists who are sensitive to this type of systemic thinking than most others large issues. But this made it also more difficult to communicate to the general public. Behavioral sciences were not always good at addressing ecological issues either and it may be that climate issues attract more than any other issues, scientists who are curious about other sciences.

Behavioral sciences' entry into the transition world was relatively late, for several reasons. These are related to several differences between natural and social sciences that need to be explained here as much to natural scientists as to stakeholders [3]. First, and not in order of importance, many social scientists are not comfortable with the natural scientific aspects (we cannot ask semi directive questions to analyse CO^2 molecules in the upper atmosphere!). Addressing the interactions between humans and non-humans, between us and not so 'natural' phenomena might mean modifying our methods, our research practices and publication potentials. And most of us are like most humans, change raises many challenges – which is why the title of this report is drivers of behavioral change and non change. This is one of the underlying ideas of this report: ecological transition efforts require human behavioral and structural changes. After all, according to natural sciences, our activities are the source of the different crises.

3. B. Lahire (2025). Vers une science sociale du vivant. La découverte. Paris.

Another difference is that natural sciences, especially those related to climate change and ecology may be on such a long-time range that from a human experience standpoint, they can be considered to be permanent. Thus, social sciences are faced with the challenge of not only identifying change and its underlying causes, but also human obstacles to human and natural changes. Otherwise, we cannot understand what stops us from changing, and we cannot devise solutions to these obstacles.

This leads to yet another difference: a human phenomenon studied by behavioral sciences – be it individual or collective or structural – can never be explained by a cause-effect linearity. It can only be explained through correlations that vary in strength, directions and importance according to the historical period, individual upbringing, culture, life phase and many others, including of course, natural phenomena. This implies that each disciplines tends to look at a limited number of factors and correlations through their specific methods and tools. Some draw a parallel between quantum physics and human sciences: when a particle/human is observed, it changes behaviors. This is well known in social sciences: the fact that one knows one is responding to surveys, that one's energy consumption is measured by new technologies (and the fact that one knows one is measuring one's consumption even if no one else is watching) impacts observations and may impact behaviors but not always. Quantum particles do not have a shred of self consciousness, we do, even though we constantly underestimate our own unconscious drivers... So, one might ask, how can anyone analyse and make sense of this complexity at all, how useful can behavioral sciences be, if they cannot give clear cut answers?![4] Well, we do have (human) scientific methods, they are not perfect, but they do work.

Natural sciences attempt to understand the deep, objective, workings of the universe; behavioral sciences attempt to understand the deep, subjective-objective, workings of human behavior and thoughts. All chapters of this report converge toward one fundamental idea: the way we live, change or do not change, the meaning we give to change, to ecology and to transition, is more than anything subjective. Not objective. That is the greatest contribution of social sciences: produce understanding on our subjective, symbolic, moral, emotional and cognitive world, in complex interaction with other individual worlds within a social, political, cultural and historical frame. These interactions in themselves produce meaning. This complexity leads disciplines to reducing the number of variables they explore and test in their search for understanding as to what make people behave or not, or partially, going from removed-from-reality laboratory choice experiments, to surveys, interviews and direct observation and so on.

4. This question was asked by a climatologist at the Copenhagen scientific preparation conference in 2009, after assisting at a social science presentation on mobility.

Which brings us to the need for transdisciplinary approaches and the emergence of a new type of Scientist in our story, one capable to work with other disciplines outside his/her mental framework. One of the IpBc's main goals is to facilitate this but it is also a multiple bet:

1) The scientific bet: attempt to agglomerate and summarize behavioral disciplines, such as what the IPBC and the IPBES do in their own fields.

2) The transdisciplinary bet: it aims at developing methods, working habits and joint research projects in order to offer more complete and more realistic answers as to why we change or not, under what conditions and so on. A very complex question because we are humans who live in subjective worlds with our meanings, our interactions and contradictions, conflicts, cooperation and mutual ignorance. No one could imagine the state of climate knowledge without its sciences working together. How can we think any differently relative to human behaviors?

3) The behavioral sciences status bet: aim to improve the status and place of behavioral sciences in stakeholder's efforts at transition, including funders, private actors and firms, research institutes, policy makers and associations of all types. **Without due consideration for the human factor in all its complexity, we will not succeed the transition challenge**.

4) Summarising behavioral science knowledge bet: if we wish to achieve transition objectives, it is necessary to produce large state of the art literature reviews that are scientifically sound, honest (including when sciences do not know or are in conflict with each other) and understandable to stakeholders.

5) Understandable and usable behavioral sciences for all stakeholders bet: if we remain among ourselves, behavioral scientists, each disciplinary expertise to talking to its own, then we miss the point. While scientific disciplines and their publication need to use their own terms, show their own analytical methods and have their own styles, they also need be 'translated' into wider-audience reports focusing on key points, understanding and conclusions from those sciences. Including analyses of why some recommendations for actions work or not.

6) The systemic bet: Go beyond individual level analysis and develop behavioral systemic ones.

Our initial discussion with behavioral scientists in 2018 in Paris had led us to organize the different Drivers of Behavioral Change and Non-Change (DBCnC) into three levels: micro (i.e., individual level and family, close social relations...); meso (i.e., urbanism, territory...) and macro (i.e., large scale politics). While this seemed to be a good pedagogical manner to present DBCnC, it appears, from a transversal reading of our first volume's chapters that it is beside the point. After all, one individual's value and implicit cognition that a firm's purpose is to make profits is also a very deep and macro-level factor! One's fear of change is also shared by a large part of the population and while we are indeed individuals with

our own idiosyncrasies, large-scale trends can be found. Price does indeed play a role in the individual's decision in daily consumption patterns (among other factors of choice), but the price is also subject to macro factors (production, war, climate change impacts, taxes, supply-demand...), but also macro level values as to what development or the good life mean.

In addition, in terms of research methods, while some behavioral sciences focus more on the individual level than others who concentrate on larger scales, these disciplines will often either start by exploring an issue with the individual and then verify hypotheses at a large scale. Thus, the scalar approach to organize our texts soon appeared as not pertinent. So, how should we organize them? What types of categories of factors playing a role in efforts at engaging in transition efforts, no matter the scale, can be identified? Are there not other ways to organise our criteria that would be more interesting and more conducive to transdisciplinary work?

Much collective thought went into this: which categories seemed most appropriate, conceptual or operational ones? As the IPBC's objective is to produce scientific states of the art reports with implications for transition efforts (while avoiding the traps listed above...), we favour operational categories for the following main reasons:

- Purely conceptual categories would be too closely linked to specific disciplines. It seems more interesting and easier to have a multidisciplinary approach by showing how disciplinary notions address common items and what our respective sciences say about it.
- Choosing operational, more practical, categories is more coherent with the idea of contributing to the understanding of real-life DBCNC in transition efforts.
- Operational categories are more interesting for non-scientific partners.

Finally, the idea has never been to write sectoral chapters, but it was, rather to draw from different sectors, examples and empirical data from which to reflect upon DBCNC. Mobility could not be a chapter's subject, it could only be one way, one source of examples among many others, to address drivers of change and non change. This led to the chapters present in this first volume, from which several transversal issues emerge (even though to different degrees). Indeed, all chapters agree that:

i) conscious thought and analysis are only a small part of our decision-making system at the individual, group and macro levels.

ii) scientific and technical data play a very minor role in our decisions and behaviors.

iii) Implicit cognition, that is, what we think automatically without being conscious of it nor without knowing why we think so is far more important than is often thought and;

iv) Emotions, that is, the way we feel about change, about ecology, about the future are powerful drivers of change and non change are also far more important.

Reflecting on this made the chapters' order of appearance emerge on its own, reflecting the fact humans are never driven by a single factor and never on only one scale. Of course, each chapter is far more interesting and deeper than what is presented in this introduction, but this is a reading that can be made of them.

What is a scientific literature review on drivers of behavioral change and non-change?

A scientific literature review can limit itself to a 'simple' description of what a field or a discipline has published on a subject. What are the main results and findings, of course but also, the main questions asked? After all, answers are only as good as questions will allow them to be, so enquiring about questions, their formulation, and the method to answer them, is important.

While this is important to do, our goal is to contribute to an eventual structuration of transdisciplinary theory construction, empirical studies and good empirical analysis-based recommendations. Our international scientific literature review gets interesting when it identifies general trends and conclusions, 'holes' in knowledge, as well as emerging potentially important signals in scientific understanding. What questions are not asked or asked in such a way as to induce unwarranted biases? Which subfield or issues are not developed nor even touched? In other words, what are we missing and why, and how can this contribute to a better understanding? The literature review thus becomes a tool allowing science to address new issues or new thinking – such as the idea that non-change is subject to very dynamic and powerful forces. Scientists, like any other human being, will also tend to have a specific point of view, work form implicit cognition, with a preference for a method and a theoretical framework. But the scientific method of peer review, method-comparison and justification all serve to reduce the risk of bias that this implies. But each discipline will favour some explanations, drivers and a scale of analysis over others, and thus undervaluing and even ignoring others.

This is normal.

And a good, constructively critical literature review also helps with possible biases and traps that researchers needed to avoid. We identified several but here are the main ones:

The disciplinary trap: aiming at multidisciplinary work means we cannot use disciplinary-based categories nor notions. The aim is to transcend and cut transversally through disciplinary boundaries while respecting the strengths and recognizing the weaknesses and disciplines' limits.

The normative ecological trap: our reports' objective is NOT to pass judgment on what a good or a bad ecological measure is. Our posture is to say what behavioral sciences say, understand and conclude (or not) regarding DBCNC in a context of transition efforts: what are the impacts of these measures on behavioral change and non-change? Does research identify methods that work and others that do not? This also means that we can – and should! – say what science says regarding whether a measure is efficient for example, for water but non efficient for climate or for air pollution, and for which stakeholder category or type.

The normative political trap: our reports' objective is NOT to pass judgment on what a good or a bad (democratic, authoritarian, and so on) policy measure is. We report on what behavioral sciences say, understand and conclude (or not) regarding the impacts of these measures on behavioral change and non-change. This also means that we can and should say what sciences say regarding the impacts of ecological policies on democratic rights and of democratic policies and norms on ecological transition efforts, for example. In other words, we cannot exclude from the reports a coercive policy just because we do not agree with the fact that it is coercive and inversely because we believe that a bottom-up democratic procedure does not work for the environment.

The normative economic trap: our reports' objective is NOT to pass judgment on what a good or a bad economic measure or system is (capitalism, socialism, green capitalism...). We report on what behavioral sciences say, understand and conclude (or not) relative to the impacts of these measures on behavioral change and non-change. BUT: we can say what our sciences reveal regarding the impacts on inequalities, for example. In other words, we cannot exclude from the reports a liberal policy just because it is liberal; nor for any other economic ideology.

The normative scientific trap: Science knows best! Actually, no discipline can ever explain anything completely but recognising one's holes is a starting point for new research, more discoveries. By bringing together different sciences and disciplines, and categories of stakeholders, with their different notions, concepts and methodologies, we can develop transdisciplinary methods and publications that can inform us in a more complete manner as to what drives us to change or to not change, at the individual, collective and structural levels. And all chapters insist on the fact that scientific data and cognition are entirely insufficient drivers of change.

The point is not to solve all points of conflicts or differences between disciplines. ***Rather, it is to make them explicit as potential sources of further understanding and cross-fertilization of ideas.***

So, we rather opted for the following organisation, starting with a general chapter on the different mechanisms aimed at behavioral change and then finding a logic through the chapters that deeply address many of the points raised in the first general chapter, including implicit cognition, emotions, values... Indeed, as pointed out by Marino Bonaiuto and Valeria Vitale in the first chapter, *human behavior is influenced by both internal (such as individuals' knowledge and beliefs, values, attitudes, and emotions) and external factors* (related to the context in which individuals engage in behavior and make choices, such as formal regulations, social norms, and cultural influences).

While the chapters have been written by and for researchers, efforts have been made in the writing style for non experts to be able to understand the main arguments. At the same time, the finer arguments and more complex ideas presented are more aimed at other researchers, Master and doctoral students interested by behavioral sciences and in the different sectors covered in these pages. A more accessible and shorter version will also be published, in the form of résumés for decision makers and curious people alike.

The first chapter (Marino Bonaiuto, Valeria Vitale, ***Social-psychological interventions promoting behavioral change for the ecological transition***) offers an analytical portrait of categories of measures aimed at changing behaviours as identified by the international literature from sociology and psychology, identifying underlying drivers of change and non change.

"Behavior change interventions" are a coordinated sets of activities designed to change specific behavior patterns: public policies, choice architecture (such as nudges), communication and educational campaigns. At issue is that even when these interventions use different techniques depending on their objectives and targets, these are not always correctly matched to the targeted behavior or public. For this to happen, actions need to consider different scales and drivers, such as socio-economic status, geographic location or life phases (the arrival of a second child, for example has consequences on mobility). Then, Bonaiuto and Vitale show we need to take into account the fact that our conscious experience hides the influence of the non-conscious system on our daily choices. For behavioral sciences, these are the most delicate factors to understand and analyse but they are more important than rational factors as drivers of behavioral change and non-change. This is a fundamental point, made by all chapters: our subjective world is far more important than our cognitive, rational, one in our specific daily actions but also in long-term global decisions and actions.

Carlos Trujillo (***The intersection of poverty and behavioral change for sustainable lifestyles***) goes beyond the usual discussions on ecological and social inequalities by including the way we define "poverty alleviation" and the unconscious postulates (implicit cognition) that inhabit it. He argues from the onset that Sustainable Development Goals are problematic, since poverty alleviation is widely understood and implemented through measures aimed at improving purchasing power, that is, increasing consumption capacity and volume! They are based on the homo economicus ideal type (see chapter by Ansart et ali). He then explores the literature on alternative criteria and qualitative drivers, raising questions such as how to decouple quality of life from consumerism. What does the "good life" mean in efforts at re defining non-consumerist and non-productivist criteria?

The individual level intersects strongly with macro scale drivers (poverty):

1) consumer self-confidence and wisdom and their obstacles are negatively impacted by poverty;

2) emotional aspiration to high consumption is often a basic driver toward 'progress', 'a better life', 'success', and thus acts as a driver of non-change toward a non-consumerist definition of the good life and;

3) cognition, whose capacity is also decreased by poverty.

Finally, Trujillo raises a critique toward research: most research on consumer behavior and sustainable consumption is conducted with middle class consumers in developed countries, and as such policies are constructed and implemented with middle classes as targets. They are thus inappropriate and inefficient at touching lower classes, addressing their needs and beyond, their social representations and mindsets relative to the "good life".

In their chapter (***Communication and behavioral change in a time of ecological transition***), Johanne Saint-Charles, Stéphanie Yates, Camille Alloing and Anne-Sophie Gousse-Lessard address the contribution of (human) communication sciences in understanding behavioural changes for socio-ecological transition. From the start, they refute several false assumptions regarding drivers of behavioral change and non-change.

The first false assumption is that communication is a toolbox from which one can pick and choose strategies to translate scientific evidence into behavioral change. This cannot work partly because human communication cannot be reduced to the transmission of information or knowledge. A meaning is conveyed by a communicant, but it meets different messages leading to new meanings, which contribute to the evolution and dissolution of relationships, social groups, norms and values. These groups then will attempt to diffuse these values and norms, through specific language. As an aside, one might note that this also applies to scientific disciplines...

This implies a second false assumption: if actors do not change, it is only because they do not have sufficient (or good) information, a common assumption in the natural science community -called the data-deficit postulate. But even when science is consensual and clearly calls for behavioural changes (stop smoking, exercise more, wear helmets, sanitary danger of BBQs...), the transmission of information on how change is to be implemented is very often deficient. As a way to explore communication processes and drivers (such as uncertainty, its perception, trust and "framing"), the authors focus on public participation in the field of risk communication.

Hélène Jalin, Camille Mouguiama-Daouda and Arnaud Sapin (***Emotions in transition: will eco-anxiety save our civilization?***) explore the role of emotions. Focusing on the emergence of eco-anxiety as a case, they first describe how exposure to constant bad news about environmental degradation or its consequences creates stress which then generates physical and emotional short-term and long-term reactions. Emotions come into play as they are closely linked to the evaluation of stressful situations and to the way in which individuals develop stress-coping strategies – and then, if that is the case, action strategies. Indeed, strategies aimed at coping with stress may not be efficient nor go in the right direction. They fall into two main categories: those aimed at resolving the problematic situation and those designed to reduce the emotional burden which often translates into inaction and denial. Beyond a stress-coping threshold specific to each individual, s/he may perceive the situation as exceeding his/her capacity, triggering worry or fear, to which we attempt to adapt, often by denying the source of anxiety of by taking action.

Which leads to the chapter's fundamental issue: the relationship between ecoanxiety and action. This often-raised question in the public arena is indeed key: why do some turn anxiety into action and others, into 'paralysis', denial and avoidance? While there are no hard, definitive answers to this question, several partial ones emerge: one's perception of one's capacity to act, one's perception of one's effect on the problem, social relationships and in-group norms play a role, as well as intrinsic and extrinsic motivations.

Sylvie Blanco, David Gotteland and Olivier Trendel address ***The role of implicit cognition in the development of a pro-environmental organizational culture*** in private firms. On-going efforts by top-level managers at integrating new systemic norms and individual behaviours within their organizational structure are often faced with different types of obstacles, such as governance as well as corporate identity and culture. Indeed, organizational culture provides – over the long-term – the firm's employees with values and beliefs that help them define the information to be collected, the levels of access to that information, and its uses for specific organizational activities. And these may or may not be compatible with ecological goals. Changing an organisational culture is a challenge for both analysis and action recommendations as it includes observable artefacts and behaviours as well as automatic and implicit values and cognition, outside conscious awareness or control. For example, the belief that "financial performance outweighs environmental responsibility" in traditional organizational culture is simply that, a belief, but one which possesses power: it profoundly influences employees' behaviours, shaping their commitment to the environment, motivation and ability to face environmental challenges successfully, or not or insufficiently. This value, or representation, of what a firm is and should be, can be modified and take on other meanings for a firm's *raison d'être*.

The authors focus on the role of implicit cognition in fostering a pro-environmental organizational culture, also arguing that the scientific literature tends to under-estimate the importance of implicit cognition and values as obstacles to change, as they are less measurable and visible, yet probably have an effect as great as, or even greater than, explicit rules.

Danyelle Guyatt (***Beyond data: The role of mindsets in closing the climate financing gap***) explores the same driver, i.e., implicit cognition as Blanco et ali but applied to a specific sector: climate financing.

Despite strong and numerous commitments to achieve net zero carbon by 2050 across investment decision making processes, the gap between commitment and the level of climate finance allocated to mitigation remains wide. The obstacles usually most identified are a lack of consistent signals from government policy makers, the need to upscale new technology, a lack of suitable investable opportunities as well as lack of data, models, or suitable metrics. In other words, objective 'outside' conditions. But 'inner' conditions are too often ignored by research but they play a crucial role in the way we act and why we make the decisions we make, including in climate financing.

This chapter also criticizes the view that insufficient data is a reason for inaction and that if investment decision-makers have information, they will invest ethically. This questions also the assumption that actors are economic rational beings, even when there is clear empirical evidence that this explanation is largely insufficient, including among supposedly 'rational' actors such as investors. The chapter explores inner conditions that influence institutional investor behaviour in relation to climate change, and the potential impact of mindsets, cognitive biases and the psychological, social, and cultural underpinnings of these

conditions. What are the interactions between investment beliefs, sense of purpose, comfort in managing complexity, social and peer group conformity pressures, personal agency, prevailing organisational and industry culture and, finally perceived tension between the short and long-term risk? The chapter finally presents the notion of "mindsets" and the conditions by which a mindset shift within the financial sector might be possible as a catalyst to close the climate financing gap.

Sandrine Ansart, Fiona Ottaviani, Raffi Duymedjian, Hughes Poissonnier and Dominique Steiler (***Homo economicus vs Entrepreneurial moderation practices: a reality with transformative potential***) explore a theoretical and methodological notion: homo economicus, at the heart of economic and management classical theory. They show that there are multiple ways to exercise rationality depending on circumstances and a person's values. But they go further: the figure of homo economicus is not only a neutral concept, it also tends to structure the way we build theories and methods, and thus the way we explain economic actors' behaviors as well as real life expectations. They thus touch upon Carlos Trujillo's argument as well, relative to the way we can redefine success and growth.

The authors oppose two figures: **i)** homo economicus, inspired by economic utilitarianism based on behavioral maximization under constraint, and **ii)** the moderate entrepreneur who, in the wake of virtue ethics, articulates a plurality of values such as moderation, prudence, the ability to take care, etc., and whose vision of the firm is not limited to profit generation. They explore the constraints and real live effects of homo economicus on understanding and legitimization of some logics of action. Then, as a counterpoint, they present the implications of an entrepreneur not exclusively guided by an essentially economic and individual purpose. Underlying this is the recognition of people's capacity to transform their own implicit assumptions relative to what a firm is and should be, their logic of action and to reflect on the institutional factors that support and diffuse one figure rather than the other.

Eduardo Bessa and Denis Couvet (***Ecological citizenship for a diversity of necessary behavioral changes***) also explore the unconscious universe of our decision making system, by addressing the issue of humans' place in nature through the exploration of a notion: ecological citizenship, which integrates responsibility for ecological limits, at the abstract and the individual empirical levels.

Ecological citizenship is based on the principle that humans are part of nature, biodiversity and ecosystems, sharing their territories with non-humans. While citizenship concerns human rights and duties toward other humans, eco-citizenship takes into consideration our interactions with living beings, taking into account the human context (philosophy, culture, institutions, laws, rules and norms, taxes, subsidies, political decision-making and so on). Non-human living dynamics (animals, plants, microorganisms) and non-living ones (the physico-chemical environment of the ecosystems) are also in complex multiple interactions with human dynamics. The authors do not argue that eco-citizenship should be considered as a moral obligation nor as a utopia, but rather as a potential expanded sense of citizenship.

How has the literature formalized ecological citizenship as a way to think about humans in their biodiversity system? What are the implications for a potential compatibility with nature and for human and non-human relationships? This raises ethical and practical questions: how should humans interact (including our activities) ecologically and evolutionarily with non-humans based on this concept; what forms of local, territorial and global governance and decisions? What might systemic thinking look like from an ecological citizenship point of view?

The final, transversal chapter, written by Stéphane La Branche, attempts to draw on the transversal points and ideas, the common conclusions as well a some of the differences between the disciplines presented in these chapters. Much is left aside in this exercise, but it is a first step at drawing upon the scientific wealth present in these chapter toward transdisciplinary work, on which we'll focus in the second volume of this First Main IpbC report. Implicit cognition, emotions, as well as the different avatars of homo economicus take an important place in these reflections.

Social-psychological interventions promoting behavioral change for the ecological transition

Ch. 1

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Introduction

Human behavior lies at the core of most global and local environmental challenges we face today. Individual consumption and lifestyle choices significantly contribute to climate change [1], ecosystem changes, biodiversity loss [2] and water scarcity [3]. Therefore, modifying human behavior is essential to address environmental challenges [4, 5]. To achieve sustainability goals and ensure a safe and healthy space for humanity and for all the species on Earth, rapid behavioral changes are required at both individual and societal levels [6]. Hence, there is a need to develop, implement and evaluate intervention approaches to encourage human behavior towards greater sustainability and reduce its environmental impact.

In psychology, various theories describe why individuals behave in certain ways and how behaviors can effectively be changed through a variety of intervention strategies. **BEHAVIOR CHANGE INTERVENTIONS ARE CHARACTERIZED AS COORDINATED SETS OF ACTIVITIES DESIGNED TO CHANGE SPECIFIED BEHAVIOR PATTERNS**. These interventions manifest themselves in various forms and employ a range of techniques depending on their objectives and targets. For instance, behavioral change interventions may be implemented as public policies or architectural modifications, as well as through educational campaigns. For these strategies to be effective, the design of interventions must consider several critical elements [7] and involve the following four phases [8]:

1) Selection of specific, relevant behaviors to address environmental concerns involves identifying and targeting behaviors that either contribute to improving environmental quality or reducing negative impacts. This includes both promoting beneficial actions (such as reducing meat consumption or conserving energy) and mitigating detrimental behaviors (such as excessive waste generation). The approach may vary depending on the sector and specific environmental issue at hand, but the underlying strategy of focusing on relevant behaviors remains consistent.

2) Analysis of factors causing these behaviors.

3) Review, pilot and Implementation of targeted interventions to modify the relevant behaviors and their antecedents.

4) Systematic evaluation of the effects of these interventions on the behaviors themselves through quantify observable properties (i.e., frequency, latency, temporal extent, or intensity) [9], their antecedents, environmental quality, and human quality of life.

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1. IPCC, 2014. - 2. Foley et al., 2005.
3. Wada & Bierkens, 2014. - 4. Fischer et al., 2012.
5. Cowling, 2014. - 6. SSteffen et al., 2015.
7. Steg & Vlek, 2009. - 8 Geller, 2002. - 9. Lange & Dewitte, 2019.

Based on this, after selecting the target environmental behavior and identifying its causal factors, intervention strategies can be implemented to address critical factors.

HUMAN BEHAVIOR IS INFLUENCED BY BOTH INTERNAL AND EXTERNAL FACTORS[10] **INTERNAL FACTORS INCLUDE INDIVIDUALS' KNOWLEDGE AND BELIEFS, VALUES, ATTITUDES, AND EMOTIONS. EXTERNAL FACTORS ARE RELATED TO THE CONTEXT IN WHICH INDIVIDUALS ENGAGE IN BEHAVIOR AND MAKE CHOICES, SUCH AS FORMAL REGULATIONS, SOCIAL NORMS, AND CULTURAL INFLUENCES**. Therefore, actions aimed at modifying human behavior should consider both types of factors, those related to internal drivers and those related to external ones.

In addition to these individual variables, situational factors that have been identified as significant components of pro-environmental behaviors should also be taken into account[11] **SITUATIONAL FACTORS INCLUDE ASPECTS SUCH AS SOCIO-ECONOMIC STATUS, GEOGRAPHIC LOCATION, OR LIFE EVENTS**. For example, prior studies showed that residents of rural areas experience the environment differently from their urban counterparts, and often have a closer connection to nature, but this does not always translate into stronger environmental concern. For instance, while rural Canadians reported higher participation in recycling and stewardship compared to their urban counterparts, they also exhibited more anthropocentric views, valuing environmental protection mainly for human benefits[12]. Conversely, urban Germans showed greater verbal commitment to environmental issues, though their practical behaviors were similar to those of rural Germans[13]. Also, residents living near environmental problem sites, such as landfills or waste disposal areas, generally exhibit higher concern for those specific issues. For example, individuals in southern California who felt more directly threatened by local environmental problems were more likely to engage in pro-environmental behaviors like recycling and water conservation[14].

Further, social class significantly impacts environmental concern, with middle- and upper-middle-class individuals often showing greater environmental engagement. For instance, wealthier nations tend to report higher environmental concern, partly due to increased economic resources allowing for greater investment in environmental improvements[15]. However, this trend is nuanced: while wealthier individuals in developed countries may prioritize environmental issues less than those in developing countries, due to less immediate environmental stress, low-income individuals in the U.S. have shown higher concern for local environmental problems compared to their wealthier counterparts[16, 17]. To address these factors effectively, it is important to tailor interventions based on the context and characteristics of the target behavior.

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10. Wallen & Daut, 2018.
11. Schultz et al., 1995.
12 Huddart-Kennedy et al., 2009.
13. Bogner & Wiseman, 1997.
14. Baldassare & Katz, 1992.
15. Franzen, 2003.
16. Uyeki & Holland, 2000.
17. Brechin, 1999.

Therefore, **WHEN BEHAVIOR APPEARS STRONGLY CORRELATED WITH ATTITUDES, EFFORTS CAN BE MADE TO PROMOTE ATTITUDE CHANGES TOWARD SPECIFIC PRO-ENVIRONMENTAL BEHAVIORS. CONVERSELY, WHEN CONTEXTUAL FACTORS SEEM TO INHIBIT SPECIFIC BEHAVIORS, INTERVENTIONS CAN BE IMPLEMENTED TO REMOVE THOSE BARRIERS. THE POTENTIAL EFFECTIVENESS OF DIFFERENT TYPES OF INTERVENTIONS APPEARS TO VARY DEPENDING ON THE CONTEXT AND THE CHARACTERISTICS OF THE TARGET BEHAVIOR, IN TERMS OF BOTH WHICH BEHAVIOR IS AIMED TO BE MODIFIED AND WHICH POPULATION GROUP THE INTERVENTION IS DIRECTED TOWARDS**.

Another aspect to consider when creating interventions aimed at promoting more sustainable behaviors concerns the evidence that **MANY HUMAN DECISIONS ARE MADE THROUGH AUTOMATIC AND UNCONSCIOUS PROCESSES, BASED ON INFORMATION OF WHICH INDIVIDUALS ARE NOT FULLY AWARE**. Psychological and neuroscientific evidence has highlighted the existence of two distinct systems of thought and reasoning: a rational thinking system, which is analytic, conscious and deliberate, and an intuitive system, which is unconscious and instinctive, guided by intuitions and perceptions [18, 19]. These two reasoning systems, the rational and the intuitive, work in parallel. However, they do not always agree. The rational system is slow and makes decisions based on careful consideration of facts and evidence. The intuitive system, on the other hand, arrives at a decision much more quickly and responds to sensory signals such as familiarity, emotional reactions and real or mental images [20].

Our conscious experience conceals the influence that the intuitive system has on our daily choices; most of us feel that our decisions are based on careful consideration of facts and available information. However, the intuitive system plays a powerful unconscious role in human behavior and often influences or prevails over rational thinking. This consideration is important because sustainable behaviors appear to be unattractive to intuitive thinking. Therefore, one way to enhance sustainability is to make sustainable actions more appealing to this system of thinking. A second strategy is to activate the rational system more strongly so that it can prevail over the intuitive system. The most effective strategies are those that combine both, making a sustainable action attractive for both rational and intuitive reasons.

18. Sloman, 1996.
19. Sloman, 2002.
20. Kahneman, 2011.

1. Conceptualization of Interventions

Behavior change interventions can take many forms and use a variety of techniques, depending on their goals and the specific audience they aim to reach.

Over the years, various strategies have been adopted to promote behavioral change towards greater sustainability. Each of these strategies has been designed to focus on specific behavioral determinants and target a particular group of people [21, 22, 23, 24]. Below, some key characteristics and differentiations that distinguish the various forms of interventions used so far are discussed.

1.1. Level of Intervention: Individual and Population

Behavioral change interventions to promote environmental sustainability and reduce harmful behaviors towards the environment can be targeted at various levels, from specific efforts aimed at individuals to broader initiatives that engage communities or drive systemic change at the societal level. In fact, addressing complex behaviors – actions influenced by multiple factors, such as social norms, personal habits, and environmental cues – often requires interventions at the individual, population and structural levels. For example, reducing plastic waste involves not only encouraging individuals to make sustainable choices but also implementing policies and educational programs that shift community practices and societal norms and it requires public policies to manage waste and recycling.

1.1.1. Individual level of intervention

Balmford and colleagues [25] proposed a taxonomy of interventions based on the level of application (individual vs. population) and the general mechanisms involved, i.e., the processes through which behaviors are influenced. Behavioral change interventions aimed at specific individuals or certain groups of people can be classified into two types: interventions focused on individual capabilities and those focused on their motivation [26, 27].

The first category of interventions aims to improve a person's physical, psychological and managerial resources to perform, modulate or avoid an action or behavior. A new sustainable behavior may not be successfully adopted because the individual lacks the required skills or knowledge. For example, an intervention that offered coupons for purchasing chicken to Amazonian families to reduce the consumption of wild meat was successful only when instructions and advice on how to cook chicken were provided [28].

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21. De Young, 1993. - 22. Gardner & Stern, 2002. - 23. Messick & Brewer, 1983. - 24. Vlek, 2000.
25. Balmford et al., 2021. - 26. Michie et al., 2011. - 27. Michie et al., 2013. - 28. Chaves et al., 2018.

Regarding the second type of individual intervention, motivation has been the subject of intense research in behavioral sciences [29], generating various intervention types aimed at promoting this aspect concerning the implementation of eco-sustainable behaviors. These interventions are designed to influence the processes that stimulate, direct, and support behavior [30], either by inducing reflective thought processes – often associated with important and infrequent behaviors – or by impacting automatic processes that underlie habitual, frequently performed behaviors [31, 32, 33]. Behavioral science suggests many ways to motivate people and achieve positive behavioral change [34], such as by instilling feelings of pride in the environment or local species, promoting pro-environmental norms through peer conversations, and providing feedback on the environmental impacts of individuals [35, 36, 37].

However, it should be noted that **MOTIVATION IS IRRELEVANT IN THE ABSENCE OF CAPABILITY**. Many people may want to protect nature, but they lack the knowledge or ability to do so, especially correctly. Therefore, a combination of both forms of intervention may sometimes be the most appropriate strategy. This approach to designing behavior change interventions aligns well with the MOA (Motivation-Opportunity-Ability) model, as adapted by Olander and Thøgersen [38] **THIS MODEL POSITS THAT AN INDIVIDUAL'S MOTIVATION, THE OPPORTUNITIES AVAILABLE TO THEM AND THEIR ABILITIES ARE CRITICAL FACTORS THAT INFLUENCE THEIR LIKELIHOOD OF ENGAGING IN ENVIRONMENTALLY FRIENDLY ACTIONS**. According to this model, behavior change occurs when individuals are sufficiently motivated, have the ability or skills necessary, and encounter favorable opportunities in their environment.

1.1.2. Population level of intervention

Despite the potential effectiveness of individual-level interventions, addressing many of the underlying causes of environmental issues (such as unsustainable resource consumption globally) generally requires population-level intervention. While individual capacity and motivation are important factors for behavioral change, no change can occur without adequate physical or social opportunity. For example, hunters of wild meat may not change their behavior without alternative ways to secure their sustenance [39], or city residents may decide not to cycle to work if doing so puts their safety at risk due to the lack of safe bike lanes [40]. Although opportunities can be improved through individual-level interventions, often interventions are needed that shape such circumstances on a broader population level (e.g., through new infrastructure such as implementing services in new neighborhoods to reduce car mobility, or changes in the economic context). Effective interventions must address both internal factors (such as motivation) and external factors (like resources and environmental conditions) to overcome individual and systemic barriers.

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29. Ryan & Deci, 2000. - 30. Thiermann & Sheate, 2020.
31. Kahneman, 2011. - 32. Marteau et al., 2012.
33. Strack and Deutsch, 2004. - 34. Teixeira et al., 2020.
35. DeWan et al., 2013. - 36. Green et al., 2019. - 37. Karlin et al., 2015.
38. Olander & Thøgersen, 1995. - 39. Fowler et al., 2017. - 40. Van Gils et al., 2019.

Comprehensive, multi-component interventions that combine motivational elements with practical support and environmental restructuring are generally more successful in promoting sustainable behavior change [41]. Four main types of behavioral change interventions that operate at this level can be identified.

The first includes interventions on the **physical microenvironment** that modify the characteristics of products and services or the environments within which they are available (e.g., stores, restaurants, workplaces or websites [42, 43]). These interventions embrace the concept of **CHOICE ARCHITECTURE, WHICH INVOLVES DESIGNING THE PRESENTATION OF ALTERNATIVES TO INFLUENCE DECISION-MAKING AND TYPICALLY OPERATE THROUGH UNCONSCIOUS ACTION PATHWAYS** [44]. In this context, a widely known approach is the nudge, which subtly alters the underlying choice architecture to guide behavior in a predictable way, without restricting options or forcing a decision [45, 46]. Nudges take advantage of behavioral biases, encouraging desired actions by making them easier or more appealing (for further details refer to Section 2.6). Research in this field suggests that interventions on the physical microenvironment can have significant effects on behavior [47, 48, 49, 50]. Relevant applications of this type of intervention include modifying the positioning of high and low environmental footprint options on menus and buffets [51, 52] or providing easily accessible recycling bins indoors and outdoors [53].

The second type of population-level interventions concerns the physical macroenvironment. This strategy involves **CHANGING THE BASIC PHYSICAL AND ORGANIZATIONAL STRUCTURES AND SERVICES NECESSARY FOR THE FUNCTIONING OF A SOCIETY OR ORGANIZATION** [54]. By shaping large-scale choice architecture, these systems, such as education system, built infrastructure, industries, and transportation, not only have direct effects on behavior by influencing which actions can be performed [55] but also reduce cognitive effort by making sustainable choices more accessible and limiting unsustainable options without overtly restricting freedom. Consequently, they can also represent constraints on the effectiveness of other types of interventions [56]. Examples of this type of intervention include increasing the supply of renewable energy and incorporating more environmental education into school programs.

A third class of population-level interventions involves altering the **ECONOMIC CONTEXT BY INTRODUCING, MODIFYING, OR REMOVING TAXES, SUBSIDIES, AND OTHER MATERIAL INCENTIVES, WHICH CAN ACT AS POWERFUL DRIVERS OF INDIVIDUAL AND ORGANIZATIONAL BEHAVIOR** [57, 58]. Illustrative cases of these strategies include the introduction of refunds and rewards for actions aimed at protecting the environment [59, 60] and taxes on environmentally harmful products [61].

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41. Michaelsen et al., 2023. - 42. Hollands et al., 2017. - 43. Marteau et al., 2020. - 44. Thaler & Sunstein, 2008.
45. Benartzi et al., 2017. - 46. Mertens et al., 2022. - 47. Wee et al., 2021. - 48. Marteau et al., 2012.
49. Marteau et al., 2015. - 50. Nisa et al., 2019. - 51. Garnett et al., 2020. - 52. Kurz, 2018. - 53. Schultz et al., 2013.
54. Swinburn et al., 1999. - 55. Creutzig et al., 2015. - 56. Seto et al., 2016. - 57. Andreyeva et al., 2010.
58. Marteau et al., 2019. - 59. Jayachandran et al., 2017. - 60. Pattanayak et al., 2010. - 61. Springmann et al., 2017.

The fourth type of population-level interventions targets the institutional environment, **BY MODIFYING VOLUNTARY AND REGULATORY CODES OF CONDUCT THAT ORGANIZATIONS AND THE POPULATION MUST ADHERE TO** [62]. These interventions can be implemented by governments or private organizations, such as the introduction, modification, or removal of sanctions; establishing or changing institutional standards; or outright bans on certain behaviors [63]. Additionally, changes in management and governance modes – such as adopting more participatory or collaborative decision-making approaches – can also shape compliance and promote sustainable practices within organizations and communities [64, 65, 66].

In addition to individual and population-level interventions, addressing environmental issues fully may require even broader system-level interventions, involving the reorganization of the overall political and global economic system [67]. In the environmental context, the most obvious example of such macroeconomic reorganization is the proposal of the "Green New Deal", which suggests a plan to coordinate and finance a large-scale overhaul of the energy system [68]. Other examples include a shift from indefinite economic growth to zero growth or even degrowth [69, 70, 71] as well as the adoption of a circular economy model, which emphasizes resource efficiency and waste reduction [72, 73, 74]. Such interventions clearly have greater transformation potential compared to individual and population-level interventions but remain challenging to implement even today. Indeed, each category of intervention presents unique challenges and transformation potential.

Individual-level interventions often have a high potential for short-term behavior change, but their impact is limited by factors like motivation, resource availability and access to alternatives. Population-level interventions, while having broader reach and longer-lasting effects, face challenges like resistance from powerful industries or societal divisions. System-level interventions offer the greatest transformation potential in addressing structural issues, yet they encounter significant obstacles such as political inertia, entrenched economic interests, and the complexity of global coordination. Comparing the transformation potential and challenges across these intervention categories reveals the need for a multi-faceted approach that balances immediate action with long-term systemic change.

62. Epstein et al., 2015.
63. Vandenbergh & Gilligan, 2017.
64. Newig & Fritsch, 2009.
65. Jager et al., 2020.
66. Fritsch & Newig, 2012.
67. Otero et al., 2020.
68. Mastini et al., 2021.
69. D'Alessandro et al., 2020.
70. Jackson, 2009.
71. Kallis et al., 2018.
72. Sanguino et al., 2020.
73. Ogunmakinde, Sher, & Egbelakin, 2021.
74. Ghisellini, Ripa, & Ulgiati, 2017.

1.2. ABC Model: Antecedent and Reactive Strategies

Another differentiation of intervention strategies used by environmental behaviorists can be conceptualized with reference to the three terms of the **ABC (Antecedent-Behavior-Consequence) model** of behavioral change. **THIS MODEL SUGGESTS THAT BEHAVIORS ARE DETERMINED BY PRECEDING STIMULI AND INVOLVE THE POSSIBILITY OF POSITIVE OR NEGATIVE CONSEQUENCES. SUBSEQUENT OCCURRENCES OF BEHAVIOR DEPEND ON THE CONSEQUENCES THAT FOLLOW THE BEHAVIOR ITSELF**. For example, a common intervention strategy might involve modifying the antecedent by providing reminders (e.g., a sign near a recycling bin reminding people to recycle), promoting the behavior (i.e., recycling), and offering a consequence (e.g., a reward or positive reinforcement such as a coupon for participating in the recycling program). The anticipation of positive consequences (like receiving a reward) can encourage the individual to engage in the desired behavior more frequently.

While environmental impacts are often the primary focus of such interventions, it is important to consider that consequences do not have to be solely environmental. Positive or negative consequences can also be personal and non-environmental, such as health benefits from biking or adopting a vegetarian diet, which may be motivations in addition to environmental concerns. For example, becoming vegetarian for ethical reasons may not directly be driven by climate change, but it can still have positive impacts on the environment, biodiversity, and animal welfare. These personal rewards (e.g., health, ethical satisfaction) could serve as important motivators alongside environmental rewards [75]. Therefore, the ABC model suggests two behavior-based approaches to encourage pro-environmental behaviors. One strategy is to introduce or increase antecedents by announcing the availability of positive and pleasant consequences for pro-environmental behaviors or negative consequences for environmentally harmful behaviors. Alternatively, interventions can introduce new positive (such as rewards) or negative (punishments/penalties) consequences after the behavior is performed, reinforcing the likelihood of the behavior being repeated. Although consequences are typically presented after the behavior, they can also evolve into antecedents by influencing future decision-making. For example, once an individual receives a reward for recycling, the positive experience might trigger them to anticipate this reward when deciding to recycle in the future.

To clarify these approaches further, it is useful to draw on key notions from behaviorism, which emphasize the role of consequences in shaping future behavior. During the operant conditioning process, the consequences of a behavior directly affect the probability of its future occurrence. Thorndike (1898, 1911) and Skinner (1938) demonstrated that reinforcement (also known as reward) strengthens a behavior, increasing its frequency, while punishment weakens a behavior, decreasing its frequency.

In this context, positive reinforcement involves presenting a pleasant stimulus following a behavior to increase its frequency. For instance, offering a financial incentive or public recognition for recycling encourages individuals to continue this pro-environmental action.

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75. De Dominicis, Schultz & Bonaiuto, 2017.

Negative reinforcement, on the other hand, increases the frequency of a behavior by removing an unpleasant stimulus; for example, eliminating an environmental surcharge for using reusable packaging reinforces sustainable behaviors. Punishment, in contrast, reduces the frequency of undesired behaviors. Positive punishment entails introducing an unpleasant stimulus, such as a fine for littering, while negative punishment involves removing a desirable stimulus, such as withdrawing tax credits or grants for individuals or companies that engage in environmentally harmful actions. These constructs underscore how antecedents and consequences can work together to influence behavior. By employing strategies grounded in these principles, interventions can effectively promote pro-environmental decision-making and foster sustained behavioral change.

Based on this, most behavioral interventions for promoting sustainability and environmental protection can be classified as either antecedent or reactive (consequence-based) strategies for behavioral change [76]. ***ANTECEDENT STRATEGIES* AIM TO MODIFY THE FACTORS PRECEDING BEHAVIOR**. They can increase awareness of the issue, provide information about choice options, and announce the likelihood of positive or negative consequences.

ANTECEDENTS PROMISING POSITIVE CONSEQUENCES FOR A DESIRED BEHAVIOR ARE REFERRED TO AS *INCENTIVES*, WHILE ANTECEDENTS SUCH AS RULES AND LAWS ANNOUNCING UNPLEASANT CONSEQUENCES FOR UNDESIRABLE BEHAVIORS ARE CALLED *DISINCENTIVES*.
A wide variety of antecedent strategies have proven effective in influencing behaviors relevant to the environment, such as interventions aimed at environmental education and information, suggestions, verbal or written feedback and environmental design. The effectiveness of behavioral interventions generally increases when they target important antecedents of the relevant behavior and the removal of barriers to change. Therefore, understanding the factors that promote or inhibit environmental behavior is important. Also, antecedent strategies can be effective in promoting pro-environmental practices when designed with specificity, proximity, convenience, and salience, but they seem to be less effective than consequence strategies [77].

On the other hand, ***REACTIVE STRATEGIES* AIM TO MODIFY THE CONSEQUENCES THAT FOLLOW BEHAVIOR**. As proposed by Skinner [78], people are motivated to do something based on what may result from it, i.e., to obtain positive consequences or avoid negative consequences. Behaviors that have led to positive consequences will be repeated over time, while those that have led to negative consequences will be avoided in the future. This idea is the theoretical basis for many types of interventions aimed at increasing pro-environmental behaviors by offering tangible rewards (e.g., money) or intangible rewards (e.g., feedback) and punishments. **CONSEQUENCE-BASED STRATEGIES (REWARDS AND PUNISHMENTS) CAN INITIATE AND MAINTAIN PRO-ENVIRONMENTAL BEHAVIOR BUT OFTEN RESULT IN SHORT-TERM CHANGES AND MAY BE LESS EFFECTIVE THAN OTHER APPROACHES LIKE PERSONALIZED PLANNING, EDUCATION, AND ENHANCING SELF-EFFICACY** [79, 80, 81].

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76. Geller, Winett & Everett, 1982. - 77. Ester & Winett, 1982. - 78. Skinner, 1974.
79. Góis et al., 2019. - 80. Leeuwis, Bommel & Alimardani, 2022. - 81. Shafiei & Maleksaeidi, 2020.

1.3. Target Factors: Informational and Structural Strategies

Another distinction that has been made is between informational strategies and structural strategies.

***INFORMATIONAL STRATEGIES* ARE DESIGNED TO CHANGE PERCEPTIONS, MOTIVATIONS, KNOWLEDGE, SELF-EFFICACY AND PREVAILING NORMS UNDERLYING BEHAVIORS WITHOUT ACTUALLY MODIFYING THE EXTERNAL CONTEXT IN WHICH CHOICES ARE MADE** [82, 83]. The goal of informational interventions is to influence people's attitudes and awareness of environmental issues and the negative environmental impact of their behaviors. Primarily, informational strategies rely on cognitive information rather than emotional tools, such as providing facts, data, and logical arguments to enhance people's knowledge of available behavioral alternatives and their pros and cons. Furthermore, informational strategies can be an important element in implementing structural strategies that compel individuals to change their behavior [84]. For example, public support for structural strategies can be increased by informing people about the necessity and possible consequences of such strategies. However, while effective in shaping perceptions and fostering awareness, informational interventions may be less impactful in prompting significant pro-environmental behavioral change unless they align with individuals' intrinsic values and motivations [85, 86].

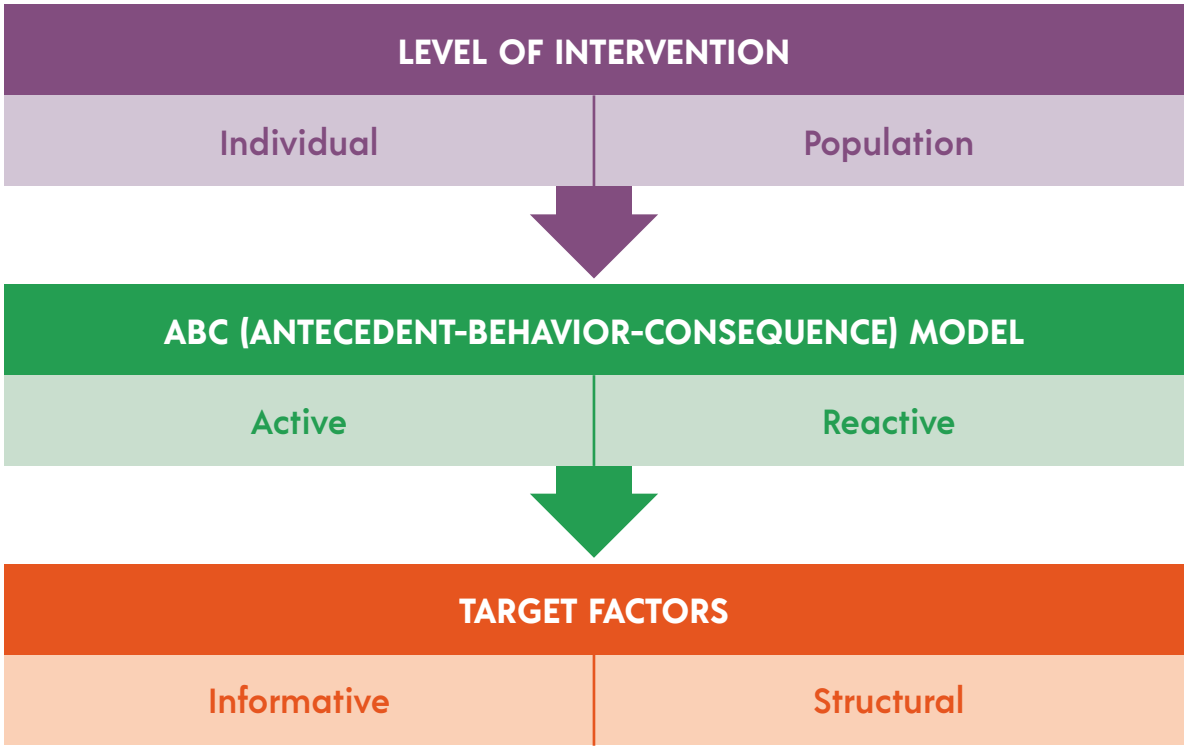
***STRUCTURAL STRATEGIES*, ON THE OTHER HAND, AIM TO MODIFY CONTEXTUAL FACTORS SURROUNDING BEHAVIORAL CHOICES, SUCH AS ADJUSTING THE COST-BENEFIT RATIO, VARIETY AND AVAILABILITY OF ENVIRONMENTALLY RELEVANT OPTIONS**. Acting in favor of the environment can often be challenging or costly due to external barriers, so changes in the circumstances in which behavioral choices are made may be necessary to increase individual opportunities to act in favor of the environment and create more attractive pro-environmental behavioral options [87, 88, 89, 90]. Structural interventions can also indirectly influence perceptions and motivational factors; for example, attitudes toward organic food may become more favorable when prices decrease; car use is reduced through urban level modifications. These interventions can modify the costs and benefits of behavioral alternatives through various means, including improving the availability and quality of products and services, implementing legal regulations and pricing policies, adopting rewards or sanctions or facility of access to daily services.

82. Messick & Brewer, 1983.
83. Abrahamse & Matthies, 2018.
84. Garling & Schuitema, 2007.
85. Bolderdijk et al., 2013.
86. Whitmarsh, Poortinga, & Capstick, 2021.
87. Rothschild, 1999.
88. Stern, 1999.
89. Thøgersen, 2005.
90. Van Raaij, 2002.

IN SUMMARY, WHILE INFORMATIONAL STRATEGIES ARE INSTRUMENTAL FOR RAISING AWARENESS AND BUILDING PUBLIC SUPPORT, STRUCTURAL STRATEGIES HAVE A MORE DIRECT IMPACT ON CHANGING BEHAVIORS BY ALTERING EXTERNAL CONDITIONS. A COMBINED APPROACH THAT LEVERAGES BOTH STRATEGIES OFTEN HAS THE HIGHEST TRANSFORMATION POTENTIAL, USING INFORMATIONAL CAMPAIGNS TO BUILD ACCEPTANCE FOR STRUCTURAL CHANGES AND FACILITATING SUSTAINABLE BEHAVIOR BY RESHAPING THE CHOICE ENVIRONMENT[91].

Figure 1 illustrates how interventions can be structured by integrating their levels of implementation, alignment with the ABC Model components, and the target factors they address.

FIGURE 1: Conceptual framework illustrating how interventions can be structured, based on levels of intervention, the ABC Model, and target factors.



91. Setiawan, Kaneko, & Kawata, 2019.

2. Types of Interventions

This section explores various key interventions designed to influence behavior, including incentives, feedback, social influences, communication strategies, nudges, and changes in the physical environment. Each type offers unique approaches to shaping behavior and decision-making.

2.1. Incentives and Rewards

To foster eco-friendly actions, offering both financial and non-financial rewards can be effective. Financial incentives might include cash bonuses, discounts, or lottery entries, while non-financial incentives could be items like gifts or vouchers that hold value but are not directly exchangeable for cash [92].

It has been widely documented in the literature that people can be motivated to mitigate environmental issues using monetary incentives [93, 94]. According to Geller [95], rewards are more effective in encouraging environmentally friendly actions compared to sanctions because they are associated with positive emotions and attitudes that support behavioral changes. As mentioned earlier, adopting more sustainable behaviors comes at a cost. The basic idea is that rewarding consumers/producers for the costs incurred in adopting more sustainable practices would promote greater adoption of such behaviors. For example, governments and other organizations have started to provide subsidies for renewable energy installations, electric vehicle purchases and eco-friendly agricultural practices. The goal is often for these subsidies to be equivalent to the difference in the cost of sustainable practices compared to less sustainable ones. Such forms of reward for those who choose sustainable paths have become common in various domains. For example, monetary incentives have been successfully introduced to motivate people to adopt a more sustainable lifestyle by providing payments based on the amount of recycled waste or reduced electricity usage [96, 97, 98]. However, for actions like home retrofitting, non-monetary barriers – such as time, effort, and logistical challenges – can also hinder adoption, suggesting that incentives alone may not be sufficient for all types of sustainable changes [99, 100]. especially when there is high cost of cognitive efforts or in time spent.

92. Rajapaksa et al., 2019.
93. Stern, 1999.
94. Bergquist et al., 2023.
95. Geller, 2002.
96. Tucker, Murney & Lamont, 1998.
97. Thøgersen & Olander, 2003.
98. Elinder, Escobar & Petré, 2017.
99. Amoah & Smith, 2024.
100. Fernández, Haffner, & Elsinga, 2022.

Indeed, **THE EFFECTIVENESS OF MONETARY POLICIES APPEARS TO BE AMBIGUOUS**. Firstly, these intervention strategies are often costly to implement [101]. Secondly, although it is acknowledged that incentives are effective for initial behavioral change, their long-term effect is still debated [102]. In fact, when rewards are substantial, people may attribute their behavioral change to the reward rather than their personal beliefs, as it seems that these forms of incentives fail to motivate people in terms of environmental sustainability [103]. Indeed, **A SIGNIFICANT LIMITATION OF MONETARY INCENTIVES IS THAT WHILE THEY MAY ENCOURAGE INITIAL ADOPTION OF ECO-FRIENDLY BEHAVIORS, THEY DO NOT NECESSARILY FOSTER A LASTING ECOLOGICAL MINDSET OR INTRINSIC MOTIVATION FOR SUSTAINABILITY**. Receiving money or other rewards for a pro-environmental practice often positions individuals as actors responding to external rewards rather than as advocates motivated by environmental, health or well-being concerns. This reliance on external rewards can lead to a phenomenon called extrinsic motivation – where actions are driven by rewards rather than personal values [104, 105]. Over time, this can reduce an individual's likelihood to engage in these behaviors if the rewards are removed, as they may not have developed an intrinsic commitment to environmental values. Behavioral scientists emphasize this distinction, as sustainable change is more likely when individuals internalize environmental values, feeling personally responsible for sustainable actions rather than merely acting for external rewards [106].

Consequently, rewards tend to have short-term effects as long as the reward is active and work just for as long as the incentive is in place. For example, Deci and colleagues [107] argue that motivation for pro-environmental behavior decreases after the incentive is removed. Furthermore, research on gain and loss framing suggests that sanctions can sometimes be even more effective than rewards, particularly when it comes to avoiding losses rather than achieving gains [108].

Thus, rewards and monetary incentives can only be effective in making pro-environmental behavior more attractive than environmentally harmful options, by providing immediate tangible benefits [109, 110], but their success often depends on whether they are accompanied by other strategies, such as informational or structural interventions. For example, informational strategies can help activate goals for behavior change by increasing awareness and aligning the behavior with personal values, while monetary incentives can provide the immediate reward to facilitate action. Thus, for long-term success, a combination of monetary incentives and other strategies may be necessary to reinforce the desired behavior and ensure sustainability. While policymakers primarily focus on how to effectively use monetary incentives to encourage individuals or industries to protect the environment, other forms of non-monetary incentives (e.g., social incentives) have also been shown to be useful tools for mitigating the negative impacts of human behavior on the environment [111]. We now turn to non-monetary rewards.

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101. Asensio & Delmas, 2015. - 102. Lefebvre & Stenger, 2020.
103. Allcott & Rogers, 2014. - 104. McDonald, 2014.
105. Yin, Wang, & Lu, 2024. - 106. Clark, Kotchen, & Moore, 2003.
107. Deci et al., 1999. - 108. Poortinga & Whitaker, 2018.
109. Garling & Loukopoulos, 2007. - 110. Garling & Schuitema, 2007. - 111. Bolderdijk et al., 2013.

2.2. Feedback

A feedback-based strategy involves providing individuals with information about the outcomes of their behaviors, particularly in relation to the environment. This can include data on how the environment has changed due to their behavior, how successful their actions were or how much energy or resources they have saved. By making the consequences of behavior more salient – such as showing reductions in environmental degradation or demonstrating the positive impact of sustainable actions –, feedback increases the likelihood of behavior change. For example, real-time data about energy consumption can help individuals adjust their behavior, leading to more eco-friendly practices.

Feedback works because it makes explicit cause-and-effect connections between behavior and consequences, facilitating cognitive work, thus influencing subsequent behaviors to avoid negative outcomes and achieve positive results. Feedback is information provided after a person (or group of people) has acted. The way feedback is provided varies considerably, from immediate positive, personal, and verbal or visual information to delayed negative, impersonal, and text-based information provided after a certain period (e.g., a household energy bill).

Interventions for environmental protection using feedback have been applied to reduce household energy consumption and have proven effective [112, 113, 114]. The frequency of feedback can vary from continuous feedback provided by monitoring devices [115], to monthly feedback comparing current usage to previous years [116].

Thaler and Sunstein [117] emphasize that it is important to provide immediate feedback to individuals on their behaviors and how they align with the desired outcomes, as well as ways to improve them. Timely and effective feedback can help individuals to understand the implications of their actions. For example, installing an energy consumption measurement device could provide feedback on the performance of various energy-consuming devices, enabling people to take measures to reduce excessive energy use and avoid unnecessary costs [118]. Additionally, feedback on "good" behaviors, such as energy savings, is equally important as it reinforces positive actions and encourages continued pro-environmental behavior.

112. Geller et al., 1982.
113. Wilson et al., 2013.
114. Dwyer et al., 1993.
115. Winett et al., 1982.
116. Hayes & Cone, 1981.
117. Thaler & Sunstein, 2008.
118. Soares et al., 2021.

2.3. Social Incentives

Several studies have indicated that people engage in pro-environmental behaviors due to various forms of "social influence"[119, 120, 121, 122, 123]. These social influences can be classified into external and internal forms[124], both of which play distinct roles in motivating behavior. **EXTERNAL SOCIAL INFLUENCES ARE OFTEN TIED TO FACTORS LIKE EXTRINSIC MOTIVATION, OTHERS' EXPECTATIONS, AND SOCIAL NORMS[125], WHILE INTERNAL INFLUENCES ARE LINKED TO PERSONAL ATTITUDES, INTRINSIC MOTIVATION, AND PERSONAL NORMS[126]**. The distinction between these types of influences is important, as they have different effects on behavior[127].

Social support in this context refers to reinforcement provided by others to promote socially accepted behaviors and social norms[128, 129]. This is somewhat different from the traditional understanding of emotional or practical support, as it more directly involves promoting awareness and adherence to societal expectations. For example, information about others' environmentally friendly actions (e.g., eco-friendly practices in a community) can act as a form of social support, reinforcing the adoption of similar behaviors. These social incentives include aspects related to both external social influence and internal social influence.

The presence of external social influences can promote environmentally friendly behaviors. For instance, studies have shown that people who receive feedback on their environmental behaviors (e.g., energy consumption) in the form of social comparisons (e.g., comparing their household energy use with others) may be motivated to engage in more sustainable practices[130, 131]. However, these external social influences are more effective for individuals who already have some interest or motivation to engage in pro-environmental behaviors. For individuals who are not initially interested in these behaviors, external influences have limited effectiveness[132], unless they are paired with other motivational strategies. Social influence mechanisms in this case include conformity (i.e., aligning behaviors to meet group expectations) and social identification (i.e., identifying with others who adopt similar behaviors), both of which help to reinforce pro-environmental actions[133]. Obviously, this would not work with climate skeptics.

INTERNAL SOCIAL INFLUENCE, WHICH INVOLVES PERSONAL VALUES, ATTITUDES, AND INTRINSIC MOTIVATION, SEEMS TO BE A MORE POWERFUL AND SUSTAINABLE DRIVER OF PRO-ENVIRONMENTAL BEHAVIORS. Internal influences not only lead to behavior change but also to a shift in perceptions and attitudes[133], which is critical for long-term sustainability. This underscores the importance of cultivating internal motivation to maintain these behaviors over time[134, 135, 136].

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119. Nguyen-Van, Stenger & Tiet, 2021. - 120.Videras et al., 2012.
121. Wan & Du, 2022. - 122. Perry et al., 2021.
123. Gifford & Nilsson, 2014. - 124. Briggs, 1966.
125. Cialdini & Goldstein, 2004. - 126. Bagozzi & Lee, 2002.
127. Silvi & Padilla, 2021127. Silvi & Padilla, 2021.
128. Jacobson, 1987. - 129. Langford et al., 1997.
130. Festinger, 1954. - 131. Robelia, Greenhow & Burton, 2011.
132. Bandura & Schunk, 1981. - 133. Nguyen-Van, Stenger & Tiet, 2021.
134. Turner, 1991. - 135. Cialdini & Goldstein, 2004. - 136. Harpine, 2015.

Interventions based on social norms, such as promoting peer behavior modeling or providing comparative feedback, have proven effective in driving pro-environmental behavior. Examples of such interventions include those aimed at promoting sustainable household electricity use [137], recycling [138], purchase of eco-friendly products [139], water conservation [140] and towel reuse [141].

Furthermore, it should be noted that social influence can be exerted in various ways. Abrahamse and Steg [142] examined the most commonly used social incentives as interventions for promoting sustainable behaviors and classified these strategies into the following categories: block-leader, public commitment, modeling, and feedback.

Specifically, one of the most effective intervention types is the **BLOCK-LEADER TECHNIQUE, WHICH IS BASED ON THE PRESENCE OF VOLUNTEERS FROM THE SAME SOCIAL CIRCLE AS THE TARGET INDIVIDUALS PROMOTING INFORMATION ON SPECIFIC ISSUES**. The underlying assumption is that communication is more effective when conveyed by peers who share similar social or cultural contexts. This peer-based approach has often been used in initiatives to increase pro-environmental behaviors, such as promoting correct recycling behaviors within a neighborhood [143, 144, 145] but also among stakeholders from the same profession. An example of the block-leader technique in action is the WePlayGreen initiative, where Morten Thorsby, a professional soccer player, served as a block leader. He helped promote environmentally sustainable practices among soccer fans, leveraging his position within the community to encourage behaviors like recycling and reducing waste. By being part of the same social network, Thorsby's influence was more impactful, showing how peer-based messaging can effectively promote environmental behaviors [146].

Strategies using the **PUBLIC COMMITMENT** technique are based on people making a commitment to engage in a specific behavior (e.g., reducing water consumption). This approach is particularly powerful when public commitments are made [147].

MODELING refers to the process by which individuals adopt behaviors observed in others, especially those who are perceived as role models or part of one's social group. When people see others engaging in pro-environmental behaviors, they are more likely to imitate those actions, especially if they feel a sense of connection or identification with the individuals who model the behavior [148, 149, 150].

137. Allcott, 2011.
138. Fornara et al., 2011.
139. Kim et al., 2012.
140. Lapinski et al., 2007.
141. Bohner & Schlueter, 2014.
142. Abrahamse & Steg, 2013.
143. Nielson & Ellington, 1983.
144. Burn, 1991.
145. Meneses & Palacio, 2007.
146. Carmichael, 2024.
147. Cialdini, 2003.
148. Schultz et al., 2007.
149. Abrahamse et al., 2005.
150. Lehman & Geller, 2004.

It is based on social learning theory, which studies the impact of the social sphere on individual learning [151]. The method involves using an exemplary person (i.e., the model) to demonstrate a specific behavior, with the idea that individuals are more likely to engage in behavioral change when a reference model is available. Unlike the block leader approach, which emphasizes a direct, structured interaction within a community, modeling operates through distant observation and imitation. For instance, a study [152] found that students were more likely to correctly categorize leftovers if they observed another person in the queue doing it correctly. Over time, these students might themselves become role models for others, creating a cascading effect of behavior adoption.

Finally, intervention strategies based on **SOCIAL FEEDBACK** refer to approaches in which the target group receives information about the behavior of others. The literature distinguishes between **FEEDBACK WITH SOCIAL COMPARISON (INFORMING PEOPLE ABOUT COMMON BEHAVIORS/ATTITUDES) OR GROUP COMPARISON FEEDBACK (PROVIDING INFORMATION ABOUT ONE'S OWN BEHAVIOR COMPARED TO THE BEHAVIOR OF OTHERS IN A CERTAIN GROUP)** [153]. For example, a research [154] demonstrated the use of social feedback in an energy conservation study. Households received feedback comparing their energy usage to neighborhood averages. Those who discovered their consumption was above average significantly reduced their energy usage. However, a "boomerang effect" occurred when households found their consumption was below average – they increased their energy use. To counteract this effect, the researchers introduced evaluative feedback (e.g., adding a positive note) or framed the comparison in terms of particularly efficient neighbors, encouraging continuous improvement rather than regression. This highlights the importance of carefully designing social feedback interventions to maximize their effectiveness while minimizing unintended consequences.

The effects of these interventions vary in terms of how effectively they influence behavior. For example, it has been highlighted that techniques based on face-to-face interactions (i.e., Block Leader, modeling, and public commitment) seem to be more effective than methods involving the use of feedback. Indeed, implementing interventions on social norms is not as straightforward as it may seem, and these interventions should be used with caution. It has been suggested that the effectiveness of this type of intervention appears to be influenced by various factors, such as the degree of an individual's identification with the reference group, the level of communication and cohesion within the group, individuals' ideologies (ex: conservative vs. liberal) and community characteristics [155].

From previous studies, it is clear that the social network represents a valuable source of knowledge and information for individuals, so the effectiveness of pro-environmental policies can be improved only if connections or interactions among individuals are increased as well.

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151. Bandura, 1977.
152. Sussman & Gifford, 2013.
153. Kluger & DeNisi, 1996.
154. Schultz et al., 2007.
155. Costa & Kahn, 2013.

2.4 Institutional Control and Sanctions

In the pursuit of desirable sustainability goals, various intervention approaches aim to influence human behavior through regulatory, political, or institutional changes that impose costs and sanctions on individuals engaging in unsustainable practices. Legal measures naturally require the enforcement of relevant laws and regulations, with violations monitored and subject to some form of punishment.

Through these strategies, governments seek to promote sustainability objectives and behaviors by focusing on those who do not adhere to rules favoring sustainable practices. However, **THE IMPOSITION OF SANCTIONS OFTEN MAKES SPECIFIC UNDESIRABLE BEHAVIORS MORE BURDENSOME, THEREBY LIMITING PEOPLE'S FREEDOM TO ACT AS THEY PREFER. THIS PERCEIVED LOSS OF FREEDOM CAN LEAD INDIVIDUALS TO ACT IN WAYS CONTRARY TO THE INTENDED INTERVENTION, A PROCESS KNOWN AS PSYCHOLOGICAL REACTANCE** [156] **OR COUNTER-CONTROL** [157]. In addition, sanction strategies may result in a negative attitude toward the entity imposing the penalties, particularly when the targeted behaviors are closely tied to personal identity, such as meat consumption. This effect is amplified when rules are framed as mandates rather than suggestions, as this approach often triggers greater psychological reactance. These dynamics suggest that excessive reliance on punitive measures to promote sustainability could undermine citizens' trust and appreciation for the government or policymakers involved.

In this regard, it is relevant to emphasize the importance of trust in government and institutions for the effectiveness of this type of intervention. Furthermore, existing literature has suggested that participation rates in pro-environmental programs can be increased by maintaining and developing greater institutional credibility [158, 159]. **GENERAL TRUST IN INSTITUTIONS (SUCH AS GOVERNMENTS, INSTITUTIONS, OR LEADERS) AND TRUST IN ECOLOGICAL EFFORTS ON THE PART OF THE SAME INSTITUTIONS MORE SPECIFICALLY, APPEARS TO BE NECESSARY TO ENSURE A POSITIVE IMPACT ON ENVIRONMENTALLY FRIENDLY BEHAVIORS**. For instance, greater institutional trust could reduce the risk of environmentally harmful behaviors as citizens would be willing to sacrifice some immediate personal benefits (e.g., contributing to the common good) if they had positive expectations about the long-term outcomes of government policies [160]. Examples of making institutions more inclusive, transparent, responsive and efficient at both local and national levels include increased transparency, better communication, and interaction with the public [161].

2.5. Information and Communication

Many interventions primarily focus on informative communication. Methods of environmental education and awareness involve providing informational materials such as flyers, newsletters, advertising campaigns, posters and magazines, with the expectation that this

156. Brehm, 1966. - 157. Sidman, 1989.
158. Polman & Slangen, 2008. - 159. Sønderskov, 2009.
160. Irwin, 2009. - 161. Zannakis, Wallin & Johansson, 2015.

information will create and strengthen awareness of environmental issues and challenges, thus modifying unsustainable behaviors. It is one of the most common approaches to promote behavioral change. **THIS INTERVENTION STRATEGY IS BASED ON THE ASSUMPTION OF KNOWLEDGE DEFICITS**[162]**, SUGGESTING THAT IN THE ABSENCE OF RELEVANT INFORMATION, BEHAVIORAL CHANGE DOES NOT OCCUR**. Information strategies aim to increase people's knowledge about environmental issues and the environmental impacts of their behavior, as well as raise awareness about available alternative behaviors and their pros and cons. It is presumed that this newfound knowledge will then translate into changes in attitudes, which in turn will influence behavior[163].

Scientific evidence suggests that information-based interventions are particularly effective when individuals are motivated by pre-existing interests and attitudes in environmental issues and a willingness to engage in pro-environmental behaviors. However, although this approach is relatively inexpensive, it does not always prove effective in achieving the ultimate goal of changing unsustainable behaviors[164]. In fact, pro-environmental attitudes do not always lead to pro-environmental behaviors[165, 166, 167, 168]. The disparity between concern for an environmental issue and associated behaviors highlights the relevance of barriers to behavioral change, including social, informational, economic, and psychological barriers[169].

Nevertheless, effective communication lays the groundwork for action, and without it, there would be no widespread awareness of climate change, and to a much lesser degree, biodiversity, as is the case today. However, it should be noted that communication about climate change or biodiversity loss is particularly challenging since they are is not immediately perceptible to most people, naturally leading to skepticism or under perception about its existence[170]. In this regard, it has been demonstrated that some communication strategies work better than others in transforming awareness into the will or intention to act. For example, informational messages containing motivational or empowering statements enhance perceived competence in addressing climate change, as well as individual engagement and intentions for eco-friendly behaviors, compared to messages emphasizing the sacrifices and efforts required for sustainability[171].

When individuals are informed of their personal responsibility and their social conscience is invoked, they may feel compelled to act to prevent the guilt that would result from inaction. It has indeed been shown that moral obligation (or altruism activated by norms), and perceived environmental responsibility are strong motivators for pro-environmental behaviors[172, 173].

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162. Owens, 2000. - 163. Schultz, 2002.
164. Abrahamse et al., 2005. - 165. Poortinga, Steg & Vlek, 2004.
166. Schultz & Zelezny, 1999. - 167. Finger, 1994.
168. Casaló, Escario, & Rodriguez-Sanchez, 2019.
169. Lorenzoni, Nicholson-Cole & Whitmarsh, 2007.
170. Moser, 2010. - 171. Gifford & Comeau, 2011.
172. Oyserman & Lee, 2008. - 173. Tanner & Kast, 2003.

2.5.1. Persuasive Communication

Communication based on persuasive strategies can be effective in influencing people's attitudes, reinforcing their altruistic and ecological values, and/or strengthening their commitment to act in favor of the environment [174, 175, 176]. Persuasion is defined as a form of communication designed to influence others by changing their beliefs, values, or attitudes [177]. Numerous studies have analyzed messages to identify factors that influence persuasive capability and have determined that the extent to which messages are attractive and persuasive depends on multiple aspects, such as whether they are emotional, memorable, capable of capturing the recipient's attention, and able to influence behavior or create favorable thoughts [178]. Finally, persuasive communication appears to be particularly effective in promoting sustainability actions when it is associated with salient beliefs already present in individuals [179, 180], as demonstrated in previous studies on waste collection behaviors [181] and towel reuse in hotels [182].

2.5.2. Framing

Framing is a lesser known mode of intervention but far likely to be more efficient than data communication. It is also much less used. People respond not only to incentives, information, and persuasion but also to how these interventions are framed and communicated [183, 184]. Often, in formulating informational interventions on environmental issues, it is assumed that simply communicating the seriousness of scientific evidence is sufficient to galvanize people into action [185]. Unfortunately, that is not the case: in fact, it is not only the quantity or accessibility of information provided to people that matters but also how such scientific evidence and other information are presented. In particular, simplifying messages is critical - making information easier to understand and aligning with individuals' cognitive processing and decision-making styles.

Additionally, **IT IS CRUCIAL TO FRAME INFORMATION IN A WAY THAT RESONATES WITH PEOPLE'S VALUES AND ATTITUDES, EMPHASIZING PERSPECTIVES THAT ARE MOST LIKELY TO INSPIRE ENGAGEMENT AND ACTION. THIS REFERS TO MESSAGE FRAMING, WHICH INDICATES HOW FACTS ARE PRESENTED FROM A PARTICULAR PERSPECTIVE OR INTERPRETATIVE FRAMEWORK. IMPORTANTLY, FRAMING CAN ALSO ENCOMPASS TAILORING MESSAGES TO SPECIFIC CULTURAL CONTEXTS [186], COMMUNICATION STYLES, AND VALUES, ENSURING THE MESSAGE RESONATES WITH DIVERSE AUDIENCES**. For example, the issue of water pollution can be framed as an environmental problem, emphasizing its impact on ecological systems, wildlife, and the aesthetics of nature. An alternative framing could present water pollution as a threat to human health, thus emphasizing the risk to people associated with this phenomenon [187].

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174. Abrahamse et al., 2005. - 175. Bamberg, 2002.
176. Jakobsson, Fujii & Garling, 2002. - 177. O'Keefe, 2002.
178. Bettinghaus & Cody, 1994. - 179. Falk, 2005.
180. Kachel & Jennings, 2010.
181. Brown, Ham & Hughes, 2010. - 182. Goldstein, Cialdini, & Griskevicius, 2008.
183. Kahneman et al., 1991. - 184. Kamenica, 2012. 185. Nisbet & Mooney, 2007.
186. Uskul & Oyserman, 2010. - 187. Manning et al., 2009.

Framing, when done ethically, does not mean deceiving people or distorting information. Rather, **IT INVOLVES HONESTLY COMMUNICATING THE EVIDENCE BUT IN A WAY THAT EMPHASIZES HOW THE PROBLEM RELATES TO INDIVIDUALS' DEEPER CONCERNS AND VALUES, MAKING THE ISSUE MORE PERSONALLY RELEVANT, CONSIDERING THE INTENDED AUDIENCE**.

2.6 Nudge

The term "nudge" is often used as a generic term to refer to various tools used to encourage certain actions or behavioral changes. Nudging has gained considerable popularity in recent decades, not only among academics but also among policymakers and civil society [188]. Nudges are used to deliberately change the decision-making context in order to influence people's decisions in a predetermined direction [189], without prohibiting any options [190]. A well-known example comes from Amsterdam's Schiphol Airport, where a small, strategically placed image of a fly in the urinals significantly reduced spillage by 80% [191]. By providing a simple visual target, this intervention subtly influenced behavior in a practical and effective way. Altering the context in which decisions are made can encourage desirable behaviors and discourage undesirable ones [192].

Unlike interventions based on incentives and environmental education, which aim at controlled and conscious decision-making to enact a behavior, **NUDGES OPERATE THROUGH THE MODIFICATION OF CONTEXTUAL VARIABLES THAT INFLUENCE BEHAVIOR THROUGH AUTOMATIC AND UNCONSCIOUS COGNITIVE PROCESSES** [193]. This can be done by simplifying the information provided or offering default choices in a way that leverage the default effect – a cognitive bias in which individuals are more likely to stick with the pre-selected or pre-set option [194]. For example, making environmentally friendly energy sources the default option on utility contracts capitalizes on this bias, encouraging socially desirable choices without requiring active decision-making from individuals. This effect works because choosing to act against the default requires extra effort or conscious deliberation.

Therefore, nudges do not seek to change people's value systems or provide information; instead, **THEY FOCUS ON PROMOTING IMMEDIATE BEHAVIORS AND DECISIONS THAT ARE BENEFICIAL TO SOCIETY AND TYPICALLY IN THE LONG-TERM INTEREST OF THE INDIVIDUAL**.

Various techniques exist as nudge tools. These include the use of defaults, primes, and prompts, as well as modifying the design and features of environments. Additionally, the use of social norms and feedback can also be considered forms of nudging. Nudges are

188. Lehner et al., 2016.
189. Wallen & Daut, 2018.
190. Thaler & Sunstein, 2008.
191. Thaler & Sunstein, 2008.
192. Grunert & Reisch, 2021.
193. Dolan et al., 2012.
194. Jachimowicz et al., 2019.

mostly employed to support the change of a collective of people in a specific behavior, regardless of individual differences. Nudge-based interventions have been successfully applied in many areas and for various types of behavior, such as reducing energy consumption [195, 196, 197], limiting water and paper consumption [198] and reducing food waste in restaurants [199]. The advantages of nudging approaches include low economic cost, preservation of individual choice and the ability to achieve desired results without major systemic changes. However, nudges are not without their challenges, and their effectiveness critically depends on situational conditions [200, 201]. Research has shown that people can react differently to a nudge [202, 203], for example, individuals' intrinsic motivation seems to influence their effectiveness [204, 205]. Also, it remains to be seen **WHETHER THE INITIAL BEHAVIORAL CHANGES PROMPTED BY NUDGES ARE SUSTAINED OVER TIME, AS LONG-TERM FOLLOW-UPS ARE RARELY CONDUCTED, AND FIELD STUDIES OFTEN LACK THE LARGE SAMPLE SIZES AND RIGOROUS CONTROLS NEEDED FOR DEFINITIVE CONCLUSIONS**.

2.6.1. Defaults

A default option refers to the preset choice, that is, an option that would be automatically followed unless a decision-maker explicitly opposes it. Default choices are made based on presumed or implicit consent rather than explicit consent [206] and involve very little cognitive effort.

Default choice is one of the most powerful and frequently used nudge techniques. **IT OPERATES ON HOW CHOICE ALTERNATIVES ARE STRUCTURED AND ORGANIZED AND INVOLVES ESTABLISHING A PRESELECTED OPTION AS THE DEFAULT AND REQUIRING INDIVIDUALS TO ACTIVELY DECIDE WHETHER TO CHANGE IT, THEREBY LEVERAGING THE TENDENCY TO STICK WITH THE STATUS QUO**. There are various reasons why people tend to choose a default option: 1) people may not even realize that they have a choice to make; 2) people may notice but presume that the default option is recommended by a competent authority; 3) actively making a different decision can involve costs in terms of money or time; going along with the default choice avoids such costs; 4) people prefer not to choose (omission bias), accepting the consequences of this inertia rather than taking responsibility for action [207].

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195. Allcott & Mullainathan, 2010.
196. Allcott & Rogers, 2014.
197. Costa & Kahn, 2013.
198. Egebark & Ekström, 2016.
199. Kallbekken & Sælen, 2013.
200. de Ridder et al., 2020.
201. Mertens et al., 2022.
202. Isoaho et al., 2019.
203. Vetter & Kutzner, 2016.
204. Lehner et al., 2016.
205. Lindahl & Stikvoort, 2015.
206. Johnson et al., 2012.
207. Ritov & Baron, 1992.

Manipulating the default choice has been shown to be effective in promoting environmentally friendly goods, especially green electricity tariffs derived from renewable sources [208]. Other examples include promoting sustainable food choices, where offering a default menu with appealing meat-free options can increase the likelihood of pro-environmental decisions in campus dining halls, complementing existing information and education efforts [209]. Similarly, using a vegetarian lunch as the default option at conferences can serve as a normative signal, effectively encouraging healthier and more sustainable food choices, with most participants expressing positive attitudes towards the nudge [210].

2.6.2. Priming

PRIMING IS A PSYCHOLOGICAL EFFECT WHEREBY EXPOSURE TO ONE STIMULUS INFLUENCES THE RESPONSE TO SUBSEQUENT STIMULI AND INVOLVES THE USE OF SMALL CUES OR "PRIMES" THAT ACTIVATE ASSOCIATED KNOWLEDGE STRUCTURES IN OUR MINDS AND INFLUENCE OUR COGNITIVE PROCESSES [211]. These influences can be strong enough to condition behavior [212]. This nudging strategy has been shown to be effective in both activating and inhibiting behaviors [213]. Additionally, motivational priming can induce a normative orientation or reinforce currently held normative beliefs and can thus lead to a change in the collective behavior of a social group [214, 215, 216].

Another technique used as a nudge is ***contextual priming***, which involves intervening in the environment in which an individual has to make a choice and in which people's preferences are influenced by the characteristics of the environment in which they are making a choice. There are many contextual features that can be influenced, especially physical ones (e.g., lighting, smells, sounds, architectural spaces, and so on). Frequently, such context alterations involve changing specific peripheral information, meaning information that is not directly related to the behavior being targeted. For example, in the context of priming interventions, previous studies have examined whether the use of olfactory signals (such as pleasant environmental fragrances) can help promote ecological behaviors, demonstrating their effectiveness [217].

208. Pichert & Katsikopoulos, 2008
209. Campbell-Arvai et al., 2014
210. Hansen, Schilling, & Malthesen, 2019
211. Scaffidi Abbate et al., 2014
212. Skandrani-Marzouki & Marzouki, 2012
213. Dijksterhuis & van Knippenberg, 1996
214 Förster, Higgins, & Taylor, 2003
215. Higgins, Shah, & Friedman, 1997
216. Sengupta & Zhou, 2007
217 Bonini et al., 2015

In addition to olfactory contextual priming, research has also studied the impact of visual contextual priming. For example, Dorofeeva, Bonini, and Hadjichristidis [218] examined the effect of visual priming on participants' recycling behavior using neutral images (e.g., geometric shapes) and nature images (e.g., a mountain image). Participants were given a biscuit (on a plastic plate) and a napkin at the start of the experiment to evaluate whether the visual priming administered influenced participants' recycling behavior, i.e., the correct disposal of the plastic plate (plastic bin) and paper (paper bin). The results showed a significant effect of visual priming; the percentage of participants who recycled the plate and paper was about twice as high in the natural priming condition compared to the neutral priming condition.

2.6.3. Prompts

One type of situational factor that has been shown to successfully promote pro-environmental behaviors is prompts, or reminders, of when to perform a specific action [219]. **PROMPTS ARE LOW-COST MODIFICATIONS TO THE PHYSICAL ENVIRONMENT, PRESENTED NEAR THE LOCATION WHERE THE BEHAVIOR OCCURS, AND SHOULD IDEALLY FOCUS ON REMINDING PEOPLE OF THE POSITIVE AND DESIRED BEHAVIOR** [220].

Schultz [221] stated that prompts work best for easy and repetitive behaviors and when prompts are displayed directly in the context where the person needs to act. This type of prompt is often called a "point-of-decision prompt" because the reminder is displayed at the time and place where the person must choose whether or not to perform the behavior. For example, prompts are widely used in local energy-saving campaigns, such as stickers reminding building occupants to turn off the lights when leaving.

The use of prompts seems to be effective because individuals often simply forget to engage in more sustainable behaviors. A person may have pro-environmental attitudes but might not act in favor of the environment in a given situation simply because they do not know how, when, or if to act in that specific context. This implies that individuals may be motivated to act sustainably, but they could be distracted or the appropriate pro-environmental behavior might not seem relevant in that context. Therefore, prompts can serve as reminders. However, the effect of prompts seems to fade easily and can often be perceived as annoying by some users [222].

218 Dorofeeva, Bonini, & Hadjichristidis, 2017.
219. Osbaldiston & Schott, 2012.
220. McKenzie-Mohr & Schultz, 2014.
221. Schultz, 2014.
222. Backhaus & Heiskanen, 2009.

2.7 Changes in the Physical Environment

The physical environment has long been recognized to have a significant impact on individuals' choices. This appears particularly significant in low-involvement decision situations, where individuals are likely to allow the physical environment to influence their choices or if the environment provides barriers to the preferred behavior. The physical environment can also provide cues and suggestions about appropriate conduct. This approach has been widely adopted across various fields, including public health, marketing, medicine, urbanism and even restroom design.

Nudging strategies through design (i.e., changes in the physical environment) seem to be particularly suitable for influencing behavior related to waste separation and recycling by altering the sizes and colors of waste bins to make recycling bins more attractive or by putting hydroalcoholic gel right in front of public entrances during the covid period [223].

Moreover, it has been demonstrated that interventions involving reduced portion sizes and dishes [224, 225] contribute to reducing food waste. Previous research has also suggested that changes in the physical environment are important for increasing the use of bicycles as a means of transportation, through the design of separate bicycle lanes along roads and bicycle parking [226].

223. Grunert & Reisch 20212.
224. Freedman & Brochado, 2010.
225. Rolls et al., 2002.
226. Pucher & Buehler, 2008

Summary table of intervention types.

TYPE OF INTERVENTION	Level of intervention		ABC Model		Target Factors		Definition
	Individual	Population	Antecedent	Reactive	Informative	Structural	
Rewards	●	●		●		●	Positive consequence for the individual after performing the desired behavior
Incentives	●	●	●	●		●	Promise of positive consequences for desired behavior
Disincentives		●	●			●	Promise of negative consequences for desired behavior
Feedback	●			●	●		Providing information about individual behaviors
Social comparative feedback	●			●	●		Providing information about a person's behavior in relation to others
Block-Leader	●		●		●		A leader from the same social group provides information
Public commitment	●		●		●		Promise to engage in a behavior
Modeling	●		●		●		Using a person as a model to demonstrate a behavior
Sanctions		●		●		●	Imposition of costs and penalties as a consequence of undesirable behavior
Information	●	●	●		●		Increasing awareness of environmental issues and sustainable behaviors
Persuasion	●	●	●		●		A form of communication to influence beliefs, values, or attitudes
Framing	●	●	●		●		The way facts are presented from a particular perspective or interpretation
Nudge		●	●			●	Techniques used to encourage specific actions or behavioral changes
Defaults		●	●			●	Creating the default option with the desired behavior
Priming		●	●			●	Psychological effect where exposure to one stimulus influences the response to a subsequent one
Prompts		●	●			●	Reminder about desired behavior
Physical Environment's changes		●	●			●	Designing the environment to facilitate and support desired behavior

3. Long-Term Interventions

While there is a substantial body of literature examining the initial effects of various forms of intervention on pro-environmental behavior change, the interpretation of "impact" often varies significantly across studies. In some cases, this refers to changes in self-reported intentions or attitudes measured through surveys; while, in others, it might involve behavioral outcomes, such as reductions in electricity consumption tracked via smart meters. These differences in study design and evaluation criteria highlight a key challenge: **THE NEED FOR GREATER CLARITY IN DEFINING AND MEASURING WHAT CONSTITUTES AN EFFECTIVE OUTCOME**.

Evidence on long-term effects and sustained pro-environmental behaviors over time remains limited, partly due to the challenges of conducting longitudinal studies that can capture enduring changes. This lack of consistency in how impacts are measured complicates comparisons across studies and underscores the importance of further research to provide clearer, more standardized results. **EXPLICITLY DEFINING OUTCOMES—WHETHER IN TERMS OF TANGIBLE METRICS LIKE KWH SAVINGS OR GREENHOUSE GAS REDUCTIONS OR SHIFTS IN MENTAL OR SOCIAL REPRESENTATIONS AND IN ACTUAL BEHAVIORS—WILL BE ESSENTIAL FOR ADVANCING OUR UNDERSTANDING OF LONG-TERM EFFICACY**. In other words, we need to answer: what are the criteria defining goals and thus, which are to be measured? The tendency is to focus on measurable criteria while subjective factors, such as social representations as less investigated while they are crucial.

IN GENERAL, THE EFFECTS OF INTERVENTIONS, LIKE THE ONES REVIEWED ABOVE, OFTEN SEEM TO FADE ONCE THE IMPLEMENTED MEASURE IS NO LONGER IN PLACE. However, some interventions can be effective in supporting sustainable behaviors over time.

Overall, treatments repeated over time appear to be an efficient strategy for facilitating sustained behavior and turning it into a person's established habit [227], although this is often impractical and expensive. Low-cost measures such as comparative feedback and statements of social norms seem like actions suitable for repetition over time and have the potential to promote stronger pro-environmental attitudes and greater awareness of environmental consequences. Hence, social networks and their influence can be helpful in motivating people in their daily lives and can be a good support tool for encouraging each other in the long-term community [228].

227. Mazar et al., 2021.
228. Abrahamse & Steg, 2013.

Furthermore, **INTERVENTIONS THAT COUNTER UNDESIRABLE HABITS WHILE SIMULTANEOUSLY PROMOTING THE FORMATION OF NEW HABITS APPEAR TO BE ESSENTIAL FOR EFFECTIVE AND LASTING CHANGE**[229, 230]. For example, installing motion-sensor lighting in homes or workplaces not only disrupts the habit of leaving lights on, but it also encourages energy-saving practices by automating the desired behavior. Frequent and repeated feedback over an extended period can foster habit formation that reduce environmental impact. A habit is a tendency to act automatically, driven by a mental association – often subconscious – between a situation and a response. These associations are formed through repeated behaviors in a particular context, making habits efficient but also challenging to alter once established. Once a habit is formed, it can persist even when individuals are no longer actively considering the environmental consequences of their actions, underscoring the importance of targeting these automatic behaviors in intervention strategies.

Research indicates **THREE GENERAL PRINCIPLES FOR DESIGNING INTERVENTIONS THAT PROMOTE THE REPETITION OF ENVIRONMENTALLY DESIRABLE BEHAVIORS, NAMELY: MODIFYING RESISTANCE AND BARRIERS; ADDING OR REMOVING ACTION SIGNALS; AND LEVERAGING PSYCHOLOGICALLY INFORMATIVE INCENTIVES**. While these principles are applicable to both short- and long-term behavior changes, they are particularly relevant for long-term change since sustained behaviors often require addressing deeper barriers, reinforcing cues over time, and maintaining motivation through meaningful incentives. By targeting these areas, interventions can help to establish and maintain habits that persist beyond immediate contexts.

The first principle involves **MODULATING BARRIERS AND REDUCING THE PERCEIVED DIFFICULTY OF PERFORMING A BEHAVIOR**. Interventions that modify these aspects alter situations to make desirable behaviors seem easier, while undesirable behaviors appear more difficult. For instance, introducing widely available and clearly labeled recycling bins in public spaces reduces the effort required for proper waste disposal, making it easier for individuals to recycle. At the same time, implementing restrictions on single-use plastic items, such as bans or surcharges, increases the difficulty or cost of less sustainable behaviors. Simplifying desirable behavior, such as promoting reusable water bottles with convenient refill stations, can also accelerate habit formation, as simple behaviors consolidate into habits more quickly than complex ones[231, 232].

229. Pierce, Schiano & Paulos, 2010.
230. Neal, Wood & Drolet, 2013.
231. Kaushal & Rhodes, 2015.
232. Lally et al., 2010.

Another approach to increase ecological behavior is to **ADD, REMOVE, OR REPLACE ACTION SIGNALS (CUES)**. Recurring signals are particularly important for habit formation. When habits form, signals become associated in memory with an action, so that the perception of the signal automatically activates the action [233]. The adoption of signals can be used to encourage the formation of desirable habits and discourage undesirable behaviors. To be more effective, action signals should be specific and unambiguous, requiring direct and concrete actions to strengthen the automatic signal-response associations that characterize habits. For example, placing brightly colored stickers near light switches with messages like "Please don't leave the lights on!" [234] serves as a clear and specific cue that prompts individuals to switch off the lights. Over time, the visual signal becomes associated with the action, reinforcing the habit of turning off lights without requiring conscious thought.

Finally, incentives and disincentives can be structured to effectively achieve environmental policy goals. Some policies, however, overlook evidence that such measures can be made more effective by drawing on key psychological principles. For example, cities implementing congestion charges to reduce car usage have found that making the charges immediate and clearly communicated increases their effectiveness. Drivers receive real-time notifications about the cost of entering certain areas, making the disincentive salient and directly tied to their behavior. A time lag between the behavior and the cue is less effective. Similarly, offering financial incentives, such as discounts on public transportation passes for those who forgo driving, can encourage individuals to adopt sustainable commuting habits [235]?

BY DESIGNING INCENTIVES AND DISINCENTIVES TO BE IMMEDIATE, SALIENT, AND LINKED TO SPECIFIC BEHAVIOR, policymakers can amplify the potential of the intervention to either induce and reinforce good habits or stop negative habits. In some cases, these incentives do not need to be permanent; once individuals have shifted to public transportation and established a new routine, the incentive can often be removed without significant behavior reversal, if the new habit is perceived as convenient or beneficial. This principle is adopted by the Vested Interested Theory which aims **TO REDUCE THE ATTITUDE-BEHAVIOR GAP OR THE KNOWLEDGE-BEHAVIOR GAP, BY LEVERAGING ON INFORMATION AND CONTEXTUAL CUES CAPABLE OF INCREASING FOUR RELEVANT FACTORS FOR A PERSON'S STAKE (I.E., INDIVIDUAL PERCEPTIONS OF THE GAIN–LOSS CONSEQUENCES OF A PARTICULAR ATTITUDE OBJECT FOR ITS HOLDER** [236, 237, 238]**): NAMELY, SALIENCE OF THE OBJECT, CERTAINTY OF THE CONSEQUENCES, IMMEDIACY OF THE CONSEQUENCES, SELF-EFFICACY OF THE INDIVIDUAL**. This has been for example shown in order to increase adaptation intentions and behaviors to cope with

233. Wood & Rünger, 2016.
234. Bergquist & Nilsson, 2016.
235. Kuss & Nicholas, 2022.
236. Crano and Prislin, 1995.
237. Crano and Prislin, 2006.
238. Crano and Prislin, 2008.

impending natural hazards (e.g., [239, 240]). This model has been applied in order to improve attitude-behavior, or knowledge-behavior, consistency in the realm of environmental behaviors, specifically in order to improve adaptation behaviors within environmental risk prone areas: for example, by structuring information communication addressed to inhabitants of higher environmental risk areas (floods) in terms of Vested Interest Theory (i.e., characterizing the relevant risk implication features in terms of its Stake, Salience, Immediacy, Certainty, and Self-Efficacy) implies an increased consistency among favorable attitude towards carrying out target adaptation behaviors or experience, on the one side, and adequate adaptation behavioral intentions, on the other side [241, 242].

Adopting these three principles can help create structural changes, with circumstances that encourage the repetition of desirable actions and discourage the habitual performance of undesirable ones. This seems to be the foundation for effectively promoting behavior change toward environmental sustainability, with lasting effects in the long term.

There are a few kinds of interventions which are designed to typically operate over an extended timeframe, either because they require long periods to implement, and/or because their effectiveness relies on prolonged exposure. Two notable examples in the case of environmental sustainability behaviors (either for adaptation or mitigation purposes) are Environmental Education and Nature-Based Solutions (NBS).

3.1. Environmental Education

Within the broad scope of environmental education, environmental psychology examines the role of social-psychological variables in fostering behavioral change following participation in environmental education activities [243]. These activities can range from traditional approaches to more innovative methods. From a psychological perspective, the focus is not only on the acquisition of specific knowledge but, more importantly, on developing a wide range of social-psychological constructs. These constructs, acting in isolation or synergistically, can increase the likelihood of individuals adopting pro-environmental actions, such as behaviors that mitigate their environmental impact or that support adaptation to climate change.

The influence of these social-psychological constructs can be direct – directly altering behavior – or indirect, through a mediated causal chain, where one construct influences another one, ultimately leading to behavioral change. Constructs such as norms (e.g., family or school norms), values, beliefs, attitudes, connection to nature, and environmental identity are all critical targets of environmental education. Even knowledge, when tailored to specific contexts and processes, can play a significant role. For example, an experimental study

239. De Dominicis, et al., 2014
240. De Dominicis, et al., 2021
241. De Dominicis et al., 2014
242. De Dominicis et al., 2021
243. Chawla & Derr, 2012

conducted in Italy highlighted the role of protected natural areas as effective contexts for environmental education [244]. Their findings showed that direct experiences in these natural settings enhanced environmental knowledge and fostered a stronger connection to nature, which, in turn, increased the likelihood of individuals engaging in sustainable behaviors. This can be generalized thanks to meta-analyses showing the powerful effect of various kinds of formal institutional environmental outdoor education interventions in specifically improving environmental knowledge and attitudes [245]. Retrospective data suggest possible chains of long-term sequential mediation effects moving from the first exposure to environmental educational experiences and norms in family and at school during childhood; via the progressive development of environmental knowledge, values, identity and the like during the following development stages; up to the final manifestation of environmental attitudes, intentions, and behavior in adulthood [246].

Environmental education aims to promote both mitigation and adaptation behaviors by targeting these constructs. Traditionally, environmental and climate change education has focused on children and adolescents. However, it can also effectively target adults, with evidence suggesting that activities aimed at children, such as school-based programs, can indirectly influence the behaviors of their parents. The design of educational interventions varies in duration – from brief initiatives to long-term programs that involve immersive experiences in natural environments. Monitoring and evaluation, employing appropriate control groups, are crucial for assessing the effectiveness and efficiency of these interventions in fostering real, significant, and stable behavioral change

3.2. Nature-Based Solutions

NATURE-BASED SOLUTIONS REFER TO INTERVENTIONS THAT UTILIZE NATURAL PROCESSES AND SYSTEMS TO ADDRESS SOCIETAL CHALLENGES, PARTICULARLY THOSE RELATED TO SUSTAINABLE URBAN DEVELOPMENT AND CLIMATE CHANGE ADAPTATION AND MITIGATION [247]. NBS involve the restoration of ecosystems, the creation of sustainable socio-ecological systems, and the enhancement of human health and well-being through ecosystem services [248].

Examples of NBS include green infrastructure, which conserves ecosystem functions while providing human benefits [249], and interventions such as blue spaces, which promote health and well-being by reducing stress and enhancing emotion regulation [250, 251, 252]. These solutions are particularly effective when integrated with technological and cultural measures that encourage community participation in landscape planning and governance. Although NBS are not a panacea for all climate challenges, they provide a unifying paradigm for promoting sustainable urbanization and supporting human and psychological health.

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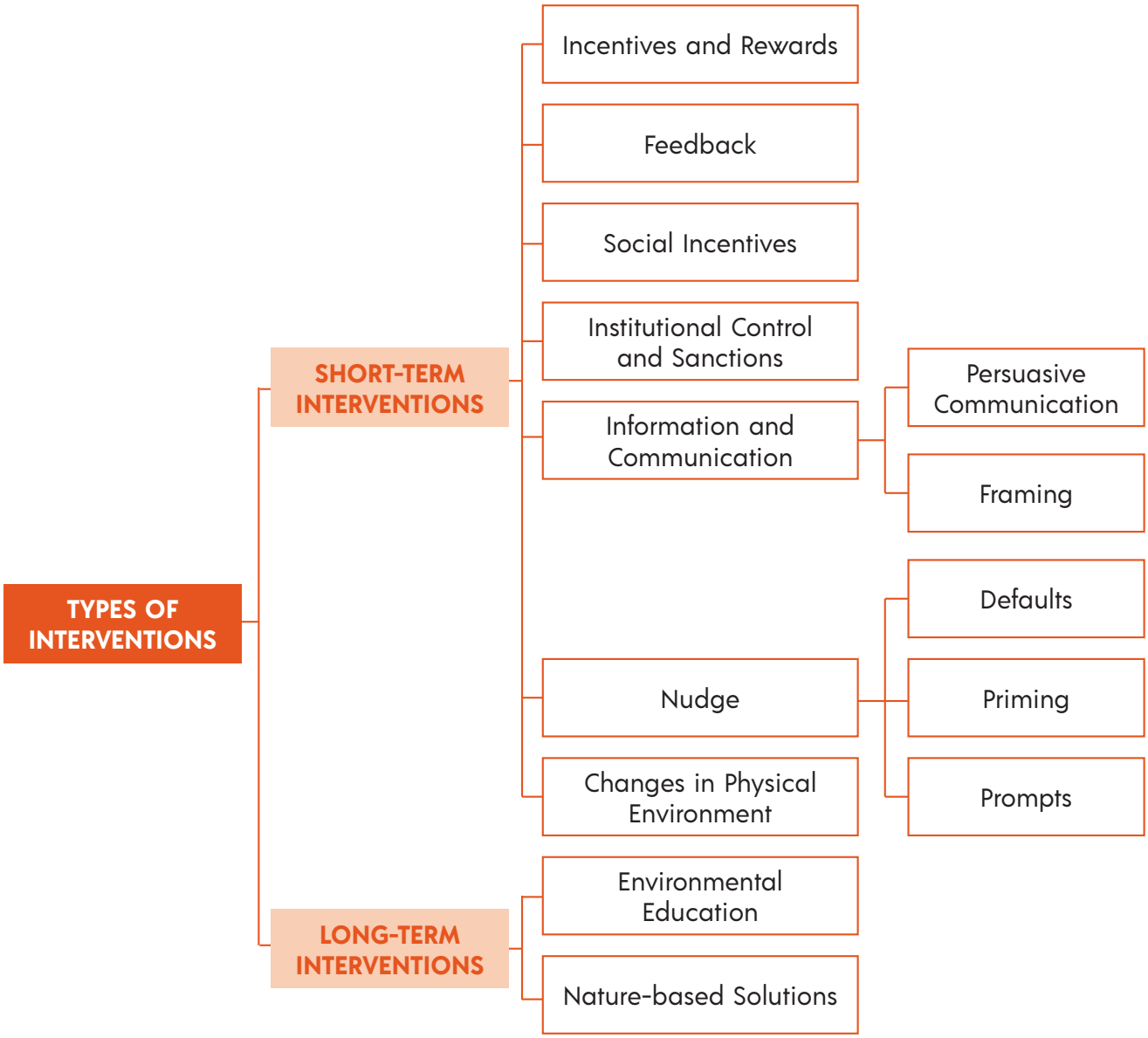
244. De Dominicis et al., 2017. - 245. Xie et al. (submitted paper).
246. Molinario et al., 2020. - 247. European Union, 2020.
248. Kabisch et al., 2016. - 249. Benedict & McMahon, 2006.
250. Hartig et al., 2014. - 251. Bonaiuto & Alberts, 2022. - 252. Bonaiuto & Alves, 2024.

Additionally, NBS can generate indirect effects, or spillovers, influencing behaviors beyond the intervention's target. However, research indicates that spillover effects are infrequent. Factors such as autonomy, normative goals, and clear rationale, without reliance on financial incentives, can slightly enhance spillover outcomes [253].

By addressing both individual and systemic factors, environmental education and NBS represent complementary approaches to promoting sustainable behavior and mitigating climate change impacts over more extended periods.

Figure 2 illustrates the categorization of interventions into short- and long-term approaches, highlighting the key strategies discussed in this chapter.

FIGURE 2. Types of interventions categorized into short- and long-term approaches with key strategies.



253. Geiger et al., 2021.

4. Transversal reflections on Behavioral Change Interventions

This chapter shows how Intervention strategies for promoting pro-environmental behaviors vary significantly in their mechanisms, scale and effectiveness. These strategies can target individuals or populations, involve antecedent or reactive methods, and leverage informational or structural approaches. The diversity of these techniques highlights the need to consider their applicability in different contexts and their potential for long-term effectiveness. By examining these interventions transversally, several patterns and insights emerge, offering valuable lessons for designing comprehensive and sustainable behavioral change programs.

4.1. Short-term vs. Long-term effects

While many interventions show promise in achieving immediate behavioral changes, sustaining these effects over time remains a challenge. Some interventions are designed for immediate, situation-specific impacts. For example, nudges, such as defaults or prompts, are effective for initiating pro-environmental actions by simplifying decision-making processes or leveraging cognitive biases like the default effect. However, their long-term impact often diminishes due to habituation or over-sensitization. To counteract this, **INTERVENTIONS NEED TO BE PAIRED WITH STRATEGIES THAT REINFORCE BEHAVIOR OVER TIME, SUCH AS FEEDBACK MECHANISMS THAT PROVIDE ONGOING REMINDERS AND REWARDS**.

Conversely, interventions that align with intrinsic motivations, such as public commitments or modeling, can foster deeper, more enduring behavioral changes. By embedding desired behaviors into individuals' identities and values, these approaches help to internalize sustainable practices, reducing reliance on external triggers. Also, structural interventions, such as changing product availability or implementing policies that incentivize sustainable behaviors, can establish new norms and habits, driving long-term transformation.

4.2. Individual vs. Collective approaches

Individual-focused interventions, such as rewards or feedback or informational campaigns, can effectively address personal motivations and capabilities. For instance, providing real-time feedback on energy consumption has been shown to reduce usage at the household level. However, these strategies may have limited reach when broader systemic factors, such as infrastructure or cultural norms, act as barriers.

Population-level interventions, such as modifying the physical macroenvironment through better infrastructure (e.g., dedicated bike lanes) or implementing economic incentives (e.g., subsidies for renewable energy), address systemic barriers and create an enabling environment for widespread behavior change. These interventions often have a larger scale impact but require significant resources and may face resistance from entrenched societal or economic interests.

4.3. Strengths and weaknesses of intervention types

Social-psychological interventions to promote ecological transition exhibit both strengths and weaknesses, which vary depending on their scale, focus and design. **INDIVIDUAL-LEVEL INTERVENTIONS**, such as feedback, education, and rewards, **EXCEL IN CUSTOMIZATION AND FOSTERING IMMEDIATE BEHAVIORAL CHANGES. HOWEVER, THEY OFTEN STRUGGLE TO ACHIEVE LONG-TERM EFFECTS, AS CHANGES MAY FADE WITHOUT SUSTAINED REINFORCEMENT. ADDITIONALLY, THEIR IMPACT IS LIMITED WHEN STRUCTURAL BARRIERS, SUCH AS LACK OF INFRASTRUCTURE OR ECONOMIC INCENTIVES, ARE NOT ADDRESSED**.

POPULATION-LEVEL STRATEGIES, including social norms campaigns and infrastructural improvements, can achieve broader and more enduring impacts. **THESE APPROACHES RESHAPE ENVIRONMENTS TO MAKE SUSTAINABLE BEHAVIORS EASIER AND MORE APPEALING. HOWEVER, THEIR SUCCESS DEPENDS ON CULTURAL AND CONTEXTUAL ALIGNMENT, AND THEY MAY ENCOUNTER RESISTANCE FROM STAKEHOLDERS OR UNINTENDED EFFECTS LIKE THE "BOOMERANG EFFECT", WHERE INDIVIDUALS REVERT TO UNSUSTAINABLE BEHAVIORS**.

Systemic interventions, such as policy reforms and large-scale economic incentives, **OFFER THE POTENTIAL FOR TRANSFORMATIVE CHANGE BY ADDRESSING ROOT CAUSES**. They embed sustainability into societal norms and practices, making sustainable behaviors the default option. Yet, these approaches are complex, costly, and time-intensive, requiring public trust and significant political will.

The effectiveness of interventions also depends on their mechanisms. **ANTECEDENT STRATEGIES, LIKE PROMPTS AND EDUCATION, ARE COST-EFFECTIVE FOR GUIDING BEHAVIOR BUT OFTEN FAIL TO SUSTAIN CHANGE. CONSEQUENCE-BASED STRATEGIES, INCLUDING REWARDS OR SANCTIONS, CAN DRIVE IMMEDIATE RESULTS BUT RISK UNDERMINING INTRINSIC MOTIVATION IF OVERUSED**.

A combined approach leveraging multiple intervention types is often the most effective, addressing individual motivations while modifying broader contexts. Still, such integration requires careful coordination and significant resources. Ultimately, the success of interventions lies in their ability to adapt to the specific behaviors, populations, and environments they target, ensuring both immediate and lasting impacts.

4.4. Designing Effective Interventions

The success of any intervention depends on its alignment with the target audience's motvations, capabilities and contextual factors. **INTERVENTIONS SHOULD TARGET SPECIFIC, MEASURABLE BEHAVIORS AND BE GROUNDED IN AN UNDERSTANDING OF THE INTERNAL DRIVERS, SUCH AS VALUES AND HABITS, AND EXTERNAL INFLUENCES, LIKE SOCIAL NORMS AND INFRASTRUCTURE**. Combining strategies that raise awareness, such as education or prompts, with mechanisms that reinforce change, like feedback or incentives, increases the likelihood of success. Also, multi-component interventions that combine informational and structural strategies are often the most effective. For example, educational campaigns about recycling can be enhanced by providing conveniently placed and clearly labeled bins, addressing both knowledge and practical barriers.

Supportive environments play a critical role in shaping behavior; removing barriers and creating opportunities, such as sustainable default options, makes pro-environmental actions easier. Leveraging social influence, through mechanisms like peer modeling or public commitments, can further amplify change by encouraging alignment with community norms. Importantly, interventions must fit the cultural and contextual realities of their target populations, ensuring relevance and inclusiveness.

Long-term change requires fostering intrinsic motivation and habit formation rather than relying solely on external incentives. By integrating these elements and aligning individual-level efforts with systemic changes, interventions can achieve both immediate impact and lasting sustainability.

To conclude, the insights from these interventions underline the importance of tailoring strategies to specific contexts and combining approaches to maximize their effectiveness. By balancing short-term gains with long-term sustainability, individual motivations with systemic opportunities, and immediate actions with permanent changes, behavioral change programs can contribute more effectively to ecological transitions

Conclusion

Social-psychological interventions, and their study, aimed at promoting behavioral change for ecological transition have evolved from focusing predominantly on knowledge dissemination to adopting more complex, multi-faceted strategies. In light of this review of interventions, it is evident that numerous strategies have been implemented to achieve sustainability goals in various domains and regarding different environmental issues. Early approaches were rooted in the belief that providing information would naturally lead to pro-environmental behaviors. However, it is now clear that awareness alone is insufficient. **CONTEMPORARY RESEARCH INTEGRATES DUAL-PROCESS THEORIES OF BEHAVIOR, RECOGNIZING THE NEED TO ADDRESS BOTH RATIONAL AND INTUITIVE SYSTEMS OF DECISION-MAKING. THIS HAS LED TO INTERVENTIONS THAT SIMULTANEOUSLY ENGAGE CONSCIOUS THOUGHT AND LEVERAGE AUTOMATIC, UNCONSCIOUS PROCESSES, MAKING PRO-ENVIRONMENTAL BEHAVIORS MORE ACCESSIBLE AND APPEALING**.

Identifying which strategy is most effective in encouraging environmentally friendly behaviors also depends on the specific barriers inhibiting individuals from acting sustainably. **IN GENERAL, A COMBINATION OF BEHAVIOR CHANGE STRATEGIES IS MORE LIKELY TO SUCCEED SINCE THERE ARE OFTEN MULTIPLE BARRIERS TO DIFFERENT PRO-ENVIRONMENTAL BEHAVIORS, BOTH INFORMATIONAL AND CONTEXTUAL**[254]**. INDEED, IN PRACTICE, MANY INTERVENTIONS INCLUDE MULTIPLE BEHAVIOR CHANGE STRATEGIES**.

While the results of conducted research are promising regarding the effectiveness of such interventions, translating experimental evidence into actual environmental policy requires further research to better understand the contexts in which certain interventions work, at what cost, and for how long[255, 256].

Key areas for future exploration include understanding the interplay of intrinsic motivators, extrinsic incentives, and social norms, as well as the role of structural barriers in shaping behavior. These dynamics are crucial for designing interventions that resonate across diverse populations and contexts. Additionally, the long-term sustainability of behavior change remains a significant challenge. While interventions that use external rewards or nudges are effective in the short term, their impact often diminishes once the stimuli are removed. Research must prioritize strategies that foster intrinsic motivation and habit formation to ensure enduring change.

Another area demanding attention is the concept of behavioral spillover—whether promoting one pro-environmental behavior can catalyze broader changes in lifestyle. This understanding could enhance the efficiency of interventions by maximizing their impact. Moreover, socio-economic and cultural differences must be accounted for in intervention design to ensure equity and inclusivity. Addressing these issues is vital for interventions to succeed in varying contexts and among diverse groups.

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254. Gardner, 2002
255. Lokhorst et al., 2013
256. Hailemariam et al., 2019

Emerging trends in the field highlight the potential of digital technologies, such as apps providing real-time feedback and gamification, to sustain engagement and scale behavioral interventions. Cross-cultural studies further reveal the significant influence of local values and practices, pointing to the importance of culturally sensitive strategies. However, challenges such as psychological reactance, where individuals resist perceived coercion, underscore the importance of maintaining a sense of autonomy in intervention designs.

Collaboration with other disciplines is essential for advancing this field. Neuroscience offers insights into the neural underpinnings of decision-making and habit formation, which can inform the design of interventions. Behavioral economics provides frameworks for understanding how incentives and framing influence behavior. Urban planning and architecture contribute by creating environments that naturally encourage sustainable choices. Finally, public policy and governance are critical for embedding these interventions within broader systemic changes, ensuring alignment between individual behaviors and structural support.

In conclusion, while significant progress has been made, future research must refine the understanding of behavioral drivers, enhance the sustainability of interventions, and ensure equitable access to solutions. Interdisciplinary collaboration will be key to addressing these challenges and driving meaningful change.

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The intersection of poverty and behavioral change for sustainable lifestyles

Ch.2

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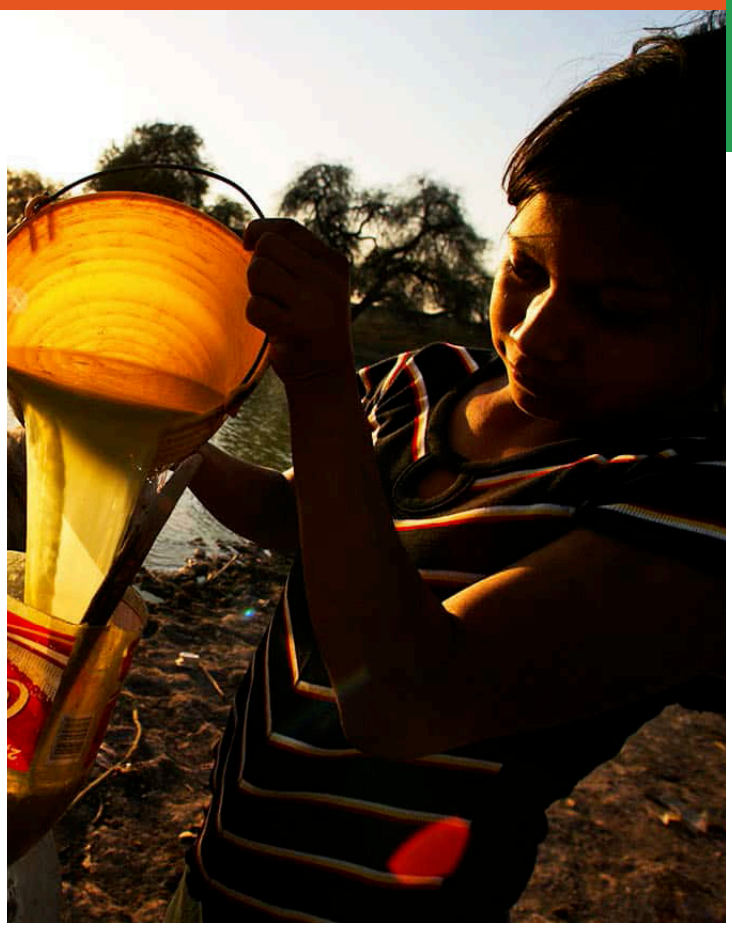

Discipline:
economics

Introduction

The challenge of achieving sustainable consumption and poverty alleviation.

Sustainable Development Goals (SDG) incorporate objectives for both poverty alleviation (1) and sustainable consumption (12). This is in itself problematic, to the extent that poverty alleviation is widely understood through purchasing power, that is, consumption capacity and volume. However, many emerging countries where poverty is still high already display average per-capita ecological footprints above planetary capacity, which, by 2022 is estimated in 1.5 global hectares (gha) per capita. For instance, Algeria has an ecological footprint of 2.3 gha and Bolivia 2.8 gha. This means that if everyone consumed at the same level as Algeria, we would need 1.53 planets, and 1.86 planets if we were to consume like Bolivia. If we look at developed countries, the ecological footprint of the US is 7.5 gha (5 planets) and that of Germany is 4.5 gha (3 planets).

Ecological footprint in most of the developed countries is decreasing (in the US, it was 10.2 gha in 2006 and in Germany, it was 5.44 gha in 2006) but it is increasing in countries that are successfully reducing poverty (China went from 2.71 gha in 2006 to 3.6 gha in 2022)[1]. Thus, the consumerist path out of poverty is wrong because the planet cannot sustain it. In simple words, emerging countries cannot target the consumption levels of the developed world. Instead, they need to understand how to drive consumption patterns of millions transiting out of poverty away from consumerism, while at the same time allowing people to achieve higher living standards. This is not easy to accomplish. **DECOUPLING QUALITY OF LIFE FROM CONSUMERISM IN EMERGING COUNTRIES WILL REQUIRE A DEEP UNDERSTANDING OF BEHAVIORAL DRIVERS OF CHANGE AND NON-CHANGE AT THE BASE OF THE SOCIOECONOMIC PYRAMID THAT WILL INFLUENCE ASPIRATIONAL LIFESTYLES FOR BOTH WELL-BEING AND SUSTAINABILITY. AN ADDITIONAL DIFFICULTY IS THAT WE STILL LACK A DEEP UNDERSTANDING OF HOW IMPOVERISHED PEOPLE COPE WITH IMPOVERISHMENT THROUGH CONSUMPTION, OUTSIDE THE PARADIGM OF INDIVIDUALISM AND RESPONSIBILITY DOMINANT IN THE WESTERN DEVELOPED WORLD**[2].

1. Footprint network (www.footprintnetwork.org)
2. Hill 2022.

In this chapter, I examine potential behavioral change and non-change drivers that may be applied or avoided in the emerging world to achieve both poverty alleviation and sustainable lifestyles, which include decisions on food consumption, leisure time, transportation, housing, investing, etc. I will focus on the following categories:

1) **Individual level constructs** that can be intervened or educated, such as consumer self-confidence and consumer wisdom and their obstacles.

2) **Emotional drivers** of aspirational consumption that help to create non consumerist well-being such as hope and contentment

3) **Cognitive implications** of poverty on decision making that may impede the proper use of product information and the adoption of sustainable lifestyles. Since most research on consumer behavior and sustainable consumption is conducted with and for middle class consumers in developed countries [3], I will discuss when and how socioeconomic level moderates the expected effects of drivers on behavior in the three categories.

Conclusions will focus on what may work to promote sustainable consumption and well-being among low SES consumers and what may backfire. These conclusions are a combination of implications of the literature with my own arguments and interpretations of gaps, opportunities and propositions.

3. For the purpose of this chapter, the term middle-class includes people with income above poverty line, which allows for discretionary use of money for health, traveling, housing etc. That is, people that can make decisions about lifestyle but are not wealthy. The upper limit is fuzzier than the lower.

The knowledge gaps of consumer behavior at low socio-economic levels and sustainable consumption

It is already widely accepted that socio economic conditions play a key role on how people think and act on the marketplace. There is substantive literature exploring the main implications of lower socio-economic conditions on cognitive and emotional consumption-related processes [4], decision making [5], market interactions and social dynamics [6], among other dimensions. **BUSINESSES AND ORGANIZATIONS THAT USE INSIGHTS ABOUT CONSUMPTION AT LOW SOCIOECONOMIC LEVELS CAN CREATE INCLUSIVE AND IMPACTFUL SOLUTIONS THAT SIGNIFICANTLY IMPROVE WELL-BEING. HOWEVER, SUCH UNDERSTANDING IS ALSO USED TO SUPPORT ECONOMIC GROWTH IN THE TRADITIONAL WAY, THAT IS, TO HELP COMPANIES EXPAND THEIR BUSINESSES BY REACHING LOW-INCOME CONSUMERS WITH PRODUCTS AND SERVICES IN HIGH VOLUMES. WHILE THIS SOUNDS POSITIVE AND DESIRABLE, IT ALSO DIFFUSES UNSUSTAINABLE MARKETING AND VALUES TO EMERGING CONSUMERS**. Through increased access to affordable products, low-income consumers may enter consumerism [7], hyperconvenience [8] or perceived obsolescence [9] without really improving their well-being. The face value of inclusive businesses may be a contribution to poverty alleviation, even helping people to reach consumption adequacy [10], which contributes to positive subjective experiences of consumption beyond income[2], but after that point, they may be also worsening the environmental impact of unsustainable lifestyles without further gains in well-being. One salient exception is research made under the Transformative Consumer Research initiative (TRC) that aims to promote consumer well-being over commercial success [11]. Nonetheless, current knowledge on the complex dynamic between consumer subjective well-being and sustainable consumption for consumers that are in either poverty or in transit to middle class is scarce. This knowledge is necessary to identify paths that reconcile human well-being with economic development without increasing environmental impacts. In other words, this issue is at the core of the trade-offs among several SDGs.

From its own basis, research on sustainable consumption is rapidly expanding and thriving during the last 10 years, but most of its insights apply to developed markets that are trying to consume more sustainably rather than to developing markets that are still dealing with poverty and underconsumption. A good example of such approach is the

4. Chakavarti 2006.
5. Blocker et. al 2023.
6. Viswanathan et. al 2010.
7. Stearns 2006.
8. Bouchamp and Ponder 2010.
9. Guillard et al., 2023.
10. Farrel and Hill 2018.
11. Mick et. al 2012.

recently published SHIFT framework [12] that highlights effective drivers of marketing actions to promote sustainable consumption, such as social influence, habit formation, appeals to individual self, activation of feelings, influence cognition and increase tangibility. Notice that these are all factors that go beyond the mere economic cost-benefit considerations. Moreover, research on sustainable consumption is expanding in many disciplines, such as environmental psychology, marketing, consumer behavior, industrial ecology, business ethics and anthropology. Despite such abundance of research, a specific consideration of how low-income conditions moderates its conclusions is rare.

This knowledge gap is not trivial because economically vulnerable consumers display behaviors that are much more complicated than what can be addressed by radical affordability of products, as it was thought in the past [13]. Instead, **SOCIO-ECONOMIC HARDSHIP IMPACTS CONSUMER BEHAVIORS IN COMPLEX WAYS. IT MAY EXACERBATE FUNCTIONAL ILLITERACY [14], THAT THWARTS THE WAY PEOPLE IN POVERTY INTERACT WITH MARKET INFORMATION AND "NORMAL" DYNAMICS. IT IMPEDES COGNITIVE FUNCTIONING [15] WHICH AFFECT THE WAY INFORMATION IS PROCESSED AND USED. POVERTY ALSO ENGENDERS A COMPLEX AND STRONG SET OF SOCIAL RELATIONSHIPS THAT MIXES CONSUMPTION, FAMILY AND ECONOMIC ACTIVITY [16]. IT CHANGES THE WAY PEOPLE HANDLE NEGATIVE FEELINGS, SUCH AS THE ABSENCE OF HOPE [17] WHICH AFFECTS THE COPING MECHANISMS TO FACE MARKET CHALLENGES AND CHANGE**. In consequence, behavioral interventions that use instruments developed for middle-classes will produce uncertain results among poor consumers. Hence, our knowledge on sustainable consumption may be useless to change behavior among poor consumers. For instance, if a campaign tries to promote sustainable consumption using social influence within a poor community, in the way the SHIFT framework proposes, there are complex social dynamics among low-income markets that will interact with such intervention in unpredictable ways, such as the possible moderation of tacit social contracts and strong business transaction among family members.

In the remaining of this chapter, I will review the potential effectiveness of behavioral interventions to promote sustainable consumption pointing out the possible ways in which poverty conditions may enhance or reduce the expected effects. I will use the best of the current knowledge but in many cases I will have to appeal to some level of informed conjecture. Importantly, I will try also to identify when the intervention may be not only ineffective to increase sustainable consumption but may also reduce well-being by promoting unsustainable consumption patterns.

12. White et.al 2019.
13. e.g. Pitta et.al 2008.
14. Viswanathan et. al 2005.
15. Mani et. al 2013.
16. Wiswanthan, Rosa and Ruth 2010.
17. Trujillo and Rosa, 2018.

Individual level constructs that can be intervened or modified

The first category of effects that I will review consists of individual-level traits that can be changed by well-targeted interventions. It is known that people develop attitudes and beliefs about the market as a product of their subjective experience as opposed to other stable traits that may have a genetic origin (e.g. personality)[18]. Some of these constructs are known (or at least believed to be so) to facilitate sustainable consumption, as I will explain in detail. However, still much more research is needed to truly understand the wide complexity of relationships between those aspects. In this section I will first explain the notion of construct, then its expected effect on sustainable consumption, and the potential moderating influence of socioeconomic conditions on this consumption. I will discuss the following: Pro-environmental beliefs and values, perceived consumer effectiveness, pro-social preferences, psychological distance, consumer wisdom, consumer self-confidence and environmental self-identity.

Pro-environmental beliefs and values: These may take many forms, but based on the most robust literature I will specifically refer to ecocentrism and self-transcendence values. Ecocentrism is "a worldview that recognizes intrinsic value in ecosystems and the biological and physical elements that they comprise, as well as in the ecological processes that spatially and temporally connect them"[19]. Ecocentrism usually entails a view of human beings on par with any other species and that are ruled by nature. Self-transcendence values are part of the system of basic human values[20] and refer to people focusing on well-being, on the welfare of others, with a sense of universalism, benevolence and a commitment to environmental sustainability. In contrast, someone who exhibits anthropocentric beliefs and self-enhancement values would think of humans as a "superior" species with the right to use natural resources for its own benefit and success. Both ecocentrism and self-transcendence are positively related to many pro-environmental behaviors and lifestyle choices such as recycling, conservation, support for environmental policies, and several sustainable lifestyle aspects[21]. These positive effects are, however, tampered by the so-called attitude-behavior gap, or value-action gap[22], which denotes the significant disconnection between values, beliefs, and actual behavior, which is mostly salient for sustainable consumption. In a world where actors are increasingly aware of the triple planetary crisis, reducing this gap is extremely important. In Latin America, over 80% of the population believe that the effects of climate change are already happening, but their consumption habits are barely changing[23]. This gap may be even bigger among low-income consumers for various reasons, as I will explain at various points in the chapter.

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18. See Milton 2021 for a review of personality influences on pro-environmental behaviors.
19. Gray, Whyte and Curry 2018. - 20. Schwartz, 1992; 2017.
21. De Groot and Steg, 2007; Stern et al. 1999; Hanel et. al 2018.
22. Caruana et. al 2016. - 23. Trujillo 2022.

Joshi and Rahman [24] identified in a systematic review that consumers who focus on functional attributes (that is, the instrumental and practical use of products or services) display a wider attitude-behavior gap. Among low-income consumers, functional attributes are extremely important [25], hence, consumption decisions may be less affected by personal beliefs. Low-income consumers also tend to think more concretely (vs abstractly) [26] which leads them to focus on very specific product details. This will probably enhance the difficulty of applying broad beliefs or values to particular products and consumption choices, increasing the gap. Thus, awareness of the climate crisis, concern for the environment, care for nature and similar arguments will potentially be less effective to increase pro-environmental behaviors among consumers in poverty than in middle class markets.

Perceived consumer effectiveness: PCE refers to individuals' beliefs in their ability to influence environmental issues through their consumption choices. Individuals with strong PCE believe that their actions as consumers meaningfully impact environmental outcomes. This belief serves as a motivational factor to adopt pro-environmental behaviors such as recycling, energy conservation, and the purchase of environmentally friendly products [27]. Moreover, the effects of PCE extend beyond individual actions to collective efforts. There is a positive relationship between PCE and connectedness to others [28]. Among low-income consumers, there could be simultaneously low PCE. This means that enhancing sustainability related PCE could be particularly effective to change behavior because there is plenty of room for increasing PCE, either by public or private actions, and the strong social ties will positively moderate the effect on pro-environmental behaviors, let alone the positive connotation of improving perceived effectiveness among the poor.

Pro-social preferences: Pro-social preferences refer to individuals' inclinations to prioritize the well-being of others and act in ways that benefit society as a whole. They may manifest as altruism, trust, fairness, willingness to cooperate or even empathy. In the context of environmental psychology, research has shown that individuals with pro-social preferences exhibit a higher propensity for pro-environmental behaviors such as recycling, energy conservation, support for environmental policies, and participation in community-based sustainability initiatives [29]. Interestingly, the direction of causality between these two constructs is not entirely clear. Vesley et. al [30] found that behaving pro-environmentally works as a signal to be cooperative to others. Among low-income consumers, once again the relevance of social ties and trustworthiness [31] would probably enhance the connection between pro-social preferences and pro-environmental behaviors. Therefore, behavior may be effectively driven and changed by harnessing social connectedness in many ways, be it promoting collective action, social norms, or networking. These interventions may be positively moderated by changes in Self-efficacy (i.e. one`s perception of own capacity to act and have an effect).

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24. 2015. - 25. Viswanathan et. al 2005.
26. Viswanathan et. al 2005; Viswanathan and Lalwani 2020.
27. Ellen et. al 1991: Arias and Trujillo, 2020.
28. Cojuharenco et al, 2016. - 29. Otto et. al 2021.
30. 2020. - 31. Viswanathan et. al 2010.

Psychological distance: Psychological distance [32] is the mental construct that ensues from the perceived separation or closeness in relation to events, objects, or issues. It is egocentric, which means that it is centered on oneself, here and now. It encompasses four positively correlated cognitive components.

1) **Spatial Distance**, involving the physical space or geographical proximity between oneself and an object or event. The farther away something is perceived, the psychologically more distant it seems.

2) **Temporal Distance**, relates to the perceived time between the present moment and the occurrence of an event or the presence of an object. Events or objects in the distant past or future are perceived as psychologically distant.

3) **Social Distance**, which involves the perceived similarity or dissimilarity between oneself and others. Greater social similarity often results in reduced psychological distance.

4) **Hypothetical Distance**, which is the imagined or hypothetical nature of an event or object. Things that exist only in the realm of possibility, low probability or imagination are considered psychologically distant. This construct influences prediction, preference, and action. For instance, a person that is psychologically distant from violence would perceive that it is only possible, that it would happen far in the future, affecting people that live in remote places to whom there is no close social connection.

Specifically, behavioral intentions towards sustainability may be negatively affected by psychological distance, that is, if for instance the effects of climate change are perceived to happen far away, to dissimilar people, far in the future and highly uncertain, behavior change will be unlikely to happen for most people. However, recent research has found contradictory evidence of such effects. Construal level theory predictions may have been misinterpreted and empirical support for the connection between psychological distance and climate action is scarce [33].

The effect of poverty in this debate is almost absent. For instance, it seems that urban adaptation is influenced by psychological distance when involving formal vs informal (poorer) settlements in Pakistan [34]. Socio economic conditions may have an impact on overall psychological distances to many events. It is known that poverty conditions impose very short-term cycles of income and consumption, as short as 24 hours [35] and make people live within very close social dynamics that take place in their neighborhoods. In addition, they tend to favor concrete over abstract thinking [36].

32. Trope and Lieberman 2010.
33. Vankelgoed et. al 2023.
34. Rana et. al 2023.
35. Viswanathan et. al 2010.
36. Viswanthan et. al 2005.

SIMPLY PUT, POVERTY CONTRIBUTES TO PEOPLE LIVING WITHIN VERY PROXIMATE REALITIES, WHICH MAKES GLOBAL PROBLEMS (E.G., GLOBAL WARMING) APPEAR TOO DISTANT. Therefore, reducing psychological distance to the planetary crisis may be effective to change behavior towards sustainable consumption particularly among low-income consumers. However, change may require to have really close experiences with climate related events. Since this cannot be controlled, psychological distance may still be reduced by making visible information about concrete situations, that happen to people in the same kind of geographical area, job, family situations, and so forth. The abstract, probabilistic tone of many awareness campaigns and scientific reports would only increase psychological distance.

Consumer wisdom: Consumer Wisdom is related to the ability of consumers to make habitual good decisions in which they can seek well-being through consumption, by managing information complexities, emotional impulses, goals and needs in a fast and consistent way. It is an application of practical wisdom [37]. To make this a useful and applicable concept, Luchs and Mick [38] developed a scale that captures Consumer Wisdom in 6 dimensions: Responsibility, Purpose, Flexibility, Perspective, Reasoning and Sustainability). Recent evidence shows that Consumer Wisdom may be a relevant positive determinant of sustainable consumption, that operates both as an overarching construct and it has nuanced multifaceted effects not only for sustainability [39]. In simple words, **WISE CONSUMERS TEND TO EMBRACE SUSTAINABLE CONSUMPTION MORE EASILY AS A PART OF A WIDER SET OF CONSUMPTION HABITS THAT HELPS THEM TO AVOID CONSUMERISM, MISTAKES AND IMPULSIVE BUYING**. The six dimensions show how consumer wisdom helps people to develop patterns of acquisition, use and disposal of products that better serve well-being. Consumer Wisdom can be a fruitful object of policy intervention to promote sustainable consumption [40].

The relationship between Consumer Wisdom and poverty is, however, currently not studied. From an oversimplified view of poverty, the pursuit of the Consumer Wisdom dimensions may be superseded by the urge to satisfy basic needs in the short term. However, as mentioned before, research on low-income consumers reveals a rich and complex consumption dynamic among the poor, in which all six dimensions of Consumer Wisdom may likely appear in consumption habits. In fact, scarcity may even increase attention to at least some wise consumption patterns such as purpose and responsibility. However, in the absence of empirical evidence or a clear theoretical argument, we are left to assume that Consumer Wisdom will be equally effective regardless of economic level. Furthermore, it should be specially protected among the poor to avoid un-wise consumption as a byproduct of exposure to consumerism and the wrong aspirational models in emerging markets.

37. Mick and Schwarz 2012; Luchs and Mick 2018.
38. 2021.
39. Trujillo and Luchs, 2025.
40. Ozzane et.al 2021.

Consumer self-confidence (CSC): This multidimensional construct is related to the psychological capabilities to consume and make effective decisions in the marketplace. It includes abilities for information acquisition, consideration set formation (i.e., the ability to identify an adequate set of alternatives before making a choice), assessment of personal outcomes, social outcomes, persuasion knowledge and handling marketplace interfaces (e.g., talking to sales representatives, placing complaints, etc.)[41]. It affects multiple aspects of consumer behavior that may be relevant for sustainable consumption, such as consumer capacity to innovate, attention to other's consumption and skepticism about product claims but it has been studied mostly in developed markets, without explicit consideration of sustainable consumption. One salient obstacle for sustainable consumption among the poor is higher prices. Blocker, Manning and Trujillo[42] investigated the moderating role of CSC in favoring the acceptance of moderate prices of sustainable products among low-income consumers. They also report that CSC tends to be lower among poor consumers, probably because of market isolation and unfamiliarity with standard middle-class dynamics. Considering that sustainable products are often more expensive than their substitutes for many reasons, including higher production costs, certifications, sustainable packaging to name a few, CSC constitutes a key construct to study and intervene to facilitate the adoption of sustainable consumption, particularly in poverty conditions.

Environmental self-identity: Identity aspects are salient triggers of behavior. People do things that reflect who they are. Actually, one of the most established principles of consumer behavior is that what we buy and own are extensions of our sense of self[43], even in modern consumption spaces like the metaverse[44]. Hence, in the domain of sustainable consumption, environmental self-identities increase pro-environmental behavior[45]. Furthermore, Udall et. al[46] shows in a meta-analysis of 104 studies, that different pro-environmental behaviors are affected in different ways by environmental self-identity. For instance, individual identities are more strongly associated to PEBs than group identities. Therefore, it is a good idea to promote environmental identity to encourage behavioral change. In simple words, becoming an environmentalist makes one consume more sustainably. For example, campaigns that appeal to environmental problems that happen to local, proximate places or communities may enhance environmental identity. In the context of poverty, however, we are unsure how (and if) this relationship works, at least not at the individual behavior level. Environmental identity may be stronger or weaker within hard economic conditions. I anticipate that if the identity is shaped by local environmental issues, it should be strong, but general global identities may be unrelated to behavior.

As a social phenomenon, environmentalism has evolved from the image of a "rich" environmentalist (someone who lives in a developed country, and cares about deforestation or endangered species), to the environmentalism of the poor[47], which involves the complex situation that arise for poor populations that depend on threatened ecosystems or natural resources and claim environmental justice.

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41. Bearden et. al 2001. - 42. 2023. - 43. Belk 1988. - 44. Hadi et. al 2024.
45. Whitemarsh and O`Neill, 2010. - 46. 2021. - 47. Martinez-Allier, 2012

These movements exist in poor regions, but there is no evidence that connects them with individual behavior. One clue may come from a recent paper by Castro and Bleys [48], in which they show that the subjective perception of income sufficiency is positively related to pro-environmental self-identity. That is, the more people have an environmental self-identity, the less income they need to perceive that it is sufficient. When looking at the ecological footprint, rich countries tend to have higher impact than poor countries, but this is caused by purchasing quantities. There is no way to attribute such difference to consumer preferences. What we know, as noted before, is that poor consumers focus more on short-term instrumental attributes and are immersed in their local immediate realities. If these, by chance, involve an environmental issue, then they will probably display environmental self-identity and behavior, but it seems that the potential effectiveness of trying to change behavior by promoting environmentalism massively among low-income consumers is very low, unless it is unambiguously tied to local ecology. In **table 1**, I summarize the constructs just discussed, the expected behavioral effect on general populations and the proposed alterations of such effect among low-income populations.

TABLE 1: Summary of effects of psychological constructs on sustainable consumption moderated by low-income conditions

Construct	Effect on pro-environmental behavior	Influence of low-income conditions or poverty
Pro-environmental beliefs and values	Positive	Reduction
Perceived consumer effectiveness	Positive	Increase
Pro-social preferences	Positive	Increase
Psychological distance	Inconclusive	Increase
Consumer Wisdom	Positive	No moderation
Consumer Self-Confidence	Undetermined	Increase
Environmental self-identity	Positive	Reduction

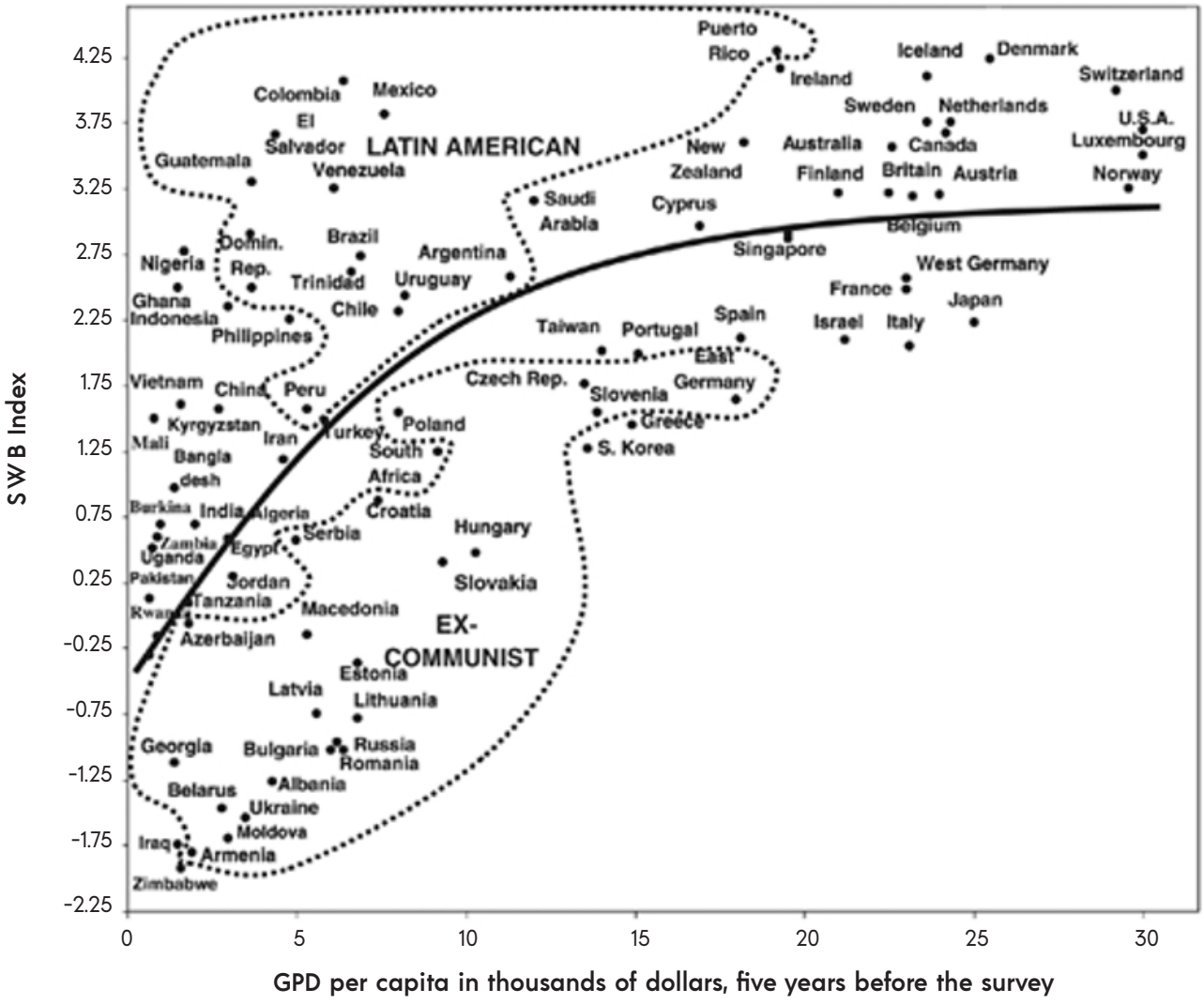
I now turn attention to one key emerging, yet not widely accepted, insight about income, consumption, and development: subjective well-being.

48. 2023.

Emotional drivers of aspirational consumption that create well-being

Subjective well-being is not linearly related to income. Their relationship is described by a positive but marginally decreasing function. That is, the positive impact of income on well-being fades out as income increases. At least at the aggregate level, countries that achieve middle income levels (which could be related to consumption adequacy level) exhibit subjective well-being levels similar to those of rich countries [49]. **IN SIMPLER WORDS, ONCE INCOME IS ENOUGH TO ACHIEVE CONSUMPTION ADEQUACY, THERE IS NO FURTHER IMPACT ON SUBJECTIVE WELL-BEING**. Figure 1 shows the relationship between GDP per capita (PPP adjusted) and a compounded index of subjective well-being, taken from Inglehart.

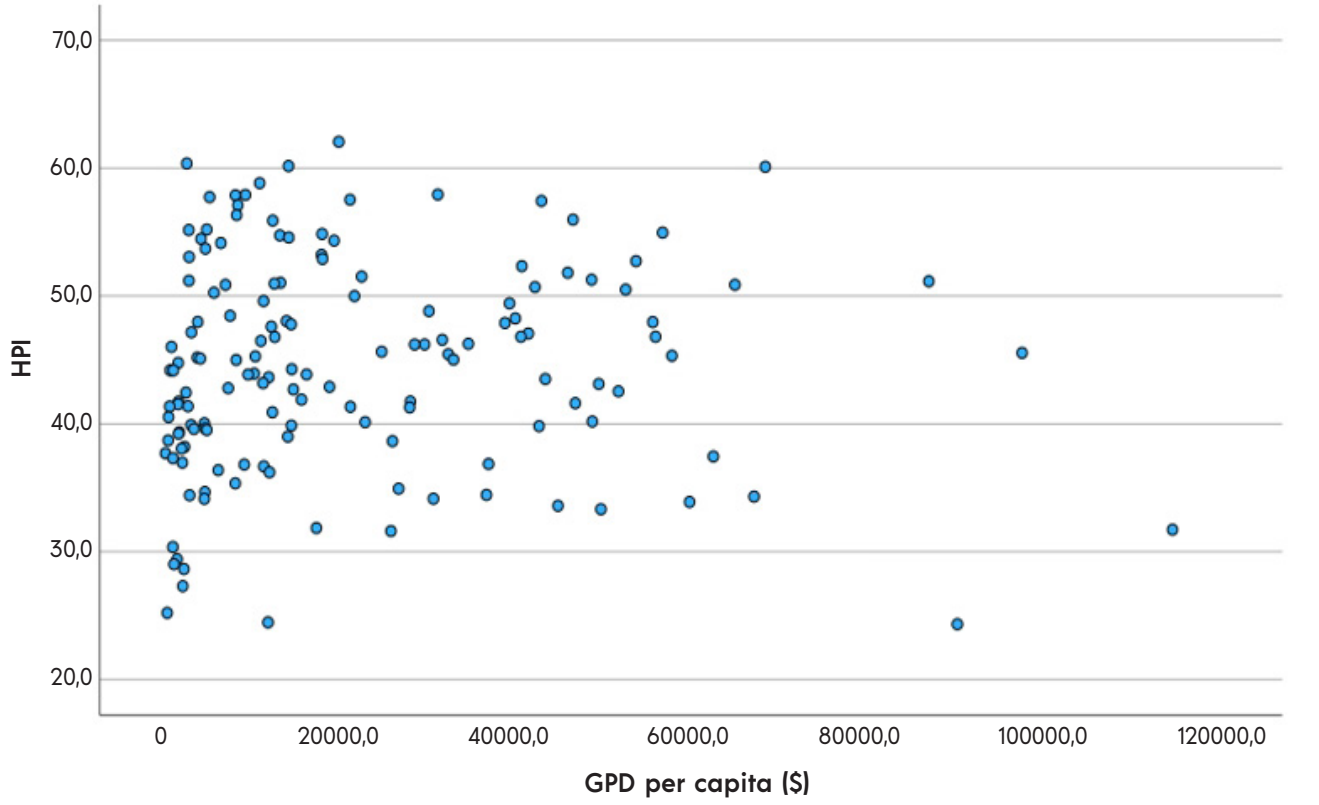
Figure 1. GDP per capita and Subjective Well-Being



49. Inglehart 2010.

Taking this idea further, the rather recently developed Happy Planet Index[50] shows a similar picture. This index captures the environmental efficiency of reaching development by taking life expectancy and subjective well-being divided by the carbon footprint of countries. It shows an astonishing story: **THERE IS NO RELATIONSHIP!** Figure 2 plots GDP per capita and Happy Planet Index. **IN OTHER WORDS, PERCEPTION OF ONE'S WELL-BEING DOES NOT DEPEND ON ONE'S CONSUMPTION!**

Figure 2. GDP per capita and Happy Planet Index.
Source: the author using free data from https://happyplanetindex.org/



This insight offers an opportunity to look for non-monetary emotional factors that help to foster well-being. It bids support for a new perspective of development in decoupling economic growth and consumption[51], a perspective that is based on what makes people happy, not rich. The challenge is to apply this idea to individual drivers of behavior. The basic assumption of the contemporary humanist approach to life[52] is that people will make decisions that lead them to be happy and bring individual well-being. In our consumerist society, however, people believe that high consumption is the path to well-being and fulfillment. But humanism and environmentalism are not at odds, they can be congruent[53].

50. https://happyplanetindex.org/
51. Hannicke and Hauptstock, 2015.
52. Mason 1969.
53. Hinchman 2004.

This may be a powerful driver of change if people learn that sustainable consumption is a path to positive emotions and well-being instead of sacrifice. Moreover, this is a path to articulate sustainable development goals of poverty alleviation and sustainable consumption, a challenge already mentioned. If people transiting out of poverty towards consumption adequacy [54] find in sustainable consumption well-being and contentment, the pressure of poverty alleviation on planetary limits is reduced.

Emotions are well known drivers of consumption behavior. Laros and Steenkamp [55] developed a framework of consumer emotions that has been subsequently applied to many products and services. They assume that consumption is an instrumental action to experience positive emotions and avoid negative ones. Marketers also try to develop "lovemarks" for brands [56] by imagining tactics to generate affective associations to brands, such that the consumer will be incentivized to buy. Research using brain imagery reveals that consumers use their affective experiences more often than declarative information to assess brand [57]. Sustainable consumption is also driven by emotions [58], and some emotions may help to enhance agency for sustainability [59], but there are some particularities and a major challenge: so far, the western aspirational living standard is not yet associated with sustainability, hence the majority of emotions elicited by consumption are still the outcome of fast consumption, consumerism and the fantasy of achieving happiness through acquiring products [60]. How can sustainable consumption disrupt such narratives?

Emotional appeals for pro-environmental behaviors have been mostly related to negative emotions such as fear and guilt, which are frequently found in the media and IPCC reports. These negative emotions are not effective drivers of pro-environmental behavior [61]. People are already concerned and scared about climate change and the planetary crisis as global polls indicate [62], but the gap to consumption and more generally behavioral changes, remains enormous. An interesting exception is **SHAME, WHICH MAY EFFECTIVELY MOTIVATE GREEN CONSUMPTION [63], BUT ONLY AMONG PEOPLE WITH HIGH ENVIRONMENTAL CONCERN. HOWEVER, SHAME IS A SOCIAL EMOTION ENGENDERED BY BEING EXPOSED TO OTHERS, THEREFORE, THE REAL DRIVER OF BEHAVIORAL CHANGE IS ADHERENCE TO SOCIAL NORMS, WHICH ARE NATURALLY ENFORCED BY SOCIAL FEELINGS**. Another reason to avoid using negative emotions to promote sustainable behavior is to avoid the dynamics of thought and belief triggered by the fear of death and mortality, as explained by Terror Management Theory [64]; people adjust their worldviews to sustain their perception of significance and

54. Hill 2022.
55. 2005.
56. Paule and Cooper 2006.
57. Esch. et al. 2012.
58. Rezvani et. al 2018.
59. Antonetti and Maklan 2014.
60. Jhally, 2014, Williams 2014.
61. van Breda et. al, 2023.
62. Nielsen IQ 2022.
63. Amatulli et. al 2017.
64. Greenberg and Arnt 2012;

importance to the rest of the world. The implication may be that **PEOPLE WILL RESPOND TO FEAR OF CLIMATE CHANGE BY INCREASING ANTHROPOCENTRISM. POSITIVE EMOTIONS, SUCH AS PRIDE AND FEELING AS A GOOD PERSON, ON THE OTHER HAND, MAY HAVE A POSITIVE IMPACT ON LONG TERM PRO-ENVIRONMENTAL BEHAVIOR**[65]. Furthermore, harmony with nature may prompt other positive emotions such as awe, compassion, and gratitude, leading to both pro-environmental and pro-social behaviors[66].

Among low-income consumers, the basic pattern of relationships between negative emotions, positive emotions and pro-environmental behaviors is probably the same overall, but some additional considerations are necessary. The most important is that to drive behaviors that solve the problem of poverty alleviation and sustainable consumption simultaneously, the emotional rewards of sustainable consumption must be connected to well-being from an eco-centric standpoint. In general, we must avoid promoting emotional rewards associated with consumerism, except for very specific situations in which people want many sustainable-friendly options (e.g., riding bycicle). Research in consumer economics on this is scarce but there are salient cues that may show the path.

For example, it is critical to understand the implications of poverty on emotional experiences in relation to consumption. For instance, Trujillo and Rosa[67] showed that **POVERTY CONDITIONS MAY REDUCE COPING MECHANISMS TO HANDLE NEGATIVE EMOTIONS**.

Comparing poor and affluent consumers, they found that those in poverty could not compensate for the absence of hope with increased effort in a creativity task as affluent people do. Hope is a relevant, underused emotional moderator of many aspects of consumer behavior that deserves to be further researched[68] and particularly among low-income consumers. It facilitates creativity and well-being under conditions of scarcity. Thus, behavioral change in consumption patterns that lead to well-being instead of hyper consumption among the poor, may be significantly driven by discrete emotions such as hope or contentment. This type of emotion would help to steer the aspirational narrative of low-income consumption towards voluntary simplicity[69] and alternative hedonism[70] and even help to transform the representation of poverty in consumer culture[71]. Such evolution of consumption may set a path for economic development that reconciles poverty alleviation with sustainability. That would be a system where having enough is ingrained in consumption aspirations[72].

65. Trujillo et.al 2021; Bissing-Bolson et. al 2016.
66. Zelenski and Desrochers 2021.
67. 2017.
68. MacInnis and de Mello 2005.
69. Alexander et.al 2012.
70. Soper, 1998; Caruana et.al 2020.
71. Hamilton et. al 2014.
72. Kaufmann 2023.

Cognitive implications of poverty on decision-making that may impede the proper use of information and the adoption of sustainable lifestyles

For many years, giving information to the consumer has been regarded as one of the keys to sustainable consumption. And we now live in a time of information overload [73]. Many consumer-protection regulatory systems in the world focus on information sharing as one of their protection pillars. Target number 12.8 of the 12th Sustainable Development Goal explicitly says: "By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature". Subsequently, the United Nations Environmental Program established a consumer information program for sustainable production and consumption to promote policies and strategies that help companies provide high quality information for their consumers to adopt sustainable patterns. This is a noble and essential effort but, nonetheless, good information is a necessary but insufficient driver of behavior. People also need to have the ability to access goods and services.

To begin with, when making decisions, people have a difficult time acquiring and processing all the relevant information to behave as if they were rational, leading to "fast and frugal" heuristics [74]. There are dozens of documented cognitive biases [75] that affect how people acquire, recall and use information, let alone make actual choices with it. It has been long established that cognitive processing is adaptive [76]; hence heuristics (cognitive short-cuts) are useful to navigate complex decision-making environments but they may also cause biases. This problem is far from being solved in the decision-making literature [77], but the simple conclusion that we can draw is that people keep adapting their decision strategies to an environment of mounting information, both in volume and complexity. This increases the need to use heuristics to handle such complexity. **THERE IS NO RESEARCH ARGUING THAT MORE INFORMATION LEADS TO MORE EDUCATED, LOGICAL OR RATIONAL THINKING NOR ECOLOGICAL BEHAVIORS**. The implication is worrisome: more information will be ineffective to significantly change behavior towards sustainability. Rather, information is a complement to other drivers of behavioral change.

73. Arnold et. al. 2023.
74. Gigerenzer and Todd 1999.
75. Hilton 2012.
76. Payne et al. 1993.
77. Kelman 2011.

Poverty and cognitive functions

In low-income contexts, the situation may be even worse. Poverty or even temporal scarcity reduces cognitive capacity[78]. **THE ISSUE IS NOT ONLY THAT POOR PEOPLE ARE LESS FORMALLY EDUCATED (WHICH TENDS TO BE ALSO TRUE) BUT ALSO THE EFFECT OF SCARCITY ON HOW PEOPLE THINK, EVEN WITHOUT EDUCATIONAL DIFFERENCES. COGNITIVE FUNCTION IS IMPAIRED BY POVERTY. IN ADDITION, IMPOVERISHED CONDITIONS ALSO AFFECT THINKING PATTERNS AND HABITS**.

We already mentioned the problem of functional illiteracy[79], in which people in poverty, even if they can read and write, lack the necessary language and numeracy to understand and use market information about products and services. Illiteracy is affected by the environment, whereby complexity, in a two-sided connection, increases the relative illiteracy and is in turn, impacted by it. This poses a challenge for well-intended efforts by either public policy or companies to improve consumer information about sustainability in emerging markets, which usually take the form of eco-labels that convey information about all kind of impacts on the environment or society, such as carbon emissions, fair trade, biodiversity risks, deforestation, child labor, energy efficiency, among many other aspects of sustainability factors. There are over 480 ecolabels registered in the eco-label index[80].

There are also other types of information sources such as the IPCC reports and increasing media coverage of climate events that are expected to foster pro-environmental behaviors. This may also backfire: according to Shao and Yu[81] **MEDIA COVERAGE OF CLIMATE CHANGE INCREASES ECO-ANXIETY BUT DOES NOT MODIFY PRO-ENVIRONMENTAL BEHAVIOR IN CHINA. FURTHERMORE, THEY IDENTIFY A RESILIENCE PARADOX, WHICH IS THAT BEING RESILIENT REDUCES THE EFFECT OF NEWS ON ECO-ANXIETY BUT ALSO REDUCES PRO-ENVIRONMENTAL BEHAVIORS**. Media coverage also selects what makes the front page in ways that do not necessarily promote behavior change but only attention[82]. The authors call for a transformation of the criteria media use to select what aspects of climate change are presented to the public. Media debates between local vs global relevance[83], which is a key distinction to reach audiences appropriately to activate behavioral intentions. In addition, people are being exposed to scientific information in an unprecedent way, which brings additional complexity to what they do with such awareness.

78. Mani et al. 2013.
79. Viswanathan et. al 2005.
80. https://www.ecolabelindex.com/
81. 2023.
82. Perga et.al, 2023.
83. Wang and Downey, 2023.

New research is being done and proposed about the effectiveness of scientific consensus around environmental science [84], highlighting the importance of adjusting to contextual motivations taking into consideration local vulnerabilities.

This is of the utmost importance to help behavior change among impoverished populations, which most likely will also face increased risks of negative consequences of climate change. In this case, it is not only effective in changing behavior, but it also ensures that the most vulnerable groups connect with their realities. Research about the influence of place attachment supports this notion. **PLACE ATTACHMENT ENCOURAGES PRO-ENVIRONMENTAL BEHAVIORS BY FOSTERING EMOTIONAL AND COGNITIVE TIES TO SPECIFIC LOCATIONS. THIS RELATIONSHIP IS INFLUENCED BY CULTURAL CONTEXTS, SOCIAL BONDS, AND EMOTIONAL FACTORS** [85].

Final remarks

The overarching question that inspires this chapter is how we can achieve sustainable consumption, well-being and poverty alleviation simultaneously at the micro-level, focusing on the experience of individual consumers, not macro trends. To this end, I have reviewed and highlighted the main drivers of change towards sustainable consumption that are currently discussed in the literature related to pro-environmental behaviors, focusing on the extent to which such drivers would work or not under conditions of poverty, subsistence or low income. Importantly, activating sustainable consumer behavior change among the poor must involve an enhancement of well-being. This is a challenging task. I align the content of this chapter to the ideas promoted by the Transformative Consumer Research initiative, which strives to use the best of knowledge and tools of consumer research to promote individual and collective well-being over profitability or growth [86]. Research under this paradigm has already tackled both poverty alleviation [87] and sustainable consumption [88], showing that there are alternatives to achieve both, while also enhancing the way we live. Changing behavior towards sustainability need not be a matter of sacrifice and reduction of quality of life. Quite the opposite, it is an opportunity to change consumption patterns in a way that a renewed or even regenerative lifestyle, in harmony and respect with nature, will bring the elusive good life, without the dangers of hyper consumption.

84. Bayes et. al 2020.
85. Daryanto and Song 2021.
86. Mick et.al 2012.
87. Blocker et. al 2013.
88. Phips et.al 2013.

Conclusion

A profound reflection on the modes of production and consumption and the principle of economic rationality underscores the urgent need for renewed ethical foundations associated with a new paradigm in response to the current environmental, climatic, social, and international crises. This paradigm must break with the existing norms to avoid perpetuating the status quo in the economic-political realm – merely doing a little more or a little less of the same thing. The urgency of the situation dictates that we can no longer afford to do so.

The critical analysis of Homo economicus and the examination of moderate entrepreneurial practices not only reveal the limitations of traditional entrepreneurial ethics based on the principle of maximization but also highlight the potential of alternative ethics based on moderation, humility, self-awareness, awareness of others, and a re-articulation of the relationship between ends and means. The existence of moderate practices prompts us to consider value beyond the economic, acknowledging the richness of non-market goods, the necessity for the social reintegration of the economy, and the abandonment of a frantic pursuit of profitability and accumulation of possessions and power in favor of a dynamic and contextually harmonious approach. In other words, we must think and act to shift away from a perspective – with its associated practices – that views the world as an object of exploitation (people, resources, animals, etc.) towards a world that is mutually interdependent between humans and non-humans and inanimate milieu. Relationships are paramount, for a simple yet overlooked reason in economic thinking: the world is interconnected, and it is these relationships that we must nurture.

The moderate entrepreneur, exemplified by Outilacier and others, embodies a promising path to innovation and change. Through a commitment to moderation, this entrepreneur demonstrates that balancing environmental preservation, social well-being, and economic viability is not only feasible but also desirable. This approach necessitates a profound reconsideration of prevailing economic assumptions (and a specific reductionist view of human beings, the homo economicus) and an emphasis on ethical behavior that is mindful of economic activities' social and environmental impacts.

Ultimately, the transition to moderate practices and the acknowledgment of the possibility of exercising virtues in the economic sphere offers a fruitful approach to addressing contemporary challenges. They call for a global contemplation of the role of the economy in society and how economic actors, from individual entrepreneurs to large corporations, can contribute to a more equitable, sustainable, and fulfilling future for all. Far from being a constraint, moderation proves to be an opportunity to redefine economic objectives, where the pursuit of meaning and responsibility towards the community and the environment becomes central. Moreover, it allows us to shift from the profit-maximizing objective of business to the greater goal of community participation, strengthening social cohesion, and contributing to the common good – what we refer to as economic peace.

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Communication and behavioural change in a time of ecological transition

Ch.3

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Introduction

The urgency to respond to the negative impacts of climate changes requires that we, humans, transform our current way of living – a process expressed by the umbrella term "ecological transition". Natural and health sciences have brought forth strong scientific arguments that have shown the extent to which the climate crisis is a result of human activity, arguments supportive of an urgent call to action. But, when it comes to understanding "what makes people tick", and how social and cultural norms and practices develop, we must rely on the vast knowledge of the social sciences and humanities to reflect upon and propose actions that will foster a true "socio-ecological transition". This chapter contributes to this endeavor by addressing what the scientific field of human communication can do to help us better understand and act upon behavioural changes for a socio-ecological transition, but also what it cannot be expected to do.

WHEN PEOPLE THINK ABOUT COMMUNICATION AND BEHAVIOURAL CHANGES THAT CAN LEAD TO TRANSITION, MANY IMAGINE A TOOLBOX FULL OF STRATEGIES ON HOW TO TRANSLATE SCIENTIFIC EVIDENCE INTO CONVINCING LAY LANGUAGE AND HOW TO COUNTER THOSE WHO SPREAD DISINFORMATION. IF IT WERE THAT EASY, WE WOULD NOT BE WORRYING ABOUT THE TRANSITION ANY LONGER, AS THE TRANSMISSION OF SCIENTIFIC FACTS WOULD ALREADY HAVE CONVINCED THE MOST RECALCITRANT CITIZENS TO EMBRACE BOLD CHANGES AND SUPPORT POLITICAL ACTORS WILLING TO TACKLE THE CURRENT CRISIS.

HUMAN COMMUNICATION, AS A PHENOMENON, IS INHERENTLY COMPLEX, LADEN WITH PROCEDURAL UNCERTAINTIES. IT CERTAINLY CANNOT BE REDUCED TO THE TRANSMISSION OF INFORMATION OR KNOWLEDGE. IT IS RATHER DEFINED BY INTERACTIONS AND RELATIONSHIPS FROM WHICH MEANING EMERGES, THIS MEANING ORIENTING AND CONSTRAINING THE DEVELOPMENT, EVOLUTION AND DISSOLUTION OF RELATIONSHIPS AND SOCIAL GROUPS.

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Historically rooted in disciplines such as sociology, philosophy, anthropology, or psychology, the field of communication has grown around multiple theories and been driven by practical and societal considerations [1, 2, 3, 4]. This diversity of perspectives has led some communication scholars to consider the field as either fragmented [5], an inter-discipline [6, 7] or a post-discipline [8]. However, as Song et al. [9] have shown, there are multiple connections between the various branches of communication studies. Indeed, the relative dispersion of the field expresses the centrality of communication in our modern times. Not that communication is a new interest – after all Plato's writings on rhetoric date back to ancient times – but the arrival of mass media and then of digital media in parallel with globalization and migration have certainly raised new communicative challenges. Hence, communication draws from several different and complementary perspectives contributing to the broad academic field of communication, and so will we in this chapter.

Many years ago, a well-known communication scholar, Niklas Luhman, wrote, referring to environmental issues: As long as this is not the subject of communication, it has no social effect [10]. And, indeed, human beings make their world "real" by communicating about it, by telling stories [11]. Hence, it comes as no surprise that the importance of communication for behaviour changes has been highlighted [12, 13]. But communication is not a magic bullet, and its sheer ubiquity is in itself a limitation to the effectiveness of any communication strategy to foster ecologically friendly behaviour. We communicate with friends, family, neighbours, colleagues, quasi-strangers on social media or during chance encounters. Each time, we gather information, and these encounters combine with numerous other communication channels we have access to [14, 15]. Hence, information, which is not concrete nor objective, is constructed through these interactions and relationships [16, 17].

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12. Anne Gammelgaard Ballantyne, 'Climate Change Communication: What Can We Learn from Communication Theory?', WIREs Climate Change 7, no. 3 (2016): 329–44, https://doi.org/10.1002/wcc.392.
13. Daniel Fischer et al., 'Sustainable Consumption Communication: A Review of an Emerging Field of Research', Journal of Cleaner Production 300 (2021): 126880, https://doi.org/10.1016/j.jclepro.2021.126880.
14. Yekatherina Bobrova, George Papachristos, and Lai Fong Chiu, 'Homeowner Low Carbon Retrofits: Implications for Future UK Policy', Energy Policy 155 (2021): 112344, https://doi.org/10.1016/j.enpol.2021.112344.
15. J. Vinke-de Kruijf, C. Pahl-Wostl, and C. Knieper, 'Wider Learning Outcomes of European Climate Change Adaptation Projects: A Qualitative Comparative Analysis', Environmental Innovation and Societal Transitions 34 (2020): 270–97, https://doi.org/10.1016/j.eist.2018.09.004.
16. Brenda Dervin and Lois Foreman-Wernet, eds., Sense-Making Methodology Reader: Selected Writings of Brenda Dervin (Cresskill, N.J: Hampton Press, 2003).
17. Marie-Ève Maillé and Johanne Saint-Charles, 'Fuelling an Environmental Conflict through Information Diffusion Strategies', Environmental Communication: A Journal of Nature and Culture 8, no. 3 (2014): 305–25, https://doi.org/10.1080/17524032.2013.851099.

Taking this into account, theories of communication have evolved from a transmission/deficit model to an interactive/dialogical approach supporting the idea that communication creates relationships as much as it is produced by them [18, 19, 20, 21]. Communication mechanisms pertaining to these models, in line with the "participatory turn" in democracies [22], include the integration of citizens' perceptions, concerns, and knowledge, with a view to co-construct a collective vision of the situation and the behavioural changes it calls for [23, 24].

It is with this complexity in mind that, in this chapter, we address central questions in communication with regards to the ecological transition, starting with the deconstruction of the "deficit model" (the postulate that not enough good info is the basic obstacle to correct change), often considered a "magic bullet model" [25, 26] ("one only needs to offer more info for correct change to occur"). We then focus on public participation, notably in the fields of public relations and risk communication and pursue by addressing the central issues of uncertainty and trust as well as the importance of framing. The chapter continues by showing the necessity to consider relationships and discourse together when thinking about instigating an ecological transition. The almost-ubiquitous presence of social media in our lives makes it an unavoidable topic in communication: we show that, although noticeable, its potential to influence changes towards ecologically friendly behaviours has limitations. We then address the role of communication in sustaining people's motivation to not only change their individual behaviour, but also to encourage collective action toward this transition. We conclude by highlighting knowledge gaps and critical issues to tackle.

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18. Ballantyne, 'Climate Change Communication'.
19. Jimmie Manning, 'A Constitutive Approach to Interpersonal Communication Studies', Communication Studies 65, no. 4 (2014): 432–40, https://doi.org/10.1080/10510974.2014.927294.
20. Laura N. Rickard, 'Pragmatic and (or) Constitutive? On the Foundations of Contemporary Risk Communication Research', Risk Analysis 41, no. 3 (2021): 466–79, https://doi.org/10.1111/risa.13415.
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24. Henrik Merkelsen, 'Risk Communication and Citizen Engagement: What to Expect from Dialogue', Journal of Risk Research 14, no. 5 (2011): 631–45, https://doi.org/10.1080/13669877.2011.553731.
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26. Katherine McComas, 'Community Engagement and Risk Management', in The Sage Handbook of Public Relations, by Robert Lawrence Heath, 2nd ed. (Thousand Oaks, CA: SAGE Publications, 2010), 461–76.

1. From the deficit model to the concept of public engagement in projects associated with the ecological transition

Anchored in the transmission paradigm of communication, the "deficit model"[27, 28] has (too) long been dominant in science communication; in fact, it is still present in many awareness campaigns based on the transmission of climate scientific data. The model can be summed up as pouring popularized scientific information "into" lay people's heads to fill their knowledge deficit; a way of "educating" the population on risks, based on scientific data, and convincing them to adopt proper behaviours. However, **COMMUNICATION STUDIES CLEARLY SHOW THAT THIS MODEL DOES NOT WORK, NOTABLY IN SOCIO-TECHNICAL CONTROVERSIES, WHEN THE EXACT PERIMETERS OF THE RISKS ARE STILL UNKNOWN OR WHEN THE RISKS OR HOW TO DEAL WITH THEM ARE STILL BEING DEBATED**[29], as may be the case with projects associated with the ecological transition, such as nuclear power or battery manufacturing facilities. In some cases, the targeted populations react negatively, sometimes by mobilizing a credible counter-expertise based on scientific data other than that mobilized by scientific or governmental authorities[30]. The result is a struggle for expertise that is unfruitful in achieving the desired behavioural changes.

In the end, communication initiatives developed from the traditional deficit model sometimes generate unexpected perverse effects such as mistrust and a rupture of communication channels between citizens and scientific or governmental authorities.

Even when science is consensual and clearly calls for behavioural changes, the simple transmission of information on why changes are needed is often ineffective - think about discourses on the necessity to rethink mobility or frantic consumption for their impacts on greenhouse gas emissions, for instance. Yet, despite evidence of the inefficiency of the

27. Marko Ahteensuu, 'Assumptions of the Deficit Model Type of Thinking: Ignorance, Attitudes, and Science Communication in the Debate on Genetic Engineering in Agriculture', Journal of Agricultural and Environmental Ethics 25, no. 3 (2012): 295–313, https://doi.org/10.1007/s10806-011-9311-9.
28. Ballantyne, 'Climate Change Communication'.
29. Carina Cortassa, 'In Science Communication, Why Does the Idea of a Public Deficit Always Return? The Eternal Recurrence of the Public Deficit', Public Understanding of Science 25, no. 4 (2019): 447–59, https://doi.org/10.1177/0963662516629745.
30. Stéphanie Yates et al., 'Acceptabilité Sociale : Revoir Les Fondements Pour Une Vision Commune de Ce Nouvel Impératif', in Acceptabilité Sociale : Enjeu de Gouvernance et Controverses Scientifiques (Titre Provisoire), by Christophe Alcantara, Laurence Saglietto, and Francine Charest (Paris, France: Presse des mines, 2023).

transmission/deficit model in communication and of its counter-productive effects [31, 32], this view remains dominant in many spheres. According to Suldovsky [33], the main cause of this dominance is the "absolute epistemic privilege" afforded to science: it has such legitimacy that if science says so, then it should be followed by action.

Given the inherent limitations of the deficit model, participatory approaches to public communication have emerged as a more fruitful alternative, particularly suitable for contexts characterized by risk and uncertainty, or socio-technical controversies, as is often the case with projects associated with the ecological transition. These approaches decisively depart from the conventional "announce, decide, convince" model [34] or the less effective «implement, reassure, justify» communication paradigm [35], where a decision is made by public or industrial authorities in a unidirectional manner, with communication aimed solely at convincing or reassuring social actors in the face of an accomplished fact. Instead, participatory models prioritize interactions between institutions and social actors at the forefront of a given project, in a dialogic context.

Implementing these approaches implies acknowledging that social actors have the legitimacy to actively engage in discussions, and hence necessitates dispelling several preconceived notions about social actors [36]. First, although the general population may not always possess the scientific knowledge required to comprehend complex scientific or technical issues, citizens often own context-specific knowledge relevant to the considerations underpinning public decision-making [37]. This experiential knowledge [38], derived from a practical understanding of specific territories or situations [39], is often crucial in finding sustainable solutions for problems or projects associated with the ecological transition, such as climate adaptation strategies or the evaluation of environmental and social impacts before the construction of a hydroelectric dam. Secondly, relevant expertise is often dispersed within the population, including retired public servants or university professors, for instance.

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31. Brianne Suldovsky, 'In Science Communication, Why Does the Idea of the Public Deficit Always Return? Exploring Key Influences', Public Understanding of Science 25, no. 4 (2016): 415–26, https://doi.org/10.1177/0963662516629750.
32. Molly J. Simis et al., 'The Lure of Rationality: Why Does the Deficit Model Persist in Science Communication?', Public Understanding of Science 25, no. 4 (2016): 400–414.
33. Suldovsky, 'In Science Communication, Why Does the Idea of the Public Deficit Always Return?'
34. McComas, 'Community Engagement and Risk Management'.
35. Marie-José Fortin and Yann Fournis, 'Une participation conflictuelle : la trajectoire territoriale des mobilisations contre le gaz de schiste au Québec', Participations 13, no. 3 (2015): 119–44, https://doi.org/10.3917/parti.013.0119.
36. Ahteensuu, 'Assumptions of the Deficit Model Type of Thinking'.
37. Nancy Tanguay, Sylvie de Grosbois, and Johanne Saint-Charles, 'Santé Territoriale, Indicateurs de Santé Animale et Vision Holistique: La Sélection Des Prises et Les Choix Alimentaires Chez Les Atikamekw de Manawan et d'Obedjiwan', Recherches Amérindiennes Au Québec 43, no. 2–3 (2014): 3–19, https://doi.org/10.7202/1026103ar.
38. Michel Callon, Pierre Lascoumes, and Yannick Barthe, Agir Dans Un Monde Incertain. Essai Sur La Démocratie Technique, Réseau « Développement Durable et Territoires Fragiles » (Paris, France: Le Seuil, 2001).
39. Yates et al., 'Acceptabilité Sociale : Revoir Les Fondements Pour Une Vision Commune de Ce Nouvel Impératif'.

Therefore, communication mechanisms allowing the information to reach decision-makers are highly relevant. Third, organizations engaged in communication must acknowledge that public skepticism on contentious matters, like the location of an electric battery manufacturing facility near residential areas, often stems from a lack of trust in authorities, be they public or private, rather than a fundamental challenge to scientific facts [40].

Over the past three decades, participatory approaches have been applied across academic disciplines, receiving significant attention in political science [41] and urban studies [42]. In this literature, participatory governance is presented as a potential remedy for «democratic disenchantment» [43] and a means to harness collective intelligence [44]. The field of public communication has taken an interest in participatory approaches since at least the 1980s, a period during which the «theory of excellence in public relations» was under development [45, 46]. The model of symmetrical two-way communication lies at the core of this normative recommendation for how public relations should be conducted in modern times. Based on dialogue and deliberation [47], this model distinguishes itself from the unidirectional models commonly associated with traditional persuasive communication.

More specifically, Grunig and his colleagues present four models of public relations representing the evolution of professional practices over time. The first model, that of the press agent or promotion, implies unidirectional communication originating from the organization highlighting its positive aspects. This model bears a resemblance to advertising, and at times, propaganda, making it incompatible with the socio-environmental transitional context, in which populations can generally access information independently. The second model, known as information to the public, also relies on unidirectional communication stemming from the organization. However, the information conveyed here is tailored to align with public expectations, needs, or «societal expectations» [48]. In the context of the ecological transition, consider a scenario in which an enterprise publicly discloses its greenhouse gas emissions. The deficit model described above, still largely used in science communication, also corresponds to this model.

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40. Alexandre Coutant and Julien Rueff, 'Tout Défiant Envers Les Médias Est-Il Un Complotiste ?', Politique et Sociétés 41, no. 1 (2023).
41. Marie-Hélène Bacqué and Y. Sintomer, La Démocratie Participative : Histoire et Généalogie (Paris, France: Éditions La Découverte, 2011).
42. Marie-Hélène Bacqué and Mario Gauthier, 'Participation, urbanisme et études urbaines. Quatre décennies de débats et d'expériences depuis « A ladder of citizen participation » de S. R. Arnstein', Participations 1, no. 1 (2011): 36–66, https://doi.org/10.3917/parti.001.0036.
43. Pierre Rosenvallon, Le Bon Gouvernement (Paris, France: Les livres du nouveau monde, 2015).
44. Loïc Blondiaux and Jean-Michel Fourniau, 'Un bilan des recherches sur la participation du public en démocratie : beaucoup de bruit pour rien ?', Participations 1, no. 1 (2011): 8–35, https://doi.org/10.3917/parti.001.0008.
45. James E. Grunig and T. Hunt, Managing Public Relations (Belmont, CA: Wadsworth Publishing Company, 1984).
46. James E. Grunig and J. White, eds., Excellence in Public Relations and Communication Management, Communication Textbook Series (Hillsdale, N.J: L. Erlbaum Associates, 1992).
47. M. Delli-Carpini, F.L. Cook, and L.R. Jacobs, 'Public Deliberation, Discursive Participation and Citizen Engagement: A Review of the Empirical Literature', Annual Review of Political Science 7 (2004): 315–44.
48. Robert Lawrence Heath and Michael J. Palenchar, Strategic Issues Management: Organizations and Public Policy Challenges (SAGE Publications, 2009).

The third model, asymmetrical two-way communication, involves a form of two-way interaction where tools allow the public to express their perspectives to the organization: open house, discussions on social media platforms, or the establishment of a follow-up committee, for instance. Communication in the third model is nevertheless asymmetrical since the public's input does not directly influence decision-making, which remains the exclusive responsibility of the organizations, which typically exhibit a reluctance to alter their standpoint. Public consultations, often orchestrated by governments or promoters of transition projects, frequently align with this third model. In such cases, participation appears to confer legitimacy on decisions that have already been made at an earlier stage.

Conversely, the fourth model, known as symmetrical two-way communication, assumes active participation by the public in organizational decision-making. The mechanisms allowing this dialogue may be the same as those in the previous models (open house or follow-up committee for instance), but this time, the parties engage in genuine mutual influence, through dialogue [49]. For instance, in the context of discussing a project, such as the construction of an electric battery factory for decarbonation, the conversation would encompass not only the fears and concerns of the local population regarding its environmental impact but also the diverse perspectives held by local stakeholders on the development of the sought-after area and the associated opportunity costs. These discussions may lead to the establishment of conditions or compromises that must be considered for the project to gain acceptability. Therefore, **THE CONCEPT OF SYMMETRY REVOLVES AROUND THE MUTUAL WILLINGNESS OF PARTIES TO COMPREHEND DIFFERENT VIEWPOINTS AND REMAIN OPEN TO EVOLVING THEIR OWN UNDERSTANDING OF THE MATTER, EVEN IF IT ENTAILS RELINQUISHING CERTAIN CONDITIONS OR DEMANDS [50]. SPECIFIC PARTICIPATORY TOOLS CAN ALSO DELEGATE POWER TO SOCIAL ACTORS, SUCH AS CITIZEN JURIES OR CONVENTIONS, AS WELL AS PARTICIPATORY BUDGETING**.

Within the realm of public relations, the dialogical perspective [51, 52] has been developed to operationalize the symmetrical two-way communication model. The very idea of dialogue is profoundly influenced by the teachings of theologian and philosopher Martin Buber [53, 54], who emphasizes the importance of recognizing the intrinsic worth of other people, considering them as an end in themselves rather than merely a means to an end.

49. Michael L. Kent and Maureen Taylor, 'Toward a Dialogic Theory of Public Relations', Public Relations Review 28, no. 1 (2002): 21–37, https://doi.org/10.1016/S0363-8111(02)00108-X.
50. Maureen Taylor and Michael L. Kent, 'Dialogic Engagement: Clarifying Foundational Concepts', Journal of Public Relations Research 26, no. 5 (2014): 384–98, https://doi.org/10.1080/1062726X.2014.956106.
51. Taylor and Kent.
52. J. A. Ledingham and S. D. Bruning, Public Relations as Relationship Management: A Relational Approach in the Study and Practice of Public Relations (Mahwaw: Lauwrence Erlbaum Associates, 2000).
53. Martin Buber, I And Thou (New York, NY: Charles Scribner's Sons, 1970).
54. Martin Buber, Between Man and Man (New York, NY: Collier Books, 1985).

Kent and Taylor[55] propose five key characteristics of dialogue:

- **MUTUALITY**. To emphasize the inherent interconnection between the organization and its stakeholders. They are inextricably linked and, as a result, must collaborate. For instance, in the case mentioned earlier, the local communities and the promoter of an electric battery manufacturing facility must establish a working relationship; otherwise, the project may face rejection due to a lack of social acceptability.
- **PROXIMITY**. To signify that the publics should be actively involved in discussions on matters relevant to them. In the context of a battery plant project, this involves engaging in exchanges that address both citizens' concerns and the promoter's considerations. All parties should be open to these discussions.
- **EMPATHY**. To underscore the importance of fostering an atmosphere of trust in dialogical approaches. Transparency and authenticity are key to foster trust. For instance, in the aforementioned project, the promoter would provide information to help individuals better understand the project under discussion, including its technical aspects.
- **RISK-TAKING**. A dialogical approach requires participants to be willing to reveal their vulnerabilities by addressing concerns and grievances. A promoter would then be open to discussions evolving in unexpected directions including, for instance, royalties or other forms of compensations.
- **COMMITMENT**. In a dialogical context, commitment relates to authenticity and sincerity in the dialogue. Conversations should be honest and candid, with a focus on enhancing the relationship rather than pursuing individual or strictly business interests. Participants should engage in these discussions with the aim of achieving mutual understanding. This could go as far as the promoter's openness to withdraw his project if it is deemed irreconcilable with citizens' interests or values.

55. Kent and Taylor, 'Toward a Dialogic Theory of Public Relations'.

2. The theory of the fully functioning society: reevaluating the role of persuasion

The emphasis on mutual understanding and dialogue prompts a reassessment of the role of persuasion in communication strategies. Do the normative models presented imply that an organization lacks the legitimacy to engage in persuasive communication with its stakeholders? This question can be addressed in two ways.

On the one hand, **A PERSUASIVE COMMUNICATION APPROACH CAN COMPLEMENT AN OPEN DIALOGICAL PROCESS IN CASES WHERE A CERTAIN CONSENSUS HAS BEEN ESTABLISHED. CONSIDER A SCENARIO INVOLVING A LARGE-SCALE PUBLIC CONSULTATION FOCUSED ON IDENTIFYING ACCEPTABLE ENERGY-SAVING MEASURES TO FACILITATE THE ECOLOGICAL TRANSITION**. Once the societal dialogue on this matter concludes, and a certain degree of agreement is reached – or social acceptability is considered established [56] – governments gain legitimacy to convey recommended or proscribed behaviors through unidirectional and persuasive communication channels.

On the other hand, while the theory of excellence tends to downplay the use of rhetorical devices by perceiving dialogue as a "neutral" process, wherein inter-influence is exercised primarily through respectful listening to the other, the theory of the fully functioning society, proposed by Robert L. Heath in 2006 [57], acknowledges the role and significance of rhetoric within societal dialogue [58].

From this perspective, an organization's (public or private) role is not to "construct meaning" based on its self-interest but, rather, to establish meaning based on the public interest, considering it as the foundation for shaping a collective vision on a specific issue [59]. This approach is referred to as ***responsive advocacy***, allowing for a dialogue between stakeholders who are open to each other's perspectives but may still hold ideas related to their own interests.

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56. Yates, Stéphanie, Corinne Gendron, Alice Friser and Marie-Luc Arpin, « Les fondements de l'acceptabilité sociale ». In Acceptabilité sociale : enjeux de société et controverses scientifiques, by Christophe Alcantara, Laurence Saglietto et Francine Charest (dir.) (2023, Paris : Presses des mines, p. 15-31).

57. Robert L. Heath, 'Onward Into More Fog: Thoughts on Public Relations' Research Directions', Journal of Public Relations Research 18, no. 2 (2006): 93–114, https://doi.org/10.1207/s1532754xjprr1802_2.

58. According to Heath (2006), "The fully functioning theory of public relations argues that it is a force (...) to foster community as blended relationships, resource distribution, and shared meanings that advance and yield to enlightened choice." (p. 97)

59. Heath, 'Onward Into More Fog'.

These interests are contemplated and understood in the context of the public interest as defined within a specific situation – in this view, the notion of public interest is clearly a construct, subject to criticism. For instance, in the case of a battery factory construction project, the promoter might advocate for the responsible management of industrial waste, recognizing that this is a fundamental requirement for gaining social acceptability within neighboring communities. But the notion of relying on battery technology to address the climate crisis, rather than reducing dependence on individual cars, for instance, may not be considered if the advocates of this idea are not involved in the dialogue. This is clearly a limitation, as well as the potential for inauthenticity among the actors involved in the dialogue, who may attempt to manipulate the process.

Ultimately, dialogical approaches to public relations aim for the authentic co-construction of meaning [60], resulting in a joint definition of the public interest, as it may be perceived in a given situation (and with the limits mentioned above). **WITHIN THIS DIALOGICAL PERSPECTIVE, THE GOAL IS NOT TO ELIMINATE CONFLICT BUT TO RECOGNIZE IT AS AN INHERENT ELEMENT OF SOCIAL DYNAMICS [61]. CONTROVERSY SERVES AS BOTH A SYMPTOM AND SYMBOL OF PEOPLE'S CONCERNS AND INTERESTS [62, 63]**. In this context, dialogue becomes the means to move beyond the controversy and explore potential compromises. It enables a fresh perspective on the project. Its goal is not merely to "assert viewpoints" but to "transcend, refine the object's definition, make it more adaptable, or transform it" [64].

To be clear, these approaches distance themselves from the conventional patterns of persuasive or engaging communication. Although normative models in public relations have faced substantial criticism due to their idealized nature, which may be scarcely practical in real-world applications [65, 66, 67, 68, 69], they have significantly influenced the realm of risk communication.

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60. Robert Lawrence Heath and W. T. Coombs, Today's Public Relations (Thousand Oaks, CA: SAGE Publications, 2006).
61. Fortin and Fournis, 'Une participation conflictuelle'.
62. Jean-Michel Besnier, 'La Controverse, Entre Science et Politique. Les Controverses Technologiques Peuvent-Elles Être Productives?', in Au Cœur Des Controverses : Des Sciences à l'action (Arles, France: Actes Sud/IHEST, 2015).
63. Morgan Meyer, 'Le confinement des controverses comme objet d'étude', Hermès, La Revue 73, no. 3 (2015): 98–100, https://doi.org/10.3917/herm.073.0098.
64. Heinz Wismann, 'Polémique, débat et controverse : retour sur une notion', in Au coeur des controverses: des sciences à l'action, ed. Institut des hautes études pour la science et la technologie, Questions vives (Arles [Paris]: Actes Sud IHEST, 2015).
65. Juliet Roper, 'Symmetrical Communication: Excellent Public Relations or a Strategy for Hegemony?', Journal of Public Relations Research 17, no. 1 (2005): 69–86, https://doi.org/10.1207/s1532754xjprr1701_6.
66. Jacquie L'Etang, '"Radical PR": Catalyst for Change or an Aporia?', The International Journal of Communication Ethics 6, no. 2 (2009): 13–18.
67. Kevin L. Stoker and Kati A. Tusinski, 'Reconsidering Public Relations' Infatuation With Dialogue: Why Engagement and Reconciliation Can Be More Ethical Than Symmetry and Reciprocity', Journal of Mass Media Ethics 21, no. 2–3 (2006): 156–76, https://doi.org/10.1080/08900523.2006.9679731.
68. Jacquie L'Etang and Magda Pieczka, Public Relations: Critical Debates and Contemporary Practice (Psychology Press, 2006).
69. R.E. Brown, 'Symmetry and Its Critics: Antecedents, Prospects, and Implications for Symmetry in a Postsymmetry Era', in The Sage Handbook of Public Relations, by Robert Lawrence Heath (Thousand Oaks, CA: SAGE Publications, 2010).

3.The participatory risk communication shift in projects associated with the socio-environmental transition

In the realm of risk communication, the traditional top-down, unidirectional approach has progressively given way to a participatory paradigm [70]. This transformation affects the communication strategies accompanying projects. First, as explained above, **CONTEMPORARY RISK MANAGEMENT AND COMMUNICATION OCCUR IN A CONTEXT WHERE IT IS UNDERSTOOD THAT THE SCIENTIFIC INFORMATION RELIED UPON BY EXPERTS IS FREQUENTLY PERCEIVED TO BE AMBIGUOUS AND SUBJECT TO THE SCIENTIFIC CONTROVERSY THAT PERMEATES THE PUBLIC DOMAIN, LEADING TO A «STRUGGLE» BETWEEN DIFFERENT AREAS OF EXPERTISE** [71]. These disputes are often associated with socio-technical controversies [72], which are prevalent in projects associated with the ecological transition such as nuclear power as we have seen earlier, carbon capture [73], windmills construction [74] or the use of digital technology to address environmental crises.

In this context, there is now recognition that risk assessment must consider the population's perception of risk, as well as the values at play, which influence the acceptability or non-acceptability of a project and its associated hazards [75]. In phase with the participatory paradigm, the participatory approach to risk communication also recognizes the value and relevance of the situated or experiential knowledge held by specific populations [76].

70. McComas, 'Community Engagement and Risk Management'.
71. Stéphanie Yates, Justine Lalande, and Mireille Lalancette, 'Du Modèle Du Déversement Du Savoir à La Gestion Participative Des Risques : Les Luttes d'expertise Au Cœur de l'acceptabilité Sociale de Projets d'exploitation Des Ressources Naturelles', Revue Canadienne de Communication, sous presse.
72. Dominique Pestré, 'L'analyse de controverses dans l'étude des sciences depuis trente ans. Entre outil méthodologique, garantie de neutralité axiologique et politique', Mil neuf cent. Revue d'histoire intellectuelle 25, no. 1 (2007): 29–43, https://doi.org/10.3917/mnc.025.0029.
73. D.J. Fiorino, The Clean Energy Transition: Policies and Politics for a Zero-Carbon World (Oxford, Boston, New York: Polity Press, 2022).
74. Maillé and Saint-Charles, 'Fuelling an Environmental Conflict through Information Diffusion Strategies'.
75. Alisius D. Leong et al., 'Expanding on Behavioral Outcomes in the Risk Information Seeking and Processing Model: Socio-Cognitive Factors Predicting Information Seeking, Sharing, and Discussion', Science Communication 45, no. 3 (2023): 310–36, https://doi.org/10.1177/10755470231165489.
76 Yann Bérard, 'L'expertise Citoyenne', in Experts, Sciences et Sociétés, by François Claveau and Julien Prud'homme (Montréal, Canada: Presses de l'Université de Montréal, 2018), 59–76.

All this necessitates hybrid forums that allow space for the expression of the public's voice [77]. Reflecting theoretical advancements in public relations, the concept of dialogue is at the core of participatory approaches to risk communication, providing an effective means to transcend the unproductive expert disputes mentioned above.

It is valuable to initiate this dialogue as early as the conceptualization phase of the project, well before its actual implementation, so that the views of social actors can concretely influence the project's design. Communities' participation in these early discussions aims at establishing the acceptable risk thresholds [78, 79], based on the perceptions, knowledge, and sentiments of the stakeholders and may prevent the rise of conflict [80].

4. Uncertainty and trust

For dialogue to happen, trust is essential and a first step towards achieving it may be to stop pretending that science always holds the truth and is always right. As we have seen, in the deficit model framework, the belief is that one must communicate in a simple manner the "truth" of scientific facts. But truth in science is often uncertain, sometimes ambiguous, or conflictual. And, faced with the multifactorial causes of climate changes which call for complex and uncertain responses, sustainability science [81, 82] is no exception. More importantly, no matter the level of recognised scientific truth, perception of science and 'truth' vary greatly among stakeholders.

After numerous years of communication practices working under the assumption that disclosing uncertainties would be too confusing for "lay" people, communication scholars have argued, to the contrary, that **CONVEYING SCIENTIFIC UNCERTAINTIES IN PUBLIC COMMUNICATION HAS POSITIVE EFFECTS ON SCIENCE UPTAKE, ATTITUDES, AND BEHAVIOURS** [83] **BUT FINDINGS IN THIS FIELD HAVE NOT ALWAYS BEEN CONCLUSIVE**. Seeking to understand whether, when, how, and why communicating uncertainty influences the perceptual, attitudinal, and behavioural responses of audiences in public science communication, Gustafson & Rice [84] conducted a literature review. Results were organised considering four types of communicated uncertainties, as presented in **Table 1**.

77. Archon Fung, 'Varieties of Participation in Complex Governance', Public Administration Review 66, no. s1 (2006): 66–75, https://doi.org/10.1111/j.1540-6210.2006.00667.x.
78. Dominic Balog-Way, Katherine McComas, and John Besley, 'The Evolving Field of Risk Communication', Risk Analysis 40, no. S1 (2020): 2240–62, https://doi.org/10.1111/risa.13615.
79. Arvai, Gregory, and McDaniels, 'Testing a Structured Decision Approach'.
80. Maillé and Saint-Charles, 'Fuelling an Environmental Conflict through Information Diffusion Strategies'.
81. Bert J. M. De Vries, Sustainability Science, 1st ed. (Cambridge University Press, 2012), https://doi.org/10.1017/CBO9780511794469.
82. Joachim H. Spangenberg, 'Sustainability Science: A Review, an Analysis and Some Empirical Lessons', Environmental Conservation 38, no. 3 (2011): 275–87, https://doi.org/10.1017/S0376892911000270.
83. Philip Campbell, 'Understanding the Receivers and the Reception of Science's Uncertain Messages', Philosophical Transactions: Mathematical, Physical and Engineering Sciences 369, no. 1956 (2011): 4891–4912.
84. Abel Gustafson and Ronald E. Rice, 'A Review of the Effects of Uncertainty in Public Science Communication', Public Understanding of Science 29, no. 6 (2020): 615, https://doi.org/10.1177/0963662520942122.

TABLE 1: Types of communicated uncertainties

TYPE	DESCRIPTION ON THESE UNCERTAINTIES	EFFECT OF COMMUNICATING
Deficient uncertainties	Known gaps in science	Positive or neutral effects
Technical uncertainties	Refers to the quantification of uncertainty as it is often found in statistical analysis	Positive or neutral effects
Scientific uncertainties	Refers to the inherent uncertainty of science rendering the reporting of scientific results to be "the best of our current knowledge"	Positive or neutral effects
Consensus uncertainty	Refers to collective disagreement between groups of scientists	Negative effects

Overall, as shown in Table 1, results show more positive or neutral effects for the three first categories while studies investigating consensus uncertainties mostly reported negative effects. In other words, **PEOPLE RESPOND FAVOURABLY, OR ARE AT LEAST NOT DETERRED BY, DEFICIENT, TECHNICAL, AND SCIENTIFIC UNCERTAINTY, WHEREAS PEOPLE'S REACTION TO CONSENSUS UNCERTAINTY MAY BE A DIMINUTION OF TRUST IN SCIENTIFIC RESEARCH**.

The authors also show that these results are moderated by contextual and individual characteristics.

Given the difficulty in interpreting numerical values expressing scientific uncertainties, the IPCC chose to report such data using a "qualitative scale" (unlikely, likely, very likely...). In their study, Budescu et al. (2012) have shown that, on a scale from 0 to 100 % overall people tend to interpret these affirmations as less extreme (especially the very likely and very unlikely). They also showed that these results vary notably with the respondents' beliefs about climate changes. The study also tested the relevance of using numerical values (rather than qualitative ones) and concludes that a dual scale (using both textual and numerical information) significantly (a) increases the level of differentiation between the various terms, (b) increases the consistency of interpretation of these terms, and (c) increases the level of consistency with the IPCC guidelines. Most importantly, these positive effects are independent of the respondents' ideological and environmental views [85].

85. David V. Budescu, Han-Hui Por, and Stephen B. Broomell, 'Effective Communication of Uncertainty in the IPCC Reports', Climatic Change 113, no. 2 (July 2012): 181, https://doi.org/10.1007/s10584-011-0330-3.

AMONG THE CONTEXTUAL AND INDIVIDUAL CHARACTERISTICS IS TRUST IN SCIENCE AND SCIENTISTS: WITHOUT SURPRISE, THOSE TRUSTING IN SCIENCE REACT MORE POSITIVELY TO UNCERTAINTY BEING COMMUNICATED. TRUST IS A FUNDAMENTAL ELEMENT OF COMMUNICATION AND ITS IMPORTANCE HAS BEEN HIGHLIGHTED FOR INTERPERSONAL AND GROUP COMMUNICATION [86], DOCTOR-PATIENT RELATIONSHIPS [87], ORGANISATIONAL COMMUNICATION [88], [89], INSTITUTIONAL COMMUNICATION [90], MASS MEDIA [91] AND, AS WE WILL SEE LATER, FOR DIGITAL MEDIA. THESE STUDIES SHOW THAT TRUST ACTS NOT ONLY AS A MEDIATOR BUT THAT IT IS ALSO AN EFFECT ON COMMUNICATION.

Trust is a complex phenomenon and has many facets. For example, scholars have distinguished between generalized trust and trust in specific others [92], [93], [94]. For the latter, a common distinction is made between cognitive trust, which translate into trust in the other's expertise, and affective trust, a confidence that the other is benevolent towards us [95]. These two types of trust have been associated with types of uncertainty: **WHEN PEOPLE SEEK ADVICE BASED ON A LACK OF INFORMATION, THEY TEND TO TURN TOWARDS THOSE THEY TRUST FOR THEIR EXPERTISE, WHILE WHEN THEY ARE DOUBTFUL ABOUT WHICH OPTION TO CHOOSE DESPITE HAVING PLENTY OF INFORMATION, THEY TURN TOWARDS THOSE THEY TRUST TO BE BENEVOLENT TOWARDS THEM OR WHOM THEY CONSIDER FRIENDS** [96].

This may help understand why the disclosure of ***consensus uncertainty*** has negative effects in public communication: groups of scientists expressing opposite opinions have no lack of information or arguments to support their claims, but they may not be the recipient of affective trust which would be needed in that case.

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86. Saonee Sarker et al., 'The Role of Communication and Trust in Global Virtual Teams: A Social Network Perspective', Journal of Management Information Systems 28, no. 1 (2011): 273–310, https://doi.org/10.2753/MIS0742-1222280109.
87. Paul Ward, 'Trust and Communication in a Doctor-Patient Relationship: A Literature Review', Arch Med 3, no. 3 (2018): 36.
88. Anna V. Chatzi et al., 'The Unexplored Link between Communication and Trust in Aviation Maintenance Practice', Aerospace 6, no. 6 (2019): 66, https://doi.org/10.3390/aerospace6060066.
89. Pamela Shockley-Zalabak, Kathleen Ellis, and Gaynelle Winograd, 'Organizational Trust: What It Means, Why It Matters', Organization Development Journal 18, no. 4 (2000): 35–48.
90. Peter Weingart and Lars Guenther, 'Science Communication and the Issue of Trust', Journal of Science Communication 15, no. 05 (2016): C01.
91. Jesper Strömbäck et al., 'News Media Trust and Its Impact on Media Use: Toward a Framework for Future Research', Annals of the International Communication Association 44, no. 2 (2020): 139–56.
92. Markus Freitag and Richard Traunmüller, 'Spheres of Trust: An Empirical Analysis of the Foundations of Particularised and Generalised Trust', European Journal of Political Research 48, no. 6 (2009): 782–803, https://doi.org/10.1111/j.1475-6765.2009.00849.x.
93. Peter Nannestad, 'What Have We Learned About Generalized Trust, If Anything?', Annual Review of Political Science 11, no. 1 (2008): 413–36, https://doi.org/10.1146/annurev.polisci.11.060606.135412.
94. André Van Hoorn, 'Trust Radius versus Trust Level: Radius of Trust as a Distinct Trust Construct', American Sociological Review 79, no. 6 (2014): 1256–59, https://doi.org/10.1177/0003122414555398.
95. Jean Goodwin and Michael F. Dahlstrom, 'Communication Strategies for Earning Trust in Climate Change Debates', WIREs Climate Change 5, no. 1 (2014): 151–60, https://doi.org/10.1002/wcc.262.
96. Johanne Saint-Charles and Pierre Mongeau, 'Different Relationships for Coping with Ambiguity and Uncertainty in Organizations', Social Networks 31, no. 1 (2009): 33–39, https://doi.org/10.1016/j.socnet.2008.09.001.

Trust plays a significant role in adaptation behaviour. In their meta-analysis [97], Cologna and Siegrist examined the role of trust in institutions, scientists, industry, environmental groups, and people in general, in relation to different climate-friendly behaviours. Among other things, their analysis showed a strong association between climate-friendly behaviours and trust in experts and environmental groups.

But how can communication be useful here? Are there ways to build trust through communication? Or does communication depend on pre-existing trust? From what we have seen above, a move from a discourse of science certainty to more transparency and disclosure at least when it concerns deficient, technical, and scientific uncertainties is a good start to earn more cognitive trust. A step further would be to name what is being done to reduce the uncertainty [98].

EARNING AFFECTIVE TRUST IS MORE CHALLENGING. IT IS NOT SO MUCH ABOUT TRUSTING THE INFORMATION BUT TRUSTING WHO IS GIVING IT [99]. IT IS STRONGLY RELATIONAL AND EMOTIONAL. AND BUILDING SUCH A RELATIONSHIP TAKES TIME. We will see in another section that with social media, trust and reputation go hand-in-hand. In this social space, as in many others, trust is not acquired overnight. One must engage with lay audiences, such as is done from a dialogical perspective, listening to oppositional arguments rather than dismissing them [100], and showing one's own engagement, vulnerability, and willingness to take risk [101]. Moreover, as we will see, the framing of scientific discourse also plays a crucial role in how people interpret it on the background of their own values [102, 103] and can contribute to the development of trust.

97. Viktoria Cologna and Michael Siegrist, 'The Role of Trust for Climate Change Mitigation and Adaptation Behaviour: A Meta-Analysis', Journal of Environmental Psychology 69 (2020): 101428, https://doi.org/10.1016/j.jenvp.2020.101428.
98. Lynn Frewer et al., 'The Views of Scientific Experts on How the Public Conceptualize Uncertainty', Journal of Risk Research 6, no. 1 (2003): 75–85, https://doi.org/10.1080/1366987032000047815.
99. Goodwin and Dahlstrom, 'Communication Strategies for Earning Trust in Climate Change Debates'.
100. Coutant and Rueff, 'Tout Défiant Envers Les Médias Est-Il Un Complotiste ?'
101. Goodwin and Dahlstrom, 'Communication Strategies for Earning Trust in Climate Change Debates'.
102. Robert M. Entman, 'Framing: Toward Clarification of a Fractured Paradigm', Journal of Communication 43 (1993): 51–58, https://doi.org/10.1111/j.1460-2466.1993.tb01304.x.
103. Robert D. Benford and David A. Snow, 'Framing Processes and Social Movements: An Overview and Assessment', Annual Review of Sociology 26 (2000): 611–39.

5. Framing the transition

In 1981, Tversky & Kahneman[104] conducted a framing experiment in which they proposed scenarios (which they called "programs") to react to a disease outbreak bound to kill 600 people. All participants were presented a choice between two programs. A group of respondents had to choose between Program A or B and another group between C or D. In fact, A and C and B and D respectively had the same effect but were framed differently. For example, "Program A" was supposed to save 200 people while "Program C" would leave 400 people to die. Nonetheless, 72% of participants, chose Program A over Program B while only 22% chose Program C over program D. Although the authors were interested in the psychological variables underlying these choices (we address some of those in the "Communication to support motivation" section) they certainly made a convincing illustration of framing as a communicational process.

The origin of framing theory is often attributed to the work of Goffman[105] who studied the functioning of framing in day-to-day interactions. The concept of frames is also utilized in various social sciences and humanities disciplines. **FRAMES CAN BE GLOBALLY DEFINED AS SCHEMES OF INTERPRETATION THROUGH WHICH PEOPLE MAKE SENSE OF THEIR WORLD. THEY ARE RELATED TO NOTIONS SUCH AS COGNITIVE STRUCTURES[106, 107], MEMES[108, 109], CULTURAL MODELS[110, 111], COGNITIVE SCHEMAS[112], RESPONSE PATTERNS[113], STYLES OF THOUGHT[114, 115] OR SOCIAL REPRESENTATIONS[116] IN THAT ALL THESE CONCEPTS RELATE TO HOW "FACTS" ARE COMPREHENDED AND FRAMED**.

104. Amos Tversky and Daniel Kahneman, 'The Framing of Decisions and the Psychology of Choice', Science 211 (1981): 453–58.
105. Erving Goffman, Frame Analysis : An Essay on the Organisation of Experience (New York: Harper & Row, 1974).
106. Deborah Tannen, 'What's in a Frame? Surface Evidence for Underlying Expectations', in New Directions in Discourse Processing, ed. Roy O. Freedle (Norwood, N.J.: ABLEX Pub. Corp., 1979), 137–81.
107. Eviatar Zerubavel, Social Mindscapes : An Invitation to Cognitive Sociology (Cambridge, Mass.: Harvard University Press, 1997).
108. Susan Blackmore, The Meme Machine (Oxford: Oxford University Press, 1999).
109. Daniel Clement Dennett, Darwin's Dangerous Idea : Evolution and the Meanings of Life (New York: Simon & Schuster, 1995).
110. Roy G. D'Andrade, The Development of Cognitive Anthropology (Cambridge: Cambridge University Press, 1995).
111. Bradd Shore, Culture in Mind : Cognition, Culture, and the Problem of Meaning (New York: Oxford University Press, 1996).
112. Ronald W. Casson, 'Schemata in Cognitive Anthropology', Annual Review of Anthropology 12 (1983): 429–62.
113. Pierre Mongeau and Jacques Tremblay, Survivre La Dynamique de l'inconfort (Sainte-Foy: Presses de l'Université du Québec, 2002).
114. Mary Douglas, Comment Pensent Les Institutions (Paris: La Découverte, 2004).
115. Ludwik Fleck, Genèse et Développement d'un Fait Scientifique (Paris: Les Belles Lettres, 2005).
116. Denise Jodelet, Les représentations sociales, 7th ed. (Presses Universitaires de France, 2003), https://doi.org/10.3917/puf.jodel.2003.01.

Frames are not only in the mind of the beholder but inscribed in discourse as well. Framing is a central theory in communication scholarship, and it contributes as much to the understanding of interpersonal communication as to the impact of mass or digital media on public opinion [117]. The focus in communication is on "how frames become embedded within and make themselves manifest in a text, or how framing influences thinking [118]".

Framing theory has been widely employed for environmental communication and typologies of frames have been proposed [119, 120] distinguishing between, for examples, scientific, economic, environmental, moral or political frames. Frames contribute to the legitimacy of the discourses deployed in the public space and to the fact that some will be more authoritative than others [121]. For climate change and the transition, framing may help reduce the psychological and temporal distance people often feel towards them [122]. For example, Aberman & Plaks [123] have shown that framing the issue of meat consumption using individual data had more significant effect on the intention to change than showing aggregate data.

This expeditive overview may raise hope as to an efficient strategy to support behavioural changes: we must find the right framing. Evidently, it is not that easy. The same framing does not have the same effect on all population groups. For instance, we can think that an ecological framing mostly appeals to already (at least mildly) convinced ecologically minded people [124, 125]. Similarly, framing transition in religious terms may appeal to religious leaders [126] and religious-inclined individuals but repel atheists.

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117. Chung Joo Chung et al., 'An Analysis on Communication Theory and Discipline', Scientometrics 95 (2013): 985–1002, https://doi.org/10.1007/s11192-012-0869-4.
118. Entman, 'Framing'.
119. Toby Bolsen and Matthew A. Shapiro, 'The US News Media, Polarization on Climate Change, and Pathways to Effective Communication', Environmental Communication 12, no. 2 (2018): 149–63, https://doi.org/10.1080/17524032.2017.1397039.
120. Matthew C. Nisbet, 'Communicating Climate Change: Why Frames Matter for Public Engagement', Environment: Science and Policy for Sustainable Development 51, no. 2 (2009): 12–23, https://doi.org/10.3200/ENVT.51.2.12-23.
121. Francis Chateauraynaud and David Chavalarias, 'L'analyse Des Grands Réseaux Évolutifs et La Sociologie Pragmatique Des Controverses: Croiser Les Méthodes Face Aux Transformations Des Mondes Numériques', Sociologie et Sociétés 49, no. 2 (2018): 137–61, https://doi.org/10.7202/1054277ar.
122. Alexa Spence and Nick Pidgeon, 'Framing and Communicating Climate Change: The Effects of Distance and Outcome Frame Manipulations', Global Environmental Change 20, no. 4 (2010): 656–67, https://doi.org/10.1016/j.gloenvcha.2010.07.002.
123. Youval Aberman and Jason Plaks, 'When Less Is Better: Messages That Present Dietary Carbon Emissions Data at the Individual (vs. Aggregate) Level Increase Commitment to Sustainable Beef Consumption', Appetite 174 (2022): 105980, https://doi.org/10.1016/j.appet.2022.105980.
124. Livia Fritz et al., 'Perceived Impacts of the Fridays for Future Climate Movement on Environmental Concern and Behaviour in Switzerland', Sustainability Science 18, no. 5 (September 2023): 2219–44, https://doi.org/10.1007/s11625-023-01348-7.
125. Stéphane La Branche, Énergie et Écologie : Les Sept Profils Socioénergétiques (Presses universitaires de Grenoble, 2021).
126. Nisbet, 'Communicating Climate Change'.

We have seen earlier that framing an issue within scientific uncertainty can have positive effects, but we also know that some have framed science as inherently uncertain to cast doubt on scientific results, and not always for the greater good [127, 128]. As well, direct exposure to hazard affects people's framing of a situation and concomitantly their sensitivities to disaster frames [129].

Studies have identified various textual and pictorial frames [130] used in a range of sources [131], but the evaluation of their effect on behaviour change outside of experimental settings remains a challenge. To address this challenge, scholars have distinguished between frames characteristics, such as positive frames highlighting the benefits that can be obtained by adopting a pro-environmental behaviour, and negative frames, focusing on the cost of maintaining non-sustainable behaviours. Frames can also be construed as abstract or concrete [132] and as focusing on benefits for the individual or for the collective [133]. As Florence et al. [134] show in their literature review, results are inconsistent especially when simple frames (focusing on only one pair of characteristics) are studied.

An obvious explanation for this lack of consistency is that context matters – not one frame fits all and a more encompassing view of framing is needed:

- Considering geo-cultural contexts is of prime importance [135] and so is considering the temporal context. For example, multiple crises (such as Climate changes and Covid-19) may lead to what Patterson et al. [136] have called apocalypse fatigue, which, they argue, may affect the effectiveness of emergency frames, or render positive frames much more effective than negative ones [137].

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127. David Michaels, Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health (Oxford ; New York: Oxford University Press, 2008).
128. Naomi Oreskes and Erik M. Conway, Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Climate Change, Paperback edition, Nachdruck (New York London Oxford New Delhi Sydney: Bloomsbury, 2022).
129. Leah Ruppanner et al., 'Emotional and Financial Health during COVID-19: The Role of Housework, Employment and Childcare in Australia and the United States', Gender, Work & Organization 28, no. 5 (2021): 1937–55, https://doi.org/10.1111/gwao.12727.
130. A.H. Simonsen, 'Blowing in the Wind—Norwegian Wind Power Photographs in Transition', Journalism Practice 16, no. 2–3 (2022): 298–316, https://doi.org/10.1080/17512786.2021.2016068.
131. N Badullovich, W J Grant, and R M Colvin, 'Framing Climate Change for Effective Communication: A Systematic Map', Environmental Research Letters 15, no. 12 (2020): 123002, https://doi.org/10.1088/1748-9326/aba4c7.
132. Yaacov Trope and Nira Liberman, 'Construal-Level Theory of Psychological Distance.', Psychological Review 117, no. 2 (2010): 440–63, https://doi.org/10.1037/a0018963.
133. Todd Green and John Peloza, 'Finding the Right Shade of Green: The Effect of Advertising Appeal Type on Environmentally Friendly Consumption', Journal of Advertising 43, no. 2 (2014): 128–41, https://doi.org/10.1080/00913367.2013.834805.
134. Emma Shaozhen Florence et al., 'Message Framing Effects on Sustainable Consumer Behaviour: A Systematic Review and Future Research Directions for Social Marketing', Journal of Social Marketing 12, no. 4 (2022): 623–52, https://doi.org/10.1108/JSOCM-09-2021-0221.
135. Badullovich, Grant, and Colvin, 'Framing Climate Change for Effective Communication'.
136. James Patterson et al., 'The Political Effects of Emergency Frames in Sustainability', Nature Sustainability 4, no. 10 (2021): 841–50, https://doi.org/10.1038/s41893-021-00749-9.
137. Marjolaine Martel-Morin and Erick Lachapelle, 'Code Red for Humanity or Time for Broad Collective Action? Exploring the Role of Positive and Negative Messaging in (de)Motivating Climate Action', Frontiers in Communication 7 (2022): 968335, https://doi.org/10.3389/fcomm.2022.968335.

- Combining two or more frames is also a promising venue [138]. For example, Baek & Yoon [139] have shown an interactive effect between guilt and positive framing on the one hand and hope and negative messaging on the other.

- Emotions can be triggered by frames or influence how a frame is perceived. They are central as both moderators and mediators of the effect of frames. For example, both pride and guilt can stimulate prosocial behaviour [140, 141] ; a frame can trigger compassion, notably through an image – we have all seen a polar bear drifting on a piece of melting ice [142]; sadness has been shown to be more effective with a positive frame (rather than a negative one) [143] while hope can act as a motivator for behaviour change [144]. Emotions then must be considered when framing a message, notably for online communication given their central place in this space, as we will see below. But we should be weary of overusing them as they can cause fatigue [145] or numbness [146], states that are non-conducive to behavioural change.

- People's state-of-mind is also to be considered. For example, White & Simpson [147] found that the effectiveness of different types of appeal is dependent on the activation of either the individual or the collective self (me or we) and such activation can be stimulated in the frame itself.

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138. Florence et al., 'Message Framing Effects on Sustainable Consumer Behaviour'.
139. Tae Hyun Baek and Sukki Yoon, 'Guilt and Shame: Environmental Message Framing Effects', Journal of Advertising 46, no. 3 (2017): 440–53, https://doi.org/10.1080/00913367.2017.1321069.
140. Sebastian Bamberg and Guido Möser, 'Twenty Years after Hines, Hungerford, and Tomera: A New Meta-Analysis of Psycho-Social Determinants of pro-Environmental Behaviour', Journal of Environmental Psychology 27, no. 1 (2007): 14–25, https://doi.org/10.1016/j.jenvp.2006.12.002.
141. Megan J. Bissing-Olson, Kelly S. Fielding, and Aarti Iyer, 'Experiences of Pride, Not Guilt, Predict pro-Environmental Behavior When pro-Environmental Descriptive Norms Are More Positive', Journal of Environmental Psychology 45 (2016): 145–53, https://doi.org/10.1016/j.jenvp.2016.01.001.
142. Dorothea Born, 'Bearing Witness? Polar Bears as Icons for Climate Change Communication in National Geographic', Environmental Communication 13, no. 5 (2019): 649–63, https://doi.org/10.1080/17524032.2018.1435557.
143. Hang Lu, 'The Effects of Emotional Appeals and Gain Versus Loss Framing in Communicating Sea Star Wasting Disease', Science Communication 38, no. 2 (2016): 143–69, https://doi.org/10.1177/1075547015619173.
144. Amy E. Chadwick, 'Toward a Theory of Persuasive Hope: Effects of Cognitive Appraisals, Hope Appeals, and Hope in the Context of Climate Change', Health Communication 30, no. 6 (2015): 598–611, https://doi.org/10.1080/10410236.2014.916777.
145. Robert Gifford, 'Dragons, Mules, and Honeybees: Barriers, Carriers, and Unwitting Enablers of Climate Change Action', Bulletin of the Atomic Scientists 69, no. 4 (2013): 41–48, https://doi.org/10.1177/0096340213493258.
146. Robert Gifford, 'The Dragons of Inaction: Psychological Barriers That Limit Climate Change Mitigation and Adaptation.', American Psychologist 66, no. 4 (2011): 290–302, https://doi.org/10.1037/a0023566.

- Another approach to framing involves tailoring messages to align with individuals' current stage of change and emphasizing self-determined motivations and intrinsic goals. This strategy recognizes that the effectiveness of communication can vary depending on where individuals are in their behavioral change journey. By focusing on self-motivated and intrinsic values, messages can be crafted to resonate more deeply with individuals' personal goals and sense of purpose, potentially enhancing their impact on behavior change [148]. The challenge here, of course, is how to apply such an individually centered approach.

No wonder framing theory is so central to communication studies: despite the challenges inherent in the construction of frames, they have a powerful impact for conveying messages, affecting the way information is processed, and decisions are taken, keeping in mind that the frames we are using are countered with opposing frames. They are the story we tell ourselves over and over because we, humans, are storytellers [149].

6. Socio-semantic networks...

Humans are storytellers and social animals. We interact with one another both in person and through media. We build diverse relationships: short-lived or long-lasting, based upon friendship or hostility, family ties or professional relationships, deep, intense, or shallow. The study of relational networks, also called social network analysis, is an interdisciplinary field initially developed by social scientists but now of great interest to natural and health scientists [150]. In the social sciences, the theory of networks marked a paradigm shift where the relationships rather than individuals became the focus of attention [151, 152]. Given that the expression "social networks" has been abducted by digital social media, we will use "relational networks" in what follows to encompass both online and offline networks.

147. Katherine White and Bonnie Simpson, 'When Do (and Don't) Normative Appeals Influence Sustainable Consumer Behaviors?', Journal of Marketing 77, no. 2 (2013): 78–95, https://doi.org/10.1509/jm.11.0278.
148. J. Paige Pope, Luc Pelletier, and Camille Guertin, 'Starting Off on the Best Foot: A Review of Message Framing and Message Tailoring, and Recommendations for the Comprehensive Messaging Strategy for Sustained Behavior Change', Health Communication 33, no. 9 (2 September 2018): 1068–77, https://doi.org/10.1080/10410236.2017.1331305.
149. Fisher, Human Communication as Narration: Toward a Philosophy of Reason, Value, and Action.
150. Stephen P. Borgatti et al., 'Network Analysis in the Social Sciences', Science 323, no. 5916 (2009): 892–95.
151. Linton C. Freeman, The Development of Social Network Analysis (Vancouver: Empirical Press, 2004).
152. Johanne Saint-Charles and Pierre Mongeau, 'L'étude Des Réseaux Humains de Communication', in Communication : Horizons de Pratiques et de Recherches, ed. Johanne Saint-Charles and Pierre Mongeau, 1 (Sainte-Foy: Presse de l'Université du Québec, 2005), 73–99.

It has been repeatedly shown that the patterns formed by the intertwining of relationships orient people's actions, beliefs, and perceptions. For example, research has demonstrated the importance of a family's relational network for adaptive behaviours [153]. For example, Nagel [154] showed an association between a family's social connectivity and its potential to adapt through innovation. On the institutional level, connexions (or lack of) between institutions may favour or impede coordinated action [155, 156, 157]. For example, Carratini et al. (2023) showed that the augmentation of environmental treaties accelerated international collaboration and led to a denser and more cohesive network which in turn facilitates "more effective policy collaboration" [158]. Pramova and colleagues (2020) have shown that the tendency to connect with the "usual suspects" in either domain of adaptation or mitigation fail to foster connections between the two domains.

It makes sense to study together people's discourse (our stories) and relationships. This is what the field of socio-semantic networks concentrates upon: the coevolution of relationships and discourse [159, 160, 161]. Discourse here is understood in its simplest meaning: what is said or written by a person, a group, or an organisation (or in the name of an organisation) about their knowledge, beliefs, ideas, or opinions [162].

Socio-semantic networks are connected to the issue of diffusion. Innovation diffusion studies have since their inception considered the central role of relational networks in these processes [163]. Thanks, notably, to the integrative work carried out by the communication scholar and sociologist, Rogers [164], we have learned much about the characteristics of diffusion [165]. Nonetheless, there remain two main competing theoretical models seeking to

153. Michael Kriegl et al., 'How Important Are Social Networks in Times of Environmental Crises?', Easy_social_sciences, no. 66 (2021): 11–20, https://doi.org/10.15464/EASY.2021.002.
154. Ben Nagel, 'Social Network Analysis as a Tool for Studying Livelihood Adaptation to Climate Change', Human Ecology Review 26, no. 2 (2020): 147–70.
155. Stefano Carattini et al., 'What Does Network Analysis Teach Us about International Environmental Cooperation?', Ecological Economics 205 (2023): 107670, https://doi.org/10.1016/j.ecolecon.2022.107670.
156. Ruhollah Oji, Mehdi Hesam, and Victoria W. Keener, 'Using Social Network Analysis to Assess Climate Change Professionals' Communications in Iran', Weather, Climate, and Society 14, no. 1 (2022): 349–63, https://doi.org/10.1175/WCAS-D-21-0002.1.
157. Pramova E. et al., Usual and Unusual Suspects: What Network Analysis Can Tell Us about Climate Policy Integration (Center for International Forestry Research (CIFOR), 2020), https://doi.org/10.17528/cifor/007592.
158. Carattini et al., 'What Does Network Analysis Teach Us about International Environmental Cooperation?'
159. Peter R. Monge and Noshir Contractor, Theories of Communication Networks (Oxford University Press, 2003).
160. Camille Roth, 'Socio-Semantic Systems' (Habilitation à diriger des recherches, Sorbonne Université, 2021), https://hal.science/tel-03360647.
161. Johanne Saint-Charles and Pierre Mongeau, 'Social Influence and Discourse Similarity Networks in Workgroups', Social Networks 52 (2018): 228–37, https://doi.org/10.1016/j.socnet.2017.09.001.
162. Saint-Charles and Mongeau.
163. N. Gondal, 'Diffusion of Innovations through Social Networks: Determinants and Implications', Sociology Compass 17, no. 5 (2023), https://doi.org/10.1111/soc4.13084.
164. Everett M. Rogers, Diffusion of Innovations (New York: Free Press, 2003).
165. Gary L. Kreps, 'Diffusion Theory in Integrative Approaches', in Oxford Research Encyclopedia of Communication, by Gary L. Kreps (Oxford University Press, 2017), https://doi.org/10.1093/acrefore/9780190228613.013.251.

explain the similarity of discourse between those who are socially connected: homophily [166] and contagion [167, 168]. **HOMOPHILY IS THE TENDENCY TO RELATE TO OTHERS BASED ON SIMILARITIES WHILE THE LATTER REFERS TO THE TENDENCY TO ADOPT THE BEHAVIOURS, ATTITUDES, AND BELIEFS OF THOSE WITH WHOM ONE IS IN CONTACT**. Linking discourse and relationships, the homophily model postulates that similarities in discourse would lead to the development of social relationships as can be observed with online interactions in social media when people connect with those whose discourse seems relevant to them. For the contagion model, social relationships, through a process of influence, lead to the sharing of similar discourses between individuals. For example, the radicalization of a person's political or religious stance would be explained by the relationships he or she maintains. From a socio-semantic perspective neither model seems prevalent, rather discourse and relationships coevolve, and socio-semantic network analysis aim at modeling this mutual influence and ultimately at finding entry points to favour change.

Studies have shown how the intertwining of discourse and interactions or relationships is linked to the constitution of ***epistemic communities*** (groups of people exchanging around similar concepts or ideas) [169], echo chambers or the emergence of communities with radical discourses [170, 171, 172], including conspiracy and climate negationist groups as well as their counterparts. For example, in the context of the 2013 publication of the IPCC report, Holmberg & Hellsten [173] have explored the difference in discourse and in discursive strategies between tweeters that were either convinced or non-convinced by the scientific evidence of climate change science. Although essentially observational, their study is informative by way of explaining what types of framing may appeal to either group. **CONVINCED ACTORS TEND TO RELY ON SCIENTIFIC INFORMATION SHARING, WHILE THE EXPRESSION OF (NEGATIVE) EMOTIONS WAS IN THE REALM OF THE NON-CONVINCED**. As we will see in the next section, the role of emotions in social media influence is central. These findings might be an invitation for those convinced to express emotions along their sharing of scientific information. Hamilton et al. [174] showed that **WITH WHOM AND IN WHICH CONTEXT ONE DISCUSSES ENERGY CONSERVATION IS RELATED TO THEIR ENERGY PRACTICES**.

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166. Miller McPherson, Lynn Smith-Lovin, and James M. Cook, 'Birds of a Feather: Homophily in Social Networks', Annual Review of Sociology 27 (2001): 415–44, https://doi.org/10.1146/annurev.soc.27.1.415.
167. S. Aral, L. Muchnik, and A. Sundararajan, 'Distinguishing Influence-Based Contagion from Homophily-Driven Diffusion in Dynamic Networks', Proceedings of the National Academy of Sciences 106, no. 51 (2009): 21544–49, https://doi.org/10.1073/pnas.0908800106.
168. Monge and Contractor, Theories of Communication Networks.
169. Camille Roth and Jean-Philippe Cointet, 'Social and Semantic Coevolution in Knowledge Networks', Social Networks 32 (2010): 16–29, https://doi.org/10.1016/j.socnet.2009.04.005.
170. Kiran Garimella et al., 'Quantifying Controversy in Social Media' (arXiv, 2017), http://arxiv.org/abs/1507.05224.
171. Guri Nordtorp Mølmen and Jacob Aasland Ravndal, 'Mechanisms of Online Radicalisation: How the Internet Affects the Radicalisation of Extreme-Right Lone Actor Terrorists', Behavioral Sciences of Terrorism and Political Aggression, 2021, 1–25, https://doi.org/10.1080/19434472.2021.1993302.
172. Roth and Cointet, 'Social and Semantic Coevolution in Knowledge Networks'.
173. Kim Holmberg and Iina Hellsten, 'Integrating and Differentiating Meanings in Tweeting about the Fifth Intergovernmental Panel on Climate Change (IPCC) Report', First Monday, 2016, https://doi.org/10.5210/fm.v21i9.6603.
174. Jo Hamilton et al., 'Conversations about Conservation? Using Social Network Analysis to Understand Energy Practices', Energy Research & Social Science 49 (2019): 180–91, https://doi.org/10.1016/j.erss.2018.10.030.

Notably, they showed that people refrain from such talk when they fear being tagged "environmentalists". In his study on the climate-change countermovement in the U.S., Farrell [175] showed that the discourse of organizations receiving funds from corporate benefactors tied to oil industry reflects itself in news media and presidential discourses showing that the influence of the oil industry actors is active not so much through their own discourse but through the discourse of those they are funding.

If the coevolution of discourse and social relationships has been largely demonstrated, our knowledge of the underlying mechanisms is still uncertain, such as the path between patterns at the macro level and processes at the microlevel (is the dominance of the fossil fuel economy discourse maintained through individual exchanges or the opposite?) or the duration of the effect of external events (crisis) on both the discourse and the structure of the relationship network [176]. The mutualistic networks model in ecology proposed by Valdovinos [177] seems to offer a promising venue for the reduction of these uncertainties and therefore for the identification of courses of action to favour the uptake of ecological transition actions [178, 179, 180, 181]. In a nutshell, a ***MUTUALISTIC NETWORK* IS THE STRUCTURATION OF MUTUALLY BENEFICIAL LINKS BETWEEN TWO SPECIES** (such as bees and flowers). Valdovinos (2019) and others have identified the structural characteristics of such networks. Applied to human relationships, the two species are humans and the discourse they share. With this point of view, discourses benefit from their adoption by humans as much as humans benefit from the adoption of discourses.

175. Justin Farrell, 'Network Structure and Influence of the Climate Change Counter-Movement', Nature Climate Change 6, no. 4 (2016): 370–74, https://doi.org/10.1038/nclimate2875.
176. Roth, 'Socio-Semantic Systems'.
177. Fernanda S. Valdovinos, 'Mutualistic Networks: Moving Closer to a Predictive Theory', ed. Helmut Hillebrand, Ecology Letters 22, no. 9 (2019): 1517–34, https://doi.org/10.1111/ele.13279.
178. Javier Borge-Holthoefer et al., 'Emergence of Consensus as a Modular-to-Nested Transition in Communication Dynamics', Scientific Reports 7, no. 1 (2017): 41673, https://doi.org/10.1038/srep41673.
179. M. J. Palazzi et al., 'Macro- and Mesoscale Pattern Interdependencies in Complex Networks', Journal of The Royal Society Interface 16, no. 159 (2019): 20190553, https://doi.org/10.1098/rsif.2019.0553.
180. Albert Solé-Ribalta et al., 'Revealing In-Block Nestedness: Detection and Benchmarking', Physical Review E 97, no. 6 (2018): 062302, https://doi.org/10.1103/PhysRevE.97.062302.
181. Jonathan St-Onge et al., 'Socio-Semantic Networks as Mutualistic Networks', Scientific Reports 12, no. 1 (2022): 1889, https://doi.org/10.1038/s41598-022-05743-5.

7. Communication and social media

The rise of online communication, driven by social media, certainly contributed to the inefficacy of communication practices based upon the deficit model [182]. Numerous studies examining the relationship between climate change communication and social media support this claim [183, 184, v185, 186, 187]. Initially, the Internet served as a network for researchers. However, its widespread accessibility and the introduction of social media platforms led to individuals relying less and less on established authority figures – such as researchers – for information on a given topic [188]. With the advent of online platforms, acquiring "authority" has evolved. Rather than reflecting legitimacy obtained offline through traditional channels (academic degrees for instance), it has become based on a new set of actions, enabled by the platforms, such as likes and shares. Algorithms convert these uses into scores, producing indicators of reputation and popularity that are progressively becoming symbols of credibility and trust [189, 190]. Again, based on these uses, patterns and the "reputational" authority of the information producers, algorithms will generate personalized recommendations for news, debates, opinions, and controversies for each user. Platform users' autonomy is constrained by the uses permitted by the platform designers. Indeed, peoples' competence with social media may vary greatly, but it remains limited to the use of standardized functionalities (for writing, sharing documents, reacting, etc.), and relatedness is exacerbated because the information content consumed is produced by our own contacts. This relatedness phenomenon reinforces confrontation when platform algorithms present information conflicting with individuals' values, beliefs or knowledge. For instance, encountering controversies online about global warming one does not fully understand or that provoke a strong emotional reaction can discourage the constructive discussions essential for informed opinion-building and democratic debate.

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182. Brianne Suldovsky, 'The Information Deficit Model and Climate Change Communication', in Oxford Research Encyclopedia of Climate Science, 2017, https://oxfordre.com/climatescience/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-301.
183. Mike S. Schäfer, 'Online Communication on Climate Change and Climate Politics: A Literature Review', WIREs Climate Change 3, no. 6 (2012): 527–43, https://doi.org/10.1002/wcc.191.
184. Nelya Koteyko, Brigitte Nerlich, and Iina Hellsten, 'Climate Change Communication and the Internet: Challenges and Opportunities for Research', Environmental Communication 9, no. 2 (2015): 149–52, https://doi.org/10.1080/17524032.2015.1029297.
185. Adam R. Pearson et al., 'Race, Class, Gender and Climate Change Communication', in Oxford Research Encyclopedia of Climate Science, by Adam R. Pearson et al. (Oxford University Press, 2017), https://doi.org/10.1093/acrefore/9780190228620.013.412.
186. vEdson C. Tandoc Jr and Nicholas Eng, 'Climate Change Communication on Facebook, Twitter, Sina Weibo, and Other Social Media Platforms', in Oxford Research Encyclopedia of Climate Science, 2017, https://oxfordre.com/climatescience/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-361.
187. Bienvenido León et al., 'Strategies for Climate Change Communication through Social Media: Objectives, Approach, and Interaction', Media International Australia 188, no. 1 (2023): 112–27, https://doi.org/10.1177/1329878X211038004.
188. R. David Lankes, 'Credibility on the Internet: Shifting from Authority to Reliability', Journal of Documentation 64, no. 5 (2008): 667–86.
189. Michael Luca, 'Designing Online Marketplaces: Trust and Reputation Mechanisms', Innovation Policy and the Economy 17 (2017): 77–93, https://doi.org/10.1086/688845.
190. Camille Alloing, La E-Réputation. Médiation, Calcul, Émotion: Médiation, Calcul, Émotion (Cnrs, 2016).

Communication is concerned with the technical and symbolic aspects of interactions, and the media content that contributes to the construction of meaning. Digital spaces serve as a prime illustration of how semiotic and technical choices influence our decisions, opinions, and our depictions of the world and of others [191]. When disseminating information online, especially on «social media» platforms, it is crucial to examine how their «affordances simultaneously allow and constrain expression, as well as how technical, social, and economic concerns determine platforms' structure, function, and use» [192]. According to Gibson [193], an **AFFORDANCE IS THAT WHICH GUIDES ACTION WITHIN AN ENVIRONMENT, i.e., THAT WHICH IS IMMEDIATELY ACCESSIBLE TO THE PERCEIVER**. For the user, it is necessary to ask how the value and meaning of «things» in an environment can be directly perceived, and how this perception can be linked to a range of possible actions in that environment. As a result, according to Norman [194], the same object may offer different perceptions of its use and different ranges of actions. For example, **WHEN WE SEE A HEART-SHAPED ICON ON A PLATFORM, WE KNOW IT IS POSSIBLE TO CLICK ON IT. HOWEVER, THE SIGNIFICANCE ATTRIBUTED TO THIS SIGN VARIES FROM ONE INDIVIDUAL TO ANOTHER**. Therefore, the relationship between the object and the actor is not fixed but depends on the perceived usefulness of the object [195]: **"AFFORDANCES ARE NOT ONLY RELATED TO THE DESIGN FEATURES OF DEVICES BUT ALSO TO THE PSYCHOLOGICAL AND SOCIAL CHARACTERISTICS OF HUMAN–TECHNOLOGY INTERACTION"**. For example, during controversy in the context of the ecological transition, the communication that occurs online depends on what the public, or active users, perceives as relevant to say or do at that moment in the situation, and on what the platforms make available to them.

The word "platformization" expresses the process by which models (economic, technical, etc.) become dominant through the orientation of actors' strategies when they use social media as mediatization tools [196]. Actors feel tensions when platformization imposes itself and reorganizes their practices. Many industries and institutions must use specific platforms to reach their captive audiences [197, 198, 199].

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191. José Van Dijck and Donya Alinejad, 'Social Media and Trust in Scientific Expertise: Debating the Covid-19 Pandemic in The Netherlands', Social Media + Society 6, no. 4 (2020): 205630512098105, https://doi.org/10.1177/2056305120981057.
192. Jean-Christophe Plantin et al., 'Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook', New Media & Society 20, no. 1 (2018): 298, https://doi.org/10.1177/1461444816661553.
193. James J. Gibson, 'The Theory of Affordances', Hilldale, USA 1, no. 2 (1977): 67–82.
194. Don Norman, 'Emotion & Design: Attractive Things Work Better', Interactions 9, no. 4 (2002): 36–42, https://doi.org/10.1145/543434.543435.
195. Peter Nagy and Gina Neff, 'Imagined Affordance: Reconstructing a Keyword for Communication Theory', Social Media + Society 1, no. 2 (2015): 205630511560338, https://doi.org/10.1177/2056305115603385.
196. Anne Helmond, 'The Platformization of the Web: Making Web Data Platform Ready', Social Media+ Society 1, no. 2 (2015): 2056305115603080.
197. David B. Nieborg and Thomas Poell, 'The Platformization of Cultural Production: Theorizing the Contingent Cultural Commodity', New Media & Society 20, no. 11 (2018): 4275–92.
198. Pauline Amiel and Alexandre Joux, 'Négocier son rapport aux plateformes: Les représentations des managers de presse locale', Sur le journalisme, About journalism, Sobre jornalismo 9, no. 1 (15 June 2020): 74–87, https://doi.org/10.25200/SLJ.v9.n1.2020.419.
199. Alloing, La E-Réputation. Médiation, Calcul, Émotion.

Consequently, these industries develop a dependency relationship with the platforms, which have become their primary tools for communication and performance evaluation. This reliance results in standardization [200, 201]. It is essential to conform to the rules and standards of a particular platform to ensure that the message is delivered to the intended audience. For instance, on Facebook's business site, there are explicit instructions about what to do and what not to do when creating content. The platform recommends evaluating the significance of communicated information using its statistics and adhering to algorithmic criteria. Specific techniques may be used to attract user attention while discussing sensitive subjects is discouraged. Non-compliance with these guidelines may lead to algorithmic penalties, resulting in diminished visibility for the publication. In the end, these techniques may replace expertise with visibility [202]. The standardization of communication can have detrimental effects in the context of behavioural changes for an ecological transition. Non-experts who voice their opinions on scientific issues online can drown out expert voices. This, in turn, can foster mistrust in institutions when lay speech contradicts their official position, potentially leading to misinformation [203]. In response, it may seem relevant to comply with the codes and standards of the platforms and their users to gain visibility [204]. But simplification may result from this compliance and lead to more controversy and misinformation.

Institutional and scientific discourses in themselves do not guarantee trustworthiness. Despite our efforts to identify rational reasons for trust, it remains elusive [205], as we have seen, in part because trust is a subjective, non rational issue. While digital platforms offer certification methods to differentiate trustworthy entities (badges, access to additional features, etc.), they also allow each user to establish their own attributes by staging their digital presence and the statistical indicators associated with it. The experts are thus the ones who, for a given audience, can make themselves visible with content that will resonate in the online communities they address.

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200. Sara Germain and Camille Alloing, 'Engager, Cliquer, Liker. L'éditorialisation Des Contenus Journalistiques Sur Les Plateformes Numériques', Quaderni, 2022, 19–38.
201. Camille Alloing, Samuel Cossette, and Sara Germain, 'Faire Face Aux Plateformes. La Communication Numérique Entre Tactiques et Dépendances', Questions de Communication, no. 40 (2021), https://journals.openedition.org/questionsdecommunication/26730.
202. Camille Alloing and Nicolas Moinet, 'Des Réseaux d'experts à l'expertise 2.0: Le Web 2.0 Modifie-t-Il La Création et La Mise En Place de Réseaux d'experts ?', Les Cahiers Du Numérique 6, no. 1 (2010): 35–53.
203. Van Dijck and Alinejad, 'Social Media and Trust in Scientific Expertise'.
204. Frank Marcinkowski et al., 'Organizational Influence on Scientists' Efforts to Go Public: An Empirical Investigation', Science Communication 36, no. 1 (2014): 56–80, https://doi.org/10.1177/1075547013494022.
205. Gloria Origgi, 'Qu'est-Ce Que La Confiance?', 2008, https://philpapers.org/rec/ORIQQL.

Online, platforms use algorithmic mechanisms to personalize recommended information for these communities. According to Rieder [206], this personalization is a result of «different levels of labor and products rather than a perverse effect, an unintended consequence». Communicating with diverse communities requires defining information content that fulfills their specific expectations and adheres to the standards of the platforms and their algorithms. However, sharing standardized information with diverse groups having their own practices and ideologies can cause tension and result in polarization (and confrontation). Such systematic confrontation of two radically opposed points of view in the same media space is particularly visible for issues that are part of public debates or activist discourses [207, 208, 209]. The question of the climate crisis is a good example of this. Within the same space, content can circulate ranging from denying the existence of any crisis to discussing actions to regulate it. This circulation depends both on platform algorithms and on the actions of each group of users who want to defend their point of view, as well as on the strategies of certain industries to defend their own interests.

Current research in communication on polarization in digital spaces focuses on [210]:

1) media content, which we have highlighted as being constantly standardized;

2) exposure to this content, which is dependent on online platforms' recommendation strategies; and iii) the impact of digital media on opinion and behaviour. Thus, both the algorithmic and the platformization of communication must be taken into consideration to fully understand the effects of online platforms on the socio-ecological transition. As an institution, should we engage directly with polarized audiences to change behaviours? Empathy is key and it is inherent to dialogical approaches.

206. Bernhard Rieder, 'The Refraction Chamber: Twitter as Sphere and Network', First Monday, 2012, http://firstmonday.org/ojs/index.php/fm/article/view/4199.

207. Jean Burgess and Ariadna Matamoros-Fernández, 'Mapping Sociocultural Controversies across Digital Media Platforms: One Week of #gamergate on Twitter, YouTube, and Tumblr', Communication Research and Practice 2, no. 1 (2016): 79–96, https://doi.org/10.1080/22041451.2016.1155338.

208. Jean Burgess, Joshua Green, and Gala Rebane, 'Agency and Controversy in the YouTube Community', in Handbuch Soziale Praktiken und Digitale Alltagswelten, ed. Heidrun Friese et al. (Wiesbaden: Springer Fachmedien Wiesbaden, 2020), 105–16, https://doi.org/10.1007/978-3-658-08357-1_10.

209. Ariadna Matamoros-Fernández, 'Platformed Racism: The Mediation and Circulation of an Australian Race-Based Controversy on Twitter, Facebook and YouTube', Information, Communication & Society 20, no. 6 (2017): 930–46, https://doi.org/10.1080/1369118X.2017.1293130.

210. Emily Kubin and Christian Von Sikorski, 'The Role of (Social) Media in Political Polarization: A Systematic Review', Annals of the International Communication Association 45, no. 3 (2021): 188–206, https://doi.org/10.1080/23808985.2021.1976070.

Social media is more about creating affects than it is about creating effects [211]. Some authors [212] call this the «affective web;» it is built on the premise that what moves us attracts our attention and leads us to action, in other words, to click. Digital industries are developing technologies to analyze emotions in text published on their platforms and to recognize emotions in photos. They provide functions to indicate whether we like a piece of content and encourage its circulation. The resulting **POLARIZATION IS NOT ONLY IDEOLOGICAL BUT ALSO EMOTIONAL [213]. AS A RESULT, THIS CAN BE BOTH A FACTOR OF CHANGE AND OF INACTION. ON THE ONE HAND, IT BECOMES POSSIBLE TO MEDIATE DISCOURSES APPEALING TO AFFECTIVE TRIGGERS (PROTECTING A CERTAIN SPECIES OF ANIMALS, ASSISTING A COMMUNITY SUFFERING FROM THE CONSEQUENCES OF THE CLIMATE CRISIS, ETC.). HOWEVER, THERE IS A RISK THAT IF THE GENERATED EMOTION IS TOO STRONG AND LEAD TO CONTROVERSY OR STERILE DEBATES. ON THE OTHER HAND, ANY DISCOURSE THAT IS TOO DETAILED AND EXPERT-BASED WILL NOT BE GIVEN VISIBILITY**.

How then can we develop a mutual understanding of the ecological transition and persuade even the most resistant audiences through online communication? In 1955, Katz and Lazarsfeld [214] developed the «two-step flow theory»: the direct influence of the media is weak; to inform an opinion, messages must be relayed by opinion leaders. On social media, these opinion leaders have mutated into influencers or micro-celebrities [215]. They possess the expertise and communication skills necessary to produce high-impact content, based on their knowledge of the standards and practices of digital platforms. Their proximity to their audience stimulates the emotional arousal necessary to incite interaction, discussion, and participation. Additionally, their online reputation aids in establishing authority. The expression «reputational authority» [216], encompasses trust, visibility, and credibility and is constructed at a semiotic level through platform-specific scorecards and measurement indicators (such as followers, views, clicks, etc.) associated with each profile. Environmental communication must constantly adapt to changes in digital platforms, increased content production, and audience expectations. The question arises: can we rely on relays of influence as the basis for environmental communication [217] ?

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211. Adam Arvidsson, 'General Sentiment: How Value and Affect Converge in the Information Economy', The Sociological Review 59, no. 2_suppl (2011): 39–59, https://doi.org/10.1111/j.1467-954X.2012.02052.x.
212. Camille Alloing and Julien Pierre, Le Web Affectif: Une Économie Numérique Des Émotions (INA éditions, 2017).
213. Maria Nordbrandt, 'Affective Polarization in the Digital Age: Testing the Direction of the Relationship between Social Media and Users' Feelings for out-Group Parties', New Media & Society 25, no. 12 (2023): 3392–3411, https://doi.org/10.1177/14614448211044393.
214. Elihu Katz and Paul F. Lazarsfeld, Personal Influence: The Part Played by People in the Flow of Mass Communications (Free Press, 1955).
215. Elmira Djafarova and Oxana Trofimenko, '"Instafamous" – Credibility and Self-Presentation of Micro-Celebrities on Social Media', Information, Communication & Society 22, no. 10 (2019): 1432–46, https://doi.org/10.1080/1369118X.2018.1438491.
216. Camille Alloing, 'La Réputation Pour Questionner l'autorité Informationnelle: Vers Une» Autorité Réputationnelle»?', Quaderni. Communication, Technologies, Pouvoir, no. 93 (2017): 33–41.
217. Mauro Galetti and Raul Costa-Pereira, 'Scientists Need Social Media Influencers', Science 357, no. 6354 (2017): 880–81, https://doi.org/10.1126/science.aao1990..

8. Communication to support motivation to individual and collective action

To achieve the desired socio-ecological transition, it is crucial to implement extensive changes in public policies, institutions and in our economic systems. Equally important are changes at the individual level, as we hope everyone will participate in this transition. Understanding what encourages or discourages voluntary participation is essential. While having adequate knowledge and information about an issue is crucial for satisfying our need for understanding, raising awareness and making informed decisions, it alone is insufficient to drive action and effect behavioral and social change [218, 219]. Even those who are well-informed and concerned about environmental issues may not engage in pro-environmental behaviors. **RESEARCH INDICATES THAT, BEYOND KNOWING AND CARING, INDIVIDUALS NEED TO BE MOTIVATED TO ACT—THAT IS, THEY MUST FEEL WILLING AND CAPABLE OF ACTING AND PERCEIVE THEIR EFFORTS AS MEANINGFUL AND IMPACTFUL** [220].

The present section focuses on the role of communication in supporting motivation towards individual and societal changes. It starts from the premise that **INSTIGATING LASTING TRANSFORMATIONS IN LIFESTYLES, SOCIAL PRACTICES, AND POLICIES, REQUIRES AN IN-DEPTH UNDERSTANDING OF MOTIVATIONAL MECHANISMS AND THE FACTORS THAT DRIVE OR IMPEDE THEM**. Regrettably, research and messaging strategies often overlook these essential motivational principles. Considering the challenges posed by climate change and the critical need for transition, we suggest that communication research and practice would benefit from theoretical approaches drawn from motivational research, to integrate these principles into their strategies of change. Hence, the aim of this section is to present some of the lesser-known theoretical frameworks in the field of communication, which we consider to be interesting alternative avenues of research for climate communication and transition. Incorporating the proposed theoretical frameworks into communication strategies could strengthen environmental motivation and facilitate positive behavior change at the individual and collective levels.

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218. Susan Owens, '"Engaging the Public": Information and Deliberation in Environmental Policy', Environment and Planning A: Economy and Space 32, no. 7 (2000): 1141–48, https://doi.org/10.1068/a3330.
219. Sebastian Bamberg, 'How Does Environmental Concern Influence Specific Environmentally Related Behaviors? A New Answer to an Old Question', Journal of Environmental Psychology 23, no. 1 (2003): 21–32, https://doi.org/10.1016/S0272-4944(02)00078-6.
220. Lucie Sauvé, 'Au Coeur Des Questions Socio-Écologiques : Des Savoirs à Construire, Des Compétences à Développer', Éducation Relative à l'environnement 11, no. Volume 11 (2014): 19–40, https://doi.org/10.4000/ere.662.

9. Why are we (not) motivated to change? An explanation from Self-determination theory

The Self-determination theory (SDT) was developed by Edward Deci and Richard Ryan [221, 222, 223]. As a macrotheory, SDT is concerned with self-regulation and the pursuit of goals and aspirations, energy and vitality, optimal functioning, and the effects of social and contextual conditions on motivation, emotions, behavior (change), and well-being [224]. This theoretical framework is particularly relevant in the context of the socio-ecological transition, as it addresses the shortcomings and failures of older behavioral communication models of change. For example, communication and intervention strategies relying on external incentives or the promise of rewards and punishments to encourage or discourage specific behaviors have demonstrated limited success in achieving lasting behavior change [225, 226]. Conversely, research has consistently shown that self-determined motivation is positively associated with the adoption of a wide range of pro-environmental behaviors [227, 228, 229], even when these behaviors are more difficult or challenging [230, 231]. Self-determined motivation has also been associated with active participation in mainstream activism [232], and sustained behavior change over time [233].

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221. E. L. Deci and R. M. Ryan, Intrinsic Motivation and Selfldeterminution in Human Behavior. (New York, NY: Plenum, 1985).
222. Edward L. Deci and Richard M. Ryan, 'The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior', Psychological Inquiry 11, no. 4 (2000): 227–68, https://doi.org/10.1207/S15327965PLI1104_01.
223. Edward L. Deci and Richard M. Ryan, 'Self-Determination Theory: A Macrotheory of Human Motivation, Development, and Health', Canadian Psychology 49, no. 3 (2008): 182–85.
224. Edward L. Deci and Richard M. Ryan, 'Facilitating Optimal Motivation and Psychological Well-Being across Life's Domains.', Canadian Psychology / Psychologie Canadienne 49, no. 1 (2008): 14–23, https://doi.org/10.1037/0708-5591.49.1.14.
225. J.W. Bolderdijk and L. Steg, 'Promoting Sustainable Consumption: The Risks of Using Financial Incentives', in Handbook of Research on Sustainable Consumption, ed. Lucia A. Reisch and John Thøgersen (Cheltenham, UK: Edward Elgar Publishing, 2015), 328–42.
226. Luc G. Pelletier, 'A Motivational Analysis of Self-Determination for pro-Enviromental Behaviors', in Handbook of Self-Determination Research., ed. Edward L. Deci and Richard M. Ryan, Handbook of Self-Determination Research. (Rochester, NY, US: University of Rochester Press, 2002), 205–32.
227. Pelletier.
228. Luc G. Pelletier et al., 'Why Are You Doing Things for the Environment? The Motivation Toward the Environment Scale (MTES) 1', Journal of Applied Social Psychology 28, no. 5 (1998): 437–68, https://doi.org/10.1111/j.1559-1816.1998.tb01714.x.
229. Chantal Séguin, Luc G. Pelletier, and John Hunsley, 'Toward a Model of Environmental Activism', Environment and Behavior 30, no. 5 (1998): 628–52, https://doi.org/10.1177/001391659803000503.
230. Nicole Michelle Aitken, Luc G. Pelletier, and Daniel Edgar Baxter, 'Doing the Difficult Stuff: Influence of Self-Determined Motivation Toward the Environment on Transportation Proenvironmental Behavior', Ecopsychology 8, no. 2 (2016): 153–62, https://doi.org/10.1089/eco.2015.0079.
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232. Kennon M. Sheldon et al., 'Understanding the Motivation of Environmental Activists: A Comparison of Self-Determination Theory and Functional Motives Theory', Ecopsychology 8, no. 4 (2016): 228–38, https://doi.org/10.1089/eco.2016.0017.
233. Luc G. Pelletier and Elizabeth Sharp, 'Persuasive Communication and Proenvironmental Behaviours: How Message Tailoring and Message Framing Can Improve the Integration of Behaviours through Self-Determined Motivation.', Canadian Psychology / Psychologie Canadienne 49, no. 3 (2008): 210–17, https://doi.org/10.1037/a0012755.

One of the distinctive features of SDT is that **IT FOCUSES NOT ONLY ON THE AMOUNT OR INTENSITY OF MOTIVATION, BUT ALSO, AND ABOVE ALL, ON ITS QUALITY, DISTINGUISHING BETWEEN DIFFERENT TYPES OF MOTIVATION AND CONCEPTUALIZING THEM ON A "CONTINUUM OF SELF-DETERMINATION"**. This continuum describes a spectrum of motivation that ranges from low levels of self-determination (external motivation) to high levels of self-determination (intrinsic motivation), reflecting the different reasons individuals engage in specific behaviors. This continuum helps explain the nature of motivation and how it influences behavior. It is generally composed of six distinct forms of motivation, which are in turn classified into two main types: controlled motivation and self-determined motivation.

MOTIVATION IS CATEGORIZED AS CONTROLLED WHEN ACTIONS ARE PROMPTED BY EXTERNAL PRESSURES SUCH AS OBLIGATIONS, REWARDS, OR PUNISHMENTS, OR BY INTERNAL PRESSURES LIKE GUILT OR THE DESIRE FOR SOCIAL APPROVAL OR RECOGNITION. For example, one might opt for public transportation to go to work primarily to benefit from a discount or to avoid criticism from their peers, reflecting controlled motivation. Conversely, motivation is considered self-determined when actions align with our values, resonates with our self-identity, or are pursued for personal satisfaction or fulfillment. For instance, an individual might consistently choose to reduce their carbon footprint and participate in collective environmental initiative because protecting the environment has become a fundamental part of who they are and what they value, reflecting autonomous motivation. Several studies have shown that self-determined motivation is associated more with greater satisfaction, persistence, and ***well-being*** in pursuing and maintaining behaviors [234] that external ones.

While the continuum of self-determination emphasizes the individual's personal characteristics, choices, and internal drives that influence their motivation, it is important to recognize that this continuum is not static. Individuals can shift along this continuum depending on contextual factors and social influences. For instance, some **INDIVIDUALS MAY ENGAGE IN BEHAVIORS DRIVEN BY INTRINSIC INTEREST OR PERSONAL VALUES, WHILE OTHERS MIGHT BE INFLUENCED BY EXTERNAL FACTORS SUCH AS SOCIAL NORMS, INFRASTRUCTURE AVAILABLE, PUBLIC POLICIES OR THE WAY THE ISSUE IS FRAMED AND DISCUSSED**. These external factors can either support or constrain individuals' ability to move upward on the continuum and act autonomously. In other words, while individuals actively shape their motivation through internal desires and values, these **INTERNAL MOTIVATIONS ARE NOT ISOLATED FROM EXTERNAL INFLUENCES.**

234. Deci and Ryan, 'Self-Determination Theory: A Macrotheory of Human Motivation, Development, and Health'.

According to SDT these factors can either enhance or undermine the progression toward self-determination by influencing the satisfaction of fundamental psychological needs. A context or communication that supports these needs facilitates the development of self-determined motivation, whereas a controlled motivation stems from unsatisfied needs. These common psychological needs are the need for autonomy, competence, and relatedness [235]. Autonomy refers to the need for individuals to have a sense of control and choice over their actions and decisions. ***Competence*** relates to the need to feel effective and capable in one's actions and pursuits. People are motivated when they perceive that they are making progress, improving their skills, and achieving their goals. Other concepts such as self-efficacy [236, 237, 238] and perception of control [239] are closely linked with this idea. On the other hand, amotivation (absence of motivation to adopt eco-friendly behaviors) can be rooted in helplessness beliefs [240]. Relatedness involves the need for social connections and relationships with others. Human beings are inherently social creatures, and meaningful connections with others contribute to their well-being and the motivation to pursue their goals [241, 242, 243, 244].

235. Deci and Ryan, 'The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior'.
236. A. Bandura, Social Learning Theory (Englewood Cliffs, New Jersey: Prentice-Hall, 1977).
237. Albert Bandura, Social Foundations of Thought and Action: A Social Cognitive Theory., Social Foundations of Thought and Action: A Social Cognitive Theory. (Englewood Cliffs, NJ, US: Prentice-Hall, Inc, 1986).
238. Albert Bandura, Self-Efficacy: The Exercise of Control., Self-Efficacy: The Exercise of Control. (New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co, 1997).
239. Icek Ajzen, 'The Theory of Planned Behavior', Organizational Behavior and Human Decision Processes 50, no. 2 (1991): 179–211, https://doi.org/10.1016/0749-5978(91)90020-T.
240. Luc G. Pelletier et al., 'Why Do People Fail to Adopt Environmental Protective Behaviors? Toward a Taxonomy of Environmental Amotivation 1', Journal of Applied Social Psychology 29, no. 12 (1999): 2481–2504, https://doi.org/10.1111/j.1559-1816.1999.tb00122.x.
241. Kelly-Ann Allen, The Psychology of Belonging, 1st ed. (Routledge, 2020), https://doi.org/10.4324/9780429327681.
242. Kelly-Ann Allen et al., 'Belonging: A Review of Conceptual Issues, an Integrative Framework, and Directions for Future Research', Australian Journal of Psychology 73, no. 1 (2021): 87–102, https://doi.org/10.1080/00049530.2021.1883409.
243. Roy F. Baumeister and Mark R. Leary, 'The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation.', Psychological Bulletin 117, no. 3 (1995): 497–529, https://doi.org/10.1037/0033-2909.117.3.497.
244. Leary, Mark R. and K.M. Kelly, 'Belonging Motivation', in Handbook of Individual Differences in Social Behavior., ed. Mark R. Leary and Rick H. Hoyle, Handbook of Individual Differences in Social Behavior. (New York, NY, US: The Guilford Press, 2009), xv, 624.

10. Communication that promotes self-determination

Given the positive impact of self-determination on well-being and behavioral change, **EFFECTIVE COMMUNICATION HELPS INDIVIDUALS PROGRESS TOWARD MORE SELF-DETERMINED FORMS OF MOTIVATION**[245]. Doing so involves creating a context and a social environment that supports the fulfillment of basic psychological needs for autonomy, competence, and relatedness. From an analytical point of view, SDT can help us understand why and under what conditions social exchanges and communication will facilitate the adoption of new behaviors (private or collective) in favor of the fight against climate change and for a just and green transition.

Within this framework, **AT AN INDIVIDUAL LEVEL, COMMUNICATION FOSTERING AUTONOMY INVOLVES CREATING AN ENVIRONMENT CONDUCIVE TO INDIVIDUAL DECISION-MAKING AND GOAL SETTING. THIS INCLUDES OFFERING CHOICES AND ENGAGING INDIVIDUALS IN DECISION-MAKING PROCESSES. ADDITIONALLY, PROVIDING GUIDANCE AND SUPPORT, RATHER THAN ENFORCING STRICT CONTROL AND UNILATERAL DECISIONS, IS ALSO ESSENTIAL TO FOSTER AUTONOMY. MOREOVER, ACKNOWLEDGING AND VALIDATING THE FEELINGS AND PERSPECTIVES OF THE INDIVIDUALS, WHILE CONNECTING ACTIONS TO PERSONAL VALUES, CAN SUBSTANTIALLY ENHANCE SELF-DETERMINATION BY GIVING MEANING AND PURPOSE TO THEIR ACTIONS**.

When people perceive that their social environment supports their autonomy by respecting their opinion and encouraging their input, they tend to develop or maintain self-determined motivation. Expanding this principle into the public sphere requires decision-makers to understand community needs by engaging with them as is recommended by dialogical perspectives as we have seen earlier. Valuing community perspectives and offering open communication channels and space for inclusive discussions can contribute to empowering communities to actively engage. People who perceive the government as one that encourages and respects their input and initiatives concerning environmental issues tend to be more self-determined and perform environmental behaviors more frequently. On the other side of the spectrum, a controlling governmental approach is related to amotivation and less environmentally friendly behaviors[246].

245. Pelletier and Sharp, 'Persuasive Communication and Proenvironmental Behaviours'.

246. I. Green-Demers et al., 'Perception of Government Environmental Strategies by the Citizens: The Government Style Questionnaire (GSQ)' (Ottawa: University of Ottawa Institute for Research on Environment and Economy., 1994).

SOCIAL ENVIRONMENTS THAT ENHANCE INDIVIDUALS' COMPETENCE ARE THOSE THAT PROMOTE SKILL DEVELOPMENT AND PROVIDE OPPORTUNITIES FOR LEARNING AND GROWTH. OFFERING TIMELY AND CONSTRUCTIVE FEEDBACK THAT HELPS INDIVIDUALS UNDERSTAND THEIR PROGRESS AND AREAS FOR IMPROVEMENT IS ALSO A CORE COMMUNICATIVE STRATEGY TO SATISFY THE NEED FOR COMPETENCE[247]. Communication can also cultivate relatedness by fostering a supportive and encouraging social environment. This involves offering opportunities that enable individuals to feel connected to like-minded people, listened to, and valued. This approach extends to community and public discussions, providing platforms and spaces for individuals to voice concerns, ask questions and exchange ideas regarding climate action and adaptation strategies. Collaborative and deliberative approaches are also essential as they offer opportunities for collective initiatives, teamwork, and shared experiences. Promoting a positive and inclusive environment is key, as individuals tend to be more self-determined when they feel valued and accepted. One can easily see the implications for fostering change within specific institutions, such as local authorities and firms. This kind of approach also enhances collective efficacy beliefs, i.e. "a group's shared belief in its conjoint capability to organize and execute the courses of action required to produce given levels of attainment"[248], and therefore helps maintain motivation over time.

Integrating these communication principles into ecological transition efforts can help organizations, scientists and decision-makers foster community engagement that respects residents' needs, encourages self-determined motivation, and promotes public support and active involvement in local initiatives. This approach not only increases the chances of success for transition projects, but also builds trust in local authorities and strengthens relationships between them and the community. This is also in line with dialogue models of communication, which strive for deliberative and inclusive forms of public engagement. Of course, achieving this goal remains a complex undertaking, requiring a change in the political culture of engagement and a rethinking of the role of citizens in implementing the socio-ecological transition. As Owens put it : "genuine engagement of, and with, the public remains a profound challenge, not least because it requires that people have the capacity to act as informed citizens at a time when the crucial interrelated components of this process – knowledge, capacity, and citizenship – are all subject to critical interpretation and renegotiation"[249]. Self-determination theory is certainly not the answer to all these challenges, yet it does offer insight into the reasons behind the effectiveness of certain communication approaches and can guide strategies and initiatives in motivating change and encouraging social participation toward transition.

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247. Lisa Legault et al., 'Impact of a Motivational Intervention and Interactive Feedback on Electricity and Water Consumption: A Smart Housing Field Experiment', Environment and Behavior 52, no. 6 (2020): 666–92, https://doi.org/10.1177/0013916518811433.
248. Bandura, Social Learning Theory.
249. Owens, '"Engaging the Public"'.

This section has underscored the necessity of integrating motivational principles into communication approaches for fostering lasting changes in face of the challenges posed by climate change. It emphasized the overlooked yet critical role of motivational mechanisms in driving behavioral transformation and advocates for incorporating theoretical insights from motivational research into communication research and practice for facilitating societal transition. There is also a noticeable lack of integration between different models of behavioral change. Multi-theoretical and comprehensive approaches that encompass theories addressing the decision-making process for change, as well as those that facilitate behavior initiation and maintenance are needed. Pelletier and Sharp [250] proposed that tailoring messages according to the stages of change and framing these messages in terms of whether they serve intrinsic goals (vs extrinsic goals) could enhance the effectiveness of messages by progressively increasing the level of self-determined motivation. Pope et al. [251] proposed the "Comprehensive messaging strategy for sustained behavior change", which combines principles from self-determination theory and a stepwise model of change. While their comprehensive model draws heavily from health communication research, we see considerable promise for its application for pro-environmental behaviors. Future research should explore and evaluate this model within the realm of environmental communication.

11. Moving forward

Humans as social animals are always interacting – hence communicating – with one another and acting together. Communication happens at the local level through exchanges with friends, family, coworkers, or quasi-strangers met on the web or at the bus stop. These micro-level interactions and relationships are knit together and form complex configurations enabling and constraining the flow of what is being exchanged. These private conversations echo in the public sphere which becomes the backdrop for their interpretation. There is therefore a need for a multi-level understanding of the effect of communication anchored in an understanding of psychological, relational, and social processes.

This may sound like too great a challenge, but certainly not greater than the ecological transition we have (hopefully) embarked upon. Communication scholarship has already given us solid foundations to build upon and guide further exploration.

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250. Pelletier and Sharp, 'Persuasive Communication and Proenvironmental Behaviours'.

251. J. Paige Pope, Luc Pelletier, and Camille Guertin, 'Starting Off on the Best Foot: A Review of Message Framing and Message Tailoring, and Recommendations for the Comprehensive Messaging Strategy for Sustained Behavior Change', Health Communication 33, no. 9 (2 September 2018): 1068–77, https://doi.org/10.1080/10410236.2017.1331305.

A common thread in communication scholarship is **THE IMPORTANCE OF TRUST BOTH IN THE MESSAGE AND IN ITS SOURCE. FIGHTING THE EPISTEMIC DOMINANCE OF [NATURAL] SCIENCES** [252]**, DENOUNCING COMMUNICATION PRACTICES BASED ON THE DEFICIT MODEL, AND DISCLOSING SCIENCE UNCERTAINTIES AND THE ACTIONS THAT WILL BE TAKEN TO REDUCE THEM IS ONE WAY TO STIMULATE COGNITIVE TRUST. SUCH PRACTICES MAY CONTRIBUTE TO LESSENING THE HARM DONE BY CONSENSUS UNCERTAINTIES**. Indeed, given that human-driven climate changes are a scientific certainty and that those that still oppose this use other scientific uncertainties to create doubt, admitting the real science uncertainties would pull the rug out from under their feet. Certainly, science communication studies should investigate the role of the disclosure of uncertainties: in which context and manner should this disclosure be made?

Affective trust is a lot more ingrained in relationships and emotions than in the objective content or validity of the information. It takes time to establish. This is a lesson online influencers have learnt: their presence on the web is constant and they engage with their public overtime. Creating spaces for dialog is one way of nourishing affective trust. Dialogical models call for the creation of interactive spaces and propose to involve "citizens" early in any process for change. And such spaces are also relevant arenas to foster self-determined motivation and engage people in decision-making. But very often these models have a blind spot: their normative perspective works only if all parties in the dialogue are equal. However, this is rarely the case: not everyone is equal when it comes to communication, climate change and the ecological transition [253, 254, 255, 256, 257]. Those at the receiving end of environmental injustice are more sensitive to the risks posed by climate changes [258], but have very little means to act upon it. Communication can play a role in highlighting these injustices [259], ensuring that all voices can be heard, and contributing to the creation of safe spaces of dialog. The contribution of NGOs and community groups already engage in a dialogue with marginalized groups would here be significant contributors [260].

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252. Suldovsky, 'In Science Communication, Why Does the Idea of the Public Deficit Always Return?'
253. Benedetta Brevini, 'The Value of Environmental Communication Research', International Communication Gazette 78, no. 7 (2016): 684–87, https://doi.org/10.1177/1748048516655728.
254. David Retchless, Carolyn Fish, and Jim Thatcher, 'Climate Change Communication beyond the Digital Divide: Exploring Cartography's Role and Privilege in Climate Action', Journal of Environmental Media 3, no. 1 (2022): 101–23, https://doi.org/10.1386/jem_00074_1.
255. Pearson et al., 'Race, Class, Gender and Climate Change Communication'.
256. Johanne Saint-Charles, Yates Stéphanie, and Kêdoté, Marius, 'Un Projet Participatif Sur La Réduction de La Pollution Atmosphérique Dans Quatre Pays de l'Afrique de l'Ouest : Quel Rôle Pour Les Femmes ?', in Recherches Participatives et Équité En Santé, ed. Loignon, Christine et al. (Presses de l'université Laval, 2022).
257. Stéphanie Yates et al., 'Reducing Air Pollution in West Africa through Participatory Activities: Issues, Challenges and Conditions for Citizens' Genuine Engagement', in Handbook of Communication for Development and Social Change, ed. Jan Servaes (Singapore: Springer Singapore, 2018), 1–18, https://doi.org/10.1007/978-981-10-7035-8_25-1.
259. Zheng Cui, Robert E. Gutsche, and Juliet Pinto, 'Seeing the (in)Justice of Sustainability: Visualizing Inequality at the Centre of Climate Change Communication', Journal of Environmental Media 3, no. 1 (2022): 3–10, https://doi.org/10.1386/jem_00069_2.
260. M. Vivion et al., 'Conférence des tables régionales de concertation des ainées', Lancement d'un outil Web pour co-construire les messages de santé publique | Institut sur le vieillissement et la participation sociale des aînés, 2023, https://www.ivpsa.ulaval.ca/actualites/lancement-dun-outil-web-pour-co-construire-les-messages-de-sante-publique.

Injustices must also be considered in the framing of climate change and the transition. As we have seen, the importance of framing at all levels of communication is unavoidable, but despite numerous studies on the topic, we lack an integrative framework. We know context matters but how, when and where it matters is not always clear. We may not need that many more studies – except maybe on the framing (or lack of) of environmental injustices – but we do need to model frame effects for behavioral changes and consider similar notions emerging from other disciplines such as social psychology, cognitive sciences, political sciences or sociology. Finally, studying social media algorithms and affordances as frames, might be a promising venue to a better understanding of both technical and usage constraints imposed by platforms and for avoiding the pitfalls of simplification.

Behavioural changes models are too often based on the premise of voluntary and rational change. However, we are much less rational than we try to believe. Beyond emotions, it is important to note that many of our actions are habitual, occurring automatically and without conscious thought, rather than from deliberate reasoning. Habitual behaviors are frequently repeated behaviors triggered by specific contextual cues. This makes habitual behavior highly resistant to change as they need to be made conscious before being addressed. Typical behavior change approach does not work if the target behavior has gained high habitual momentum.

Some scholars emphasize the need to address habits first before attempting behavior change interventions. Verplanken and Wood [261], for example, suggest that **SUCCESSFUL INTERVENTIONS TARGETING HABIT CHANGE ENCOMPASS THOSE THAT DISRUPT AUTOMATIC ENVIRONMENTAL TRIGGERS LINKED TO HABITS**. The authors propose a potential strategy for habit change that involves providing information at times when habits are susceptible to alteration, like when natural disruptions (e.g., moving households, career shifts) or induced disruptions (e.g., planned change in road infrastructure) occur.

The arguments presented in this chapter demonstrate that there is still a tendency in the field of communication to address behavioural changes at the level of the individual. This is surprising given how important relationships are for communication and that we have known for a long time the importance of the social and cultural context and of collective action. The same limitation applies to models of behaviour changes with their prevalent focus on individual behaviors in the private sphere [262] as "independent variable".

261. Bas Verplanken and Wendy Wood, 'Interventions to Break and Create Consumer Habits', Journal of Public Policy & Marketing 25, no. 1 (2006): 90–103, https://doi.org/10.1509/jppm.25.1.90.

262. Paul C. Stern, 'New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior', Journal of Social Issues 56, no. 3 (2000): 407–24, https://doi.org/10.1111/0022-4537.00175.

The current climate challenges call for extensive and fundamental societal transformations. Recognizing that the determinants of collective action diverge from those of individualistic behaviors [263, 264, 265, 266, 267], further research should explore communication approaches that effectively cultivate social engagement. We need more than just conscientious consumers: we need active stakeholders willing to engage collectively toward societal change. This means forging close and supportive relationships with neighbors, participating in municipal councils, engaging in citizen committees, getting involved in environmental organizations, or trying to influence elected officials to change current policies.

The study of socio-semantic networks is one promising avenue to lead us out of this bias given its focus on relational patterns which form ideologically coherent collectives or epistemic communities. Insights from scholars of socio-semantic networks in the fields of political science and relational sociology would also be welcome. We need a stronger theoretical base to explain how discourses, ideas and beliefs and the creation, transformation and dissolution of social groups influence one another. As we have seen, the mutualist networks model shows promise here [268] and a relevant step forward might be to connect this model with innovation diffusion models, notably such models that address how a counter-normative innovation may diffuse [269] if we are to reach out to those for whom transition is far from an imperative.

As a multilevel phenomenon, communication effects are hard to measure, and we need creativity to develop pre-post studies for behaviour changes [270] outside of the laboratory. We also need longitudinal large-scale projects using mixed methods to consider the numerous shades of communication.

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263. Sebastian Bamberg, Jonas H. Rees, and Maxie Schulte, 'Environmental Protection through Societal Change: What Psychology Knows about Collective Climate Action—and What It Needs to Find Out', in Psychology and Climate Change: Human Perceptions, Impacts, and Responses., ed. Susan Clayton and Christie Manning, Psychology and Climate Change: Human Perceptions, Impacts, and Responses. (San Diego, CA, US: Elsevier Academic Press, 2018), 185–213.
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268. St-Onge et al., 'Socio-Semantic Networks as Mutualistic Networks'.
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270. Florence et al., 'Message Framing Effects on Sustainable Consumer Behaviour'.

One important strength of communication scholarship is its interdisciplinary nature which should facilitate the integration of other social science perspectives. But it might also be where the problem lies for lack of exchanges within sub-disciplines. Therefore, communication scholarship would gain from conversations with other disciplines, but also from conversations between its own sub-disciplines. In pursuit of an integrated perspective, an ecosystem view should be adopted. This involves considering individual factors that impact behavior alongside addressing wider social, institutional, and political aspects of the issues at hand. Achieving the integration of diverse perspectives requires fostering interdisciplinary and transdisciplinary collaborations in both communication research and practice.
The vastness of the field of communication is impossible to capture in a single chapter. Hence, we have prioritized public communication and its subfields of public relations, environmental, sustainability, and science communication, risk communication and social media – given this is where one can find most of the studies related to the topic. The subfields of political, governmental, and international communication and that of interpersonal, intercultural, group, and organizational communication have been neglected.

The synthesis we have offered in this chapter has emphasized the centrality of the notions of trust, dialog and frames as well as the pertinence of considering the social platform affordances and algorithms – especially now in the AI era. We have shown what is meant by the idea of communication as "constitutive" of our relationships, of how we make sense of the world and how we orient our action. As central as it is for the social being that we are, we have shown that communication is not the magic bullet it is often thought to be, and we have made the case for a rigorous communication scholarship anchored both in theory and practice.

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Emotions in transition: will eco-anxiety save our civilization?

Ch.4

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Introduction

For the past two decades, there has been a prevailing view that the lack of collective response to climate change is due to a lack of information. Many decision-makers believe that all that is needed is to explain scientific aspects of the problem to people - for example, by popularizing IPCC reports or explaining the carbon cycle in schools and universities – and that this will naturally lead to an appropriate response from actors. However, several studies show that the level of information is not necessarily correlated with the adoption of behaviors likely to mitigate the crisis[1]. The aim of this chapter is to ***explain how psychology has provided insights into how humans react to the environmental crisis and scientific evidence***, and how the emergence of eco-anxiety may be one sign of a potential turning point in humanity's ability to cope with the colossal challenges ahead. Indeed, psychological sciences offer explanations regarding the role (real and potential) of eco-anxiety. Finally, a number of research directions will be proposed to help raise public awareness of ecological issues.

1. Kellstedt et al., 2008.

Humans are largely driven by their emotions (even if they may not realize it!)

When a person is exposed to information, they use two distinct but interactive processing systems: an affective (or experiential) system based on emotions derived from individual and collective experiences, and an analytical system based on reasoning [2]. The concepts of "system 1" (affective) and "system 2" (analytical) were developed by psychologist Daniel Kahneman and his colleagues (2001, 2011) to describe these two distinct modes of thinking. System 1 is intuitive, automatic and fast. When exposed to threatening information about climate change, it generates immediate emotional reactions such as fear, anxiety, guilt or compassion and the ensuing reactions. The analytical system, on the other hand, mobilizes learned knowledge and "algorithms" that require conscious thought. For example, when exposed to the same threatening information, the individual may examine in depth the scientific evidence for this change, attempt to assess its long-term consequences, and look for solutions to mitigate it.

The two forms of processing are not neatly separated: any decision-making process always integrates both, but the affective system is usually the determining factor. **WHEN AN INDIVIDUAL COMES INTO CONTACT WITH ALARMING INFORMATION ABOUT THE ECOLOGICAL CRISIS, IT IS MAINLY THE AFFECTIVE SYSTEM THAT IS ACTIVATED**, triggering the emotional regulation mechanisms we will describe in the following section.

2. Weber, 2006

How do humans cope with the stress related to the ecological crisis?

Stress arises from exposure to constant bad news about environmental degradation or the direct consequences of environmental crisis (pollution, climatic events, attacks on the living world, etc.), and generates a physical (increased heart rate, muscle tension, and a release of stress hormones like cortisol) and emotional reaction. It can be acute (short term) or chronic (long term). It differs from fear, which is also a physical and emotional response, but appears in the case of immediate danger, whereas stress can come from non-threatening situations. Lazarus and Folkman's (1984) model of stress highlights the importance of emotions in the way individuals perceive and react to stress. Emotions are closely linked to the evaluation of stressful situations and to the way in which individuals develop strategies to cope with stress. According to this model, the stress response process begins with a primary evaluation of the level of threat engendered by a situation. Beyond a threshold specific to each individual (according to their perception of their personal resources), the individual may perceive the situation as exceeding their resources, triggering an emotional response such as worry or fear, which in turn generates stress. One example could be a driving test. An individual's stress level when facing a driving test will depend first on their perception of the challenge posed by the exam such as how difficult they believe the test will be, their fear of failure or, inversely, the pressure they feel to succeed. Several parallels to transition efforts can be made, such as the pressure to succeed! Second, their stress will be influenced by their perception of the resources they have to handle the situation, including their preparation, driving skills, confidence, and support from others, i.e., their perception of their own capacity to act successfully. If they believe the test exceeds their capabilities or that they lack the necessary resources, stress levels will increase. Depending on the type and intensity of the emotion experienced, the individual will more or less consciously implement psychological adaptation strategies, or coping strategies, to deal with the stress. Generally speaking, **THESE STRATEGIES FALL INTO TWO MAIN CATEGORIES: THOSE AIMED AT RESOLVING THE PROBLEMATIC SITUATION ("PROBLEM-SOLVING" COPING) AND THOSE DESIGNED TO REDUCE THE EMOTIONAL BURDEN ("EMOTION-FOCUSED" COPING)**.

To cite a few examples, when facing stress associated with the environmental crisis, a problem-solving focused strategy might be to make decisions to reduce one's carbon footprint or to advocate for ecology, and an emotion-focused coping strategy might be to search for distraction to take one's attention away from the problem, to contact friends for their emotional support, or to stop reading news on the subject to avoid the stress now associated with it.

The ecological crisis possesses several characteristics (unprecedented severity, perceived as uncontrollable due to magnitude and complexity, continuous stressors) that make it quite exceptional within this framework. Firstly, its unprecedented severity on a global scale lacks historical precedent, making it impossible to reference known facts for comprehension and assessment of its tangible real-world consequences. Secondly, given its magnitude, complexity, and the efforts required to mitigate it, the crisis can easily be perceived as uncontrollable, meaning no individual action can solve it. However, on the one hand, the perceived uncontrollability of a situation increases an individual's perceived stress, and on the other hand, it leads them to prioritize emotion-focused coping strategies, which can be more effective in reducing their stress than problem-focused strategies. Simply put, the perceived lack of control and inability to solve the environmental crisis lead individuals to refrain from trying to address it. The third distinctive feature is that this crisis still largely manifests through continuous stressors, which refer to slow changes, such as drought, pollution, sea level rise, soil erosion [3]. The issue with this type of stressor is twofold.

Firstly, **INDIVIDUALS HAVE THE TIME TO BECOME ACCUSTOMED TO AND NORMALIZE THESE STRESSORS**. As these are part of daily life, they no longer generate stress or emotion, and therefore they no longer constitute a trigger for change, a form of habituation to climate signals. Secondly, the resulting integration period allows them to implement, both individually and collectively, sometimes highly sophisticated coping strategies to minimize the emotional burden they carry, which will be elaborated on further in the text.
In comparison, the Covid-19 pandemic occurred rapidly, generating an immediate sense of panic that led to the implementation and collective acceptance – at least initially – of radical measures such as lockdowns and widespread vaccination. It was only later that certain defense strategies were implemented, both individually and collectively, to counteract the restrictions imposed [4]. The relative slowness of the climate phenomenon and the collective stress management strategies developed over a few decades have led humanity to a situation that is both astonishing and tragic. As the climate threat becomes more palpable, individuals increasingly fortify themselves behind psychological defenses, leading to a diminished response [5].

Worse still, even in the case of extreme events like hurricanes or tropical storms, victims most often attribute them to weather patterns, geography, or inadequate infrastructure. This tendency is strongly influenced by psychological factors, as people struggle to grasp the abstract and complex nature of climate change. The immediacy of the event and the need to find tangible causes make it easier to focus on local, visible explanations. Furthermore, the way IPCC forecasters communicate in terms of increased probabilities rather than direct causality further complicates the public's understanding, making the connection between climate change and these events less intuitive and harder to internalize [6].

3. Reser et al., 2011
4. Dodds, 2021
5. IPBC, 2021
6. Leiserowitz, 2006

Denial and cognitive avoidance: what prevents us collectively from addressing the environmental crisis?

In the face of the ecological crisis, one of the primary emotion-focused strategies is ***denial***. This strategy is typically unconscious and aims to suppress, deny or avoid uncomfortable emotions associated with the situation. Denial, which operates as a defense mechanism, not only prevents individuals from confronting the facts but also alleviates the emotional burden that comes with acknowledging the severity of the crisis. There are several types of denial that we will present in the following sections : literal denial, implicatory denial and interpretative denial[7] (which includes several coping strategies). The first and most obvious type is literal denial, or skepticism, which involves rejecting the reality of the environmental crisis and/or denying human responsibility for its development. According to a recent international survey[8], **APPROXIMATELY 37% OF INDIVIDUALS WORLDWIDE WERE AFFECTED BY THIS TYPE OF DENIAL IN 2022** (from age 16)! Notably, this form of denial has been increasing despite mounting scientific evidence. Over a three-year span, it has risen by 6%, demonstrating a troubling resilience in climate skepticism. The survey results indicate that this denial is increasingly manifested not by denying the reality of the environmental crisis but rather by denying human responsibility. This trend is particularly striking, considering that surveyed populations have been experiencing a growing number of climate-related events in recent years and a proliferation of scientific reports detailing these effects, as reported by the media.

PARADOXICALLY, RATHER THAN DIMINISHING DENIAL, THESE FREQUENT EXPOSURES TO THE ENVIRONMENTAL CRISIS MIGHT EXACERBATE IT. In response to overwhelming stress, denial serves as a coping mechanism that offers psychological relief. One might expect this exposure to reality to reduce climate skepticism, a commonly held belief. However, this result can also be explained by stress regulation mechanisms: faced with an increasingly distressing and seemingly uncontrollable reality, humans tend to reinforce protective denial mechanisms against the crisis rather than take action to mitigate its magnitude. To protect themselves from the unpleasant emotions resulting from the existence of this threat, some individuals develop behavioral mechanisms to distance themselves from associated information, either by downplaying or contradicting it. For example, individuals may construct beliefs contrary to those disseminated by the IPCC. To do so, they may focus their attention on anti-scientific discourse, which proliferates on the internet, denounce messages

7. Cohen, 2013
8. Witkowski & Boy, 2022

incompatible with their beliefs or criticize the authors of such messages, including scientists and the media [9]. This phenomenon is well-documented in recent studies, such as the one conducted by the Yale Program on Climate Change Communication ("Global Warming's Six Americas," n.d.) shows that among the population, six profiles can be identified according to their environmental awareness; the "dismissive" category, corresponding to climate skeptics, having the lowest level of trust in science and the media.

The second form of denial, known as **implicatory denial,** is more subtle. This type does not involve denying the information itself but rather the moral, psychological, behavioral or political consequences that stem from it for oneself or one's community [10, 11]. In contrast to literal denial, implicatory denial allows individuals to acknowledge the reality of the crisis while avoiding the more challenging demands for personal or societal change. This defense mechanism may be less psychologically taxing than outright denial because it does not require individuals to oppose a reality increasingly accepted by the scientific community, and beyond. In this mechanism, individuals acknowledge the reality of the environmental crisis but do not respond adequately, or their response is woefully insufficient. This inconsistency between awareness and action is a key feature of implicatory denial.
The study by Witkowski & Boy is particularly revealing: in 2022, even though wealthier individuals, on average, express greater concern about the ecological crisis, they continue to be the largest emitters of CO2. The dual-system theory helps explain this phenomenon. The rational brain, linked to conscious thought and logical decision-making, recognizes the urgency of the environmental crisis and the need for action. Meanwhile, the emotional brain, which governs automatic and affective responses, resists change, prioritizing immediate comfort and avoiding perceived discomfort or effort. **THIS INTERNAL CONFLICT OFTEN LEADS TO COMPROMISES IN WHICH INDIVIDUALS OPT FOR SYMBOLIC, LOW-EFFORT ACTIONS TO EASE THEIR CONSCIENCE WITHOUT MAKING SIGNIFICANT SACRIFICES.**

For instance, someone with a fear of birds may rationally understand that birds are harmless; however, their emotional brain triggers a flight response upon encountering one. Similarly, in the context of the environmental crisis, while the rational brain acknowledges the necessity of pro-ecological behaviors, the emotional brain resists due to the effort and sacrifices involved. This phenomenon can be observed in the prevalence of minor ecological behaviors that do not significantly reduce CO^2 emissions but are easier to adopt – such as waste sorting, the most important action undertaken by households to fight climate change [12] or reusable bag use. Regarding the environmental crisis, the rational mind understands and acknowledges the importance of taking action, but the emotional side remains resistant to behavioral changes due to the perceived constraints and cognitive efforts required. Several studies support this hypothesis, demonstrating that the most common ecological behaviors are generally not the most effective in reducing CO^2 emissions but are instead the simplest to implement. These behaviors provide psychological comfort without requiring deeper lifestyle changes [13].

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9. Gifford, 2011 - 10. Cohen, 2013
11. Wullenkord & Reese, 2021
12. La Branche and Susa, 2023.
13. Moberg et al., 2019

Another consequence of this implicit denial may be the displacement of personal responsibility onto others, whom the individual perceives as more capable of effecting change or more directly responsible, such as private companies or heavily polluting countries. This shift in responsibility allows individuals to maintain a cognitive and emotional distance from the problem. It is important to note that **MAINTAINING THIS DISSOCIATION IS PSYCHOLOGICALLY EXHAUSTING; SUSTAINING DENIAL REQUIRES ENERGY AND DOES NOT COMPLETELY ALLEVIATE EMOTIONAL DISCOMFORT, ESPECIALLY AS THE ENVIRONMENTAL CRISIS CONTINUES TO INTENSIFY. WHEN DENIAL PERSISTS, REPRESSED EMOTIONS SUCH AS ANXIETY, FEAR, OR ANGER CAN ACCUMULATE, LEADING TO MORE SEVERE PSYCHOLOGICAL ISSUES LIKE DEPRESSION, EMOTIONAL EXHAUSTION, OR PSYCHOSOMATIC SYMPTOMS**. Moreover, denial fosters isolation by cutting individuals off from conversations or relationships that may challenge their beliefs, exacerbating feelings of alienation. Individuals may also rely on other psychological defense mechanisms, such as **interpretative denial**, which involves reinterpreting the consequences of the crisis in order to downplay them [14]. These aspects can also be approached from the perspective of cognitive avoidance.

Cognitive avoidance, as a form of emotion-focused coping, is a deliberate attempt to evade confronting stressful information. As mentioned earlier, coping strategies, especially secondary cognitive appraisal, can provide a psychological perspective on the relatively slow pace of individual and collective responses to climate change. Among emotion-focused coping strategies, **COGNITIVE AVOIDANCE REFERS TO THE TENDENCY OF INDIVIDUALS TO ACTIVELY AVOID THINKING ABOUT OR CONFRONTING STRESSFUL INFORMATION OR ISSUES**. Thus, for example, cognitive avoidance of the climate crisis occurs in response to the magnitude and severity of climate change issues, involving actively ignoring or disengaging from the topic. This cognitive avoidance may manifest as a deliberate ignorance of scientific evidence regarding climate change or a refusal to discuss the matter to escape the negative emotions associated with it.

Several specific cognitive strategies enable this avoidance [15, 16]:

- **MINIMIZATION**: Individuals may convince themselves that they will not be directly affected by climate change or that others will find a solution to the climate problem, thus downplaying its significance. For example, a homeowner in a region prone to storms might dismiss warnings about rising sea levels, thinking, "That won't happen to me; there are plenty of experts working on this issue." In response to this attribution of responsibility, one encounters that of blame.
- **ATTRIBUTION OF BLAME**: This strategy involves shifting responsibility away from oneself to external entities, such as governments or corporations. By attributing blame to others, individuals can alleviate their personal sense of responsibility or guilt regarding environmental issues.

14. Cohen, 2013
15. Uhl et al., 2018
16. Wullenkord & Reese, 2021

- **DISTRACTION**: This involves focusing on more immediate or superficial concerns, often through excessive attention to social media, entertainment or daily preoccupations, as means to escape from the climate reality.
- **COLLECTIVE APATHY**: This concept refers to an attitude where individuals or groups of individuals, due to their perception of the magnitude of a problem, believe that their efforts are futile and that individual or even community actions will not make a difference. This can lead to a sense of fatalism or resignation, resulting in inaction. For instance, a community may recognize the need for collective environmental initiatives but refrain from taking action, believing, "even if we all recycle, it won't change anything unless large corporations and governments take action first."
- **LEARNED HELPLESSNESS**: This occurs when individuals feel that they have no control over the outcomes of their actions, leading to a passive acceptance of the situation. For instance, a person might continue to book flights for vacations, rationalizing that, regardless of their personal choices, airplanes will continue to take off with or without them. This mindset can lead them to believe that their individual decision to avoid flying would have little impact on the overall environmental situation, fostering a sense of helplessness in the face of climate change.

In all these forms, **COGNITIVE AVOIDANCE REFLECTS NOT JUST INDIVIDUAL PSYCHOLOGICAL TENDENCIES BUT BROADER SOCIAL DYNAMICS THAT INHIBIT MEANINGFUL COLLECTIVE RESPONSES TO CLIMATE CHANGE**. Cognitive avoidance can also manifest as a search for emotional comfort. Individuals may seek information or ideas that reassure them rather than confronting the alarming aspects of climate change. Those seeking comfort tend to gravitate towards others who share similar beliefs, limiting diversity of thought and generating polarization on topics that evoke the most psychological tension, such as the environmental crisis. For instance, someone might only engage with social media groups that trivialize the issue, allowing them to feel validated and avoiding the discomfort of confronting difficult realities.

It is important to note that the relative use of each form of denial or cognitive avoidance is influenced by culture and the policies pursued in each country. For example, climate skepticism is more prevalent in the United States, where it has been propagated by various leaders and economic actors, related to a relatively low trust in science among Americans [17]. This environment has facilitated the development of divergent beliefs. In contrast, implicatory denial is more common in European countries like Norway, where leaders do not deny the ecological crisis but instead seek to «green» the image of the country's fossil fuel production to continue reaping financial benefits [18].

17. Norgaard, 2011
18. Ibid

This resulting ambiguity trickles down to citizens, who mobilize no more than their political leaders do. Furthermore, attentional avoidance is also encouraged by what sociologist Norgaard refers to as the "social organization of denial" which is based on a cultural stock of strategies and social narratives provided to individuals as "ready-to-think" by governments and media. These narratives divert attention from information related to the environmental crisis by emphasizing sources of national pride or the importance of nature in traditions. For instance, narratives that prioritize individualism over collective responsibility emphasize personal freedom and choice while downplaying the necessity for collective action to address ecological issues. Additionally, other narratives, such as market ideology, suggest that free markets and technological advancements will solve environmental issues, thereby discouraging immediate action [19].

The various forms of denial described here constitute a significant obstacle to collective action and mobilization to address climate change. The latest Yale Climate Opinion Maps report from 2021 indicates that about two-thirds (64%) of Americans never discuss climate change. However, cognitive avoidance is not the only psychological response to climate change.

Why and how does eco-anxiety develop?

ECO-ANXIETY CONTRASTS WITH DENIAL IN THE SENSE THAT IT CORRESPONDS TO A HEIGHTENED AWARENESS OF THE EMOTIONAL AND PSYCHOLOGICAL AND PHYSICAL CONSEQUENCES OF THE ENVIRONMENTAL CRISIS. It can quite simply be defined as apprehension and worry about the potential magnitude of the expected impacts of climate change [20]. Its emergence in populations is linked to increased exposure to climate stress. In particular, extreme climate events such as wildfires, hurricanes and heatwaves, which are all on the rise, are punctual stressors that trigger more intense emotional reactions than the continuous stressors discussed in the previous section [21]. These acute events bring the crisis into sharper focus, triggering emotional spikes. Exposure to such events reduces the psychological distance from the disruption, meaning the mental perception of our proximity to the situation and how it can directly affect us [22]. Given the significant exposure to climate disaster information on social media, especially among adolescents and young adults [23], we could also hypothesize a vicariant experience of an extreme climatic event as the trigger for an emotional response [24].

19. Norgaard, 2011 - 20. Jalin et al., 2024
21. Reser et al., 2011 - 22. Trope & Liberman, 2010
23. Benoit et al., 2022 - 24. Maran & Begotti, 2021

This indirect exposure creates an emotional contagion effect, where individuals who have not experienced an event firsthand can still feel its emotional weight. With the emotional brain still in command, information about the climate crisis may begin to outweigh fears associated with the loss of one's way of life. This can lead to a shift from moderate concern to a more intense emotional response. Indeed, when individuals with eco-anxiety are questioned about their experiences, they often describe a rapid onset, for example, after exposure to particularly alarming information or during a heatwave, during which climate change is experienced directly within their bodies.

The emotional burden felt in these situations becomes so overwhelming that previously effective denial mechanisms are no longer sufficient to contain the emotion, which then fully expresses itself, sometimes particularly intensely and unpleasantly. The emotions associated with this psychological phenomenon are diverse: anxiety, sadness, guilt, anger, frustration and despair are the most commonly mentioned [25]. It is also worth noting that a lack of concern for the environment does not necessarily imply denial. For certain populations (in some regions of the world or certain socio-economic categories), this lack of ecological concern may stem from limited access to information or education about the environmental crisis, or it may be due to competing priorities, meaning that other, more pressing concerns (especially economic) overshadow the issue of climate change (i.e. the opposition between dealing with the 'end of the world' and the 'end of the month'). These competing demands on attention and resources can limit mental space for ecological concerns.

Although this phenomenon is difficult to quantify due to the lack of collectively shared clinical characterization, it appears to be on the rise. **A RECENT STUDY [26] CONDUCTED IN TEN COUNTRIES WORLDWIDE REVEALED THAT 45% OF YOUNG PEOPLE AGED 16 TO 25 REPORTED THEY WERE ALREADY BEING AFFECTED BY ECO-ANXIETY IN THEIR DAILY LIVES**. These rates were significantly higher in countries like the Philippines and India, which are heavily impacted by climate disruption and experience increasingly regular extreme events. In a large study on a French sample (n=2,080), Heeren et al. (2022) showed that approximately 16% of the participants frequently reported climate-related anxiety that led to functional consequences in their daily lives. Individuals experiencing eco-anxiety are subjected to complex emotional waves that can manifest as anxiety disorders or depressive episodes [26]. The chronic exposure to stress can lead to sustained mental health challenges, and coping mechanisms can help individuals integrate the stress that arises from awareness. Depending on the individual and their level of resilience, this period, also referred to as climate grief [27, 28], can be more or less lengthy and painful.

25. Clayton, 2018
26. Hickman et al., 2021
27. Cunsolo et al., 2020
28. Randall, 2009

Furthermore, as the source of stress becomes chronic, eco-anxious individuals will develop a range of coping strategies to deploy as needed, allowing them to go about their daily lives despite exposure to increasingly stressful information. These coping strategies, as identified in research, are both emotion-focused and problem-focused: emotion-focused strategies include seeking social support and conscious avoidance (i.e., consciously distancing oneself from overly stressful information to avoid emotional overwhelm); while examples of problem-focused strategies are adopting pro-environmental behaviors and engaging in collective advocacy [29, 30]. A third category, **meaning-focused coping**, is emerging as particularly relevant in addressing eco-anxiety, as it helps individuals connect their lived experiences to deeper values and beliefs. By fostering a broader sense of identity – such as a social or ecological self – this approach enhances understanding of one's role in the world and can cultivate genuine hope. However, studies in this area remain insufficient to date.

In particular, to our knowledge, there is no true comparison between the strategies used by individuals with eco-anxiety and those in denial, which would shed more light on the psychological mechanisms at play. Understanding this difference could provide crucial insights into how individuals choose between action-oriented coping strategies and avoidance mechanisms. More generally, it is still relatively **DIFFICULT AS OF TODAY TO IDENTIFY WITH PRECISION THE SET OF MECHANISMS THAT PUSH A PERSON TOWARDS AN ACTION-CENTERED COPING AND ANOTHER TO DENIAL**. Nevertheless, research in social and environmental psychology has, during the last decades, highlighted a number of other psychosocial sources of influence (see below). However, the issue of competing life priorities can be mentioned, particularly in young adults, where consideration of environmental issues may come into conflict with other considerations perceived as more important (economic, professional, social or family).

Is eco-anxiety a problem?

While eco-anxiety can be challenging to experience, it is not inherently problematic. It is simply a logical psychological consequence of the serious and ongoing environmental challenges that we collectively face. **LABELING ECO-ANXIETY AS A PROBLEM IMPLICITLY SUGGESTS THAT DENIAL IS THE NORMAL ATTITUDE, WHICH IS PROBLEMATIC IN ITSELF**. Most researchers studying it believe that eco-anxiety should not be considered a mental health disorder [31, 32]. While it is true that some complex forms of eco-anxiety may generate excessive suffering or psychological paralysis in some individuals, in the vast majority of cases they tend to diminish over time. If they persist, they often reveal underlying psychological issues such as difficulties in emotion regulation or a history of trauma [33].

29. Homburg et al., 2007
30. Stanley et al., 2021
31. Longman et al., 2023
32. Verplanken et al., 2020
33. Coffey et al., 2021

However, in most cases, eco-anxiety becomes manageable over time and can lead to individual mobilization. This is referred to as "**adaptive anxiety**". Psychotherapists know that emotional avoidance strategies are useful only in the short term and can become detrimental when prolonged [34]. While they may help manage stress temporarily, they should eventually give way to strategies aimed at problem resolution, which is the primary purpose of most emotions. However, as mentioned above, both the severity and perceived uncontrollable nature of the environmental crisis cause a significant portion of the population to remain stuck in avoidance strategies, preventing emotions from serving their role as motivators for action.

Does eco-anxiety lead to action?

The emergence of the concept of eco-anxiety has raised many questions, initially among a few researchers and then in society as a whole, about whether or not it serves as a catalyst for pro-environmental action. Several publications explore the question of the link between pro-environmental behaviors and climate anxiety. It has been demonstrated that perceiving climate change as concrete tends to lead individuals to adapt their behaviors, both at a global level [35, 36] and a local level [37]. While the issue of psychological paralysis still arises, **RECENT RESEARCH SHOWS THAT ECO-ANXIETY ALSO ENCOURAGES INDIVIDUALS TO SEEK MORE INFORMATION AND MODIFY THEIR LIFESTYLES TO MAKE THEM MORE RESILIENT [38]. SEVERAL STUDIES [39, 40, 41, 42] SEEM TO SUGGEST THAT ECOLOGICAL DISTRESS IS A PREDICTIVE FACTOR OF BEHAVIORAL ENGAGEMENT**. However, other studies contradict this [43] by finding almost no correlation between the level of climate anxiety and the adoption of pro-environmental behaviors. To explain this result, the authors propose the hypothesis of a potential paralyzing effect of eco-anxiety that could offset its motivating effect [44, 45]. **THIS ECO-PARALYSIS CORRESPONDS TO A MALADAPTIVE ASPECT OF ECO-ANXIETY, WHICH COULD HAVE SIGNIFICANT FUNCTIONAL REPERCUSSIONS IN INDIVIDUALS' LIVES, THUS LOSING ITS ADAPTIVE NATURE BY RENDERING INDIVIDUALS INCAPABLE OF ENGAGING IN MORE VIRTUOUS BEHAVIORS.**

34. Lazarus & Folkman, 1984
35. Reser et al., 2011
36. Whitmarsh, 2008
37. Corral-Verdugo et al., 2017
38. Cunsolo et al., 2020
39. Heeren et al., 2021
40. Mouguiama-Daouda et al., 2022
42. Verplanken & Roy, 2013
43. Clayton & Karazsia, 2020
44. Heeren et al., 2021
45. Innocenti et al., 2023

In this regard, these results are consistent with studies on "classic" anxiety, which suggest that when anxiety becomes excessive or severe, it can not only impair functioning and cause psychological distress but also fail to fulfill its adaptive function [46, 47, 48]. Nevertheless, other studies on eco-anxiety challenge this hypothesis by highlighting a very clear linearity in the link between eco-anxiety and pro-environmental engagement, even at high levels of eco-anxiety. Our research [49] shows that people experiencing eco-emotions were also those most involved in pro-environmental actions, particularly collective actions, demonstrating a certain search for effectiveness. Awareness of the severity of the environmental crisis likely strengthens intrinsic motivation to act, such as contributing to the collective effort to mitigate its consequences and feeling aligned with one's values. **PEOPLE WITH HIGH ECO-ANXIETY OFTEN TURN TO FORMS OF ACTION THEY PERCEIVE AS HAVING A GREATER IMPACT IN ORDER TO COPE EFFECTIVELY; THIS FREQUENTLY LEADS THEM TOWARD MORE OR LESS RADICAL FORMS OF COLLECTIVE ACTION**. Additionally, **INDIVIDUALS WHO EXPERIENCE STRONG ECO-ANXIETY TEND TO HOLD VALUES AROUND NATURE PROTECTION AND ALIGN WITH CERTAIN POLITICAL IDEOLOGIES, WHICH SERVE AS ADDITIONAL MOTIVATIONAL FACTORS FOR ENGAGING IN MORE RADICAL FORMS OF ACTION. AT THE SAME TIME, AWARENESS MAY REDUCE THE RELATIVE IMPORTANCE OF EXTRINSIC MOTIVATIONS THAT DRIVE INACTION, SUCH AS MATERIAL COMFORT, HABIT, OR CONSUMER CULTURE. THE SENSE OF RESPONSIBILITY THAT CAN EMERGE MAKES EXTERNAL FACTORS, LIKE SOCIAL COMPARISON, LESS SIGNIFICANT FOR THE INDIVIDUAL**.

To clarify the underlying theoretical model and better understand reality, it is important to conduct further research to determine how eco-anxiety manifests in individuals, as well as what other factors are involved in the adoption of pro-environmental behaviors rather than denial. Ultimately, scientific research in this domain aims to identify the factors or individual profiles that influence whether eco-anxiety is adaptive or dysfunctional.

46. Bar-Haim et al., 2007
47. Cisler & Koster, 2010
48. Van Bockstaele et al., 2014
49. Jalin et al., in press

The complexity of the determinants of pro-environmental action.

The literature dedicated to the psychological mechanisms involved in pro-environmental action is vast. Eco-anxiety has only recently been integrated into study designs, mainly because there was no validated scale to measure it until 2020 [50]. Although there is no meta-analysis on this topic as yet, it seems that most of the research mentioned above validates that eco-anxiety is likely to be an important emotional factor motivating action. However, we would like to emphasize here that it does not explain behavioral investment on its own, as many other factors come into play. Among the main ones, let us cite individual values that play a role in forming our beliefs about climate change [51], perceived self-efficacy [52] ("Will this action actually contribute to solving the problem?"), the type of emotional responses elicited by the ecological crisis in certain situations [53] and connectedness to nature [54, 55]. We can also mention cognitive dissonance, as denial is not the only internal conflict an individual might experience. Cognitive dissonance refers more to the awareness of inconsistency between a person's behaviors and their values, such as driving a car while adhering to an environmentalist ideology. This inconsistency creates discomfort, which can lead to one of two outcomes depending on the situation: aligning behaviors with values or the opposite. In this sense, **COGNITIVE DISSONANCE CAN ACT AS BOTH A MOTIVATOR AND A BARRIER TO ENVIRONMENTAL ENGAGEMENT**.

In addition, the social norms of our immediate environment appear to be a determining factor [56, 57] which can, for example, lead individuals to act against their values out of fear of being devalued by the social groups they belong to ("Will my friends find it ridiculous if I order a vegetarian dish?"). Eco-anxious individuals often report complex relational and social situations, leading to frustration ("In my family, it's impossible for me to act as I would like") or anger ("I can't stand seeing others consume so many manufactured products that they don't need") [58]. Nevertheless, it should also be mentioned that **WE ARE WITNESSING THE EMERGENCE OF PRO-ENVIRONMENTAL SOCIAL NORMS IN MANY GROUPS AND SOCIAL SETTINGS, WHICH TEND TO DISCOURAGE ANTI-ECOLOGICAL BEHAVIORS INSTEAD**.

These transformations of norms are an essential step toward change. This refers to a fundamental aspect of ecological transition: humans construct themselves in reaction to their peers. Our opinions and behaviors towards the environment are the result of how we perceive ourselves within our social group, and of our identity [59].

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50. Clayton & Karazsia, 2020 - 51. Stern et al., 1999
52. Tabernero & Hernández, 2011 - 53. Hahnel & Brosch, 2018
54. Mackay & Schmitt, 2019 - 55. Barragan-Jason et al., 2023
56. Norgaard, 2011 - 57. Bamberg et al., 2018
58. Jalin et al., 2024 - 59. Fielding & Hornsey, 2016

If an individual's group actively values virtuous behaviors, it is likely that they will perform more of them, regardless of their level of eco-anxiety. Thus, it is important to remember the significance of intergroup relationships: for example, an individual identifying with a conservative movement may tend to internalize the stereotypes conveyed by their group and thus adopt a less favorable attitude towards fighting climate change [60]. The group therefore imposes its views on the individual. At a larger scale, other social dynamics can be observed : some studies show that exposure to climate stress can have psychosocial consequences, including accentuating group prejudices, ethnocentrism and nationalism [61, 62].

Modeling ecoanxiety?

In the light of these results, it is highly likely that exposure to the ecological crisis is influencing our societies in a much more profound way than we might at first consider. A whole range of factors, even beyond those mentioned in this chapter, infuse our perceptions, behaviors and beliefs, adding further complexity to the decision-making system that conditions our decision to take action. To better understand them, it seems essential to create research designs associating complementary disciplines, at the very least sociology and psychology, in order to better understand the phenomena at play. Some innovative experimental approaches are particularly interesting in this context. These include agent-based modeling, an approach that models interactions between autonomous individuals to understand collective behavior and emergent phenomena. In fact, it involves fully simulating a system of interactions between computerized individuals to better understand the phenomena that occur in real life.

A recent study [63] carried out using this method showed that the multiplication of threatening climate messages led to an increase in the average level of climate anxiety within the population modeled, and thus, in response, to a rise in the proportion of climate-skeptics. The result was a social evolution towards polarization [64] around the climate theme, which may resemble what is currently observed in many societies [65, 66]. In addition, social activism of the skeptical sub-group to maintain their belief canceled out at the global level, the positive effect on the climate of the additional behavioral commitment of the remaining population [67]. These authors suggest that offering the population a range of "turn-key" solutions to fight climate change would enhance the sense of control over the climate crisis within the population and, in so doing, limit the reactions of denial or other symbolic defenses mentioned above, such as ethnocentrism or the depreciation of others. These solutions also decrease the cognitive overload, and thus, facilitating change.

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60. Fielding & Hornsey, 2016 - 61. Uhl et al., 2018
62. Fritsche et al., 2012 - 63. Kapeller & Jäger, 2020
64. Stoner, 1968 - 65. Jansma et al., 2022
66. Falkenberg et al., 2022 - 67. Kapeller & Jäger, 2020

Finally, **BEHAVIORAL ENGAGEMENT HAS POSITIVE EFFECTS ON PSYCHOLOGICAL WELL-BEING**. Studies show a correlation between environmental action and well-being [68, 69], while others associate behavioral engagement with a reduction in depressive and anxiety symptoms in people who are highly alarmed by the state of the planet [70]. In addition, climate activism is said to lead to an improved sense of self-efficacy, i.e. the belief in one's ability to act [71]. Activism also appears as an opportunity to promote positive social relationships [72], which could mitigate the sense of isolation felt by many people suffering from eco-anxiety.

Consequences for public communication

Considering these different, complex and at times contradictory elements, how should the public be informed about the ecological crisis? The studies mentioned in this article show that it is important to carefully balance the alarming nature of messages. Indeed, there are **TWO TYPES OF RISK: THE FIRST WOULD BE TO ATTENUATE THE SERIOUSNESS OF THE SITUATION TO MAKE IT MORE "PRESENTABLE", AT THE RISK OF NOT GENERATING THE PEAK OF ANXIETY NEEDED TO DRIVE THE DESIRED CHANGE** [73]. Let us not forget that societal evolution resulting in the mitigation of the climate threat would have to be quite radical in the richest countries, and therefore likely to challenge lifestyles underpinning collective identity. So, sufficient motivation will have to be generated for us to evolve collectively.

The second and opposite risk, mentioned above, would be **TO CREATE MORE ANXIETY THAN A PART OF THE POPULATION CAN BEAR, AT THE RISK OF SEEING THE EMERGENCE OF BARRIERS OF DENIAL OR SOCIAL PROBLEMS ASSOCIATED WITH THE POLARIZATION OF OPINIONS OR THE MULTIPLICATION OF DISCRIMINATORY BEHAVIOR**. Unfortunately, there is a fine line between these two risks, and it is likely that the awakening of some will lead to denial in others, meaning that the aim needs to be to set the cursor correctly so that as many people as possible take action. It is also crucial to accompany the necessary anxiety-provoking messages with public policies offering ready-to-use solutions, which would encourage individuals to opt for action rather than denial, which is always more comfortable in the short term. It also seems useful to link the efforts required to the results hoped for. One must be careful, however, not to give too much hope. A study carried out in Sweden [74] shows that **HOPE FELT WITH REGARD TO ENVIRONMENTAL PROBLEMS IS POSITIVELY CORRELATED WITH BEHAVIORAL COMMITMENT AMONG PEOPLE MOST CONCERNED ABOUT THE ECOLOGICAL CRISIS, BUT IS COUNTER-PRODUCTIVE AMONG PEOPLE WHO ARE NOT VERY WORRIED**. For the latter, these positive messages could fuel unrealistic optimism [75] based, for example, on the assumption that solutions to climate change can be found thanks to scientific progress.

68. Corral-Verdugo et al., 2015 - 69. Passmore et al., 2022
70. Bradley et al., 2020 - 71. Doherty, 2015, p. 208 - 72. Bamberg et al., 2018
73. Kapeller & Jäger, 2020 - 74. Ojala, 2007 - 75. Ojala, 2012

Marketing professionals have been aware for some time now of the value of emotions as a mobilizing force in influencing consumer choices. In view of the points made in this chapter, IPCC reports – and any other abstract representation of the ecological crisis – cannot be the only communication tool used by public decision-makers to encourage people to take action. It is essential to build awareness campaigns that ***use positive emotions*** to present and promote virtuous behavior, but also to denounce those that are not. This includes communicating about expected changes in social norms, for example by highlighting and promoting desired behaviors, or by making harmful behaviors appear socially unacceptable. To cite just one example, flight shaming in Sweden following Greta Thunberg's statements led to a substantial drop in air traffic for several months [76].

There are, of course, other leverage points that can be mobilized in intervention frameworks, linked with the constructs we mentioned earlier. For example, we can work on individuals' sense of efficacy and competence, aiming ***to empower*** them regarding the ecological transition. We can also focus on the ***relationship with nature***, particularly with children. Several studies [77] have demonstrated the effectiveness (in terms of ecological behaviors) of fostering a close relationship with nature in children. It is imperative to think about new campaigns that both alert people to the seriousness of the climate crisis and propose individual and collective solutions to deal with it. For the time being, in France at least, such campaigns remain rare, apart from those encouraging waste sorting. It also seems worthwhile to try original communication methods that ***encourage collective emulation***. There are already systems to calculate the carbon footprint of households, so why not make them more widespread? Why not reward the most exemplary? In this way, campaigns would not only encourage the desire to do well, but also perhaps encourage social comparison and contribute to the emergence of new social norms. There is an urgent need for innovation and experimentation in this field, as the potential margins for progress are both enormous and necessary.

It is also important to keep in mind that ecological behaviors are not a uniform whole; each practice comes with specific constraints and influencing factors. As initially discussed by Stern and Oskamp [78], interventions targeting ecological practices require tailored efforts for each type of behavior (waste management, mobility, food, digital practices, etc.) to fully understand their unique characteristics. A transdisciplinary approach that starts with one sector and then expands to multiple sectors could enable a deeper understanding of the drivers specific to each area.

Finally, amplifying individual changes requires introducing new ways of understanding the situation, its causes, and its solutions. Policymakers must coordinate a range of initiatives aimed at planning the decarbonization of our economies at both the micro and macro levels.

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76. Mkono, 2020
77. Barrable et al, 2019
78. Stern & Oskamp, 1987

The need to create new collective norms

Liberal modes of governance in some countries favor what Maniates [79] refers to as the individualization of responsibility, which leaves "little room for reflection on institutions, the nature and exercise of power". Responsibility for solving environmental problems is too often assigned to consumers, generating guilt in them which they resolve either by psychic defenses (e.g. the search for scapegoats), or by adopting easy actions, usually at their individual level, which have little impact, as seen above. This "green consumerism" is also encouraged by the fact that these days you need to be very well informed to know what the comparative impact of an action will be: is it better for the planet to stop eating meat or to stop flying? To sort your garbage or to reduce your central heating? How can we choose the effort we want to make? It seems urgent to propose and promote actions that are genuinely effective, through the dedicated and targeted awareness-raising campaigns mentioned above. It could include, for example, the development and widespread use of individual or household-level CO_2 measurement systems.

Furthermore, the various possibilities for changing one's behavior are still too often perceived as a set of actions, which people can draw as they please. There is little overall vision that prioritizes the margins for progress by sector and the results expected at individual, local, national and global levels. This lack of an overarching vision makes it difficult to ***prioritize impactful behaviors***. A more structured approach, prioritizing actions by sector with clear benefits at individual, local, national, and global levels, could give people the sense that they are contributing to an effective set of collective actions, restoring a feeling of control that could reduce overall levels of eco-anxiety. As a secondary effect, this approach might also help lift some individuals out of denial, as the overwhelming sense of uncontrollability would begin to diminish. Behavioral sciences could support this by identifying which actions are most feasible and socially acceptable and measuring their potential to reduce CO_2 emissions.

A shift toward collective norms and cooperative efforts would be far more motivating – and potentially anxiety-reducing – than current approaches that rely on individual responsibility. By fostering a collective mindset ("all of us are concerned") and a cooperative dynamic ("we are stronger together"), we can create an environment that alleviates the burden on individuals, reduces feelings of isolation and guilt, and offers shared pathways for action. This collective engagement model, though emerging through local social movements [80, 81] could be expanded to provide individuals with a structured, supportive framework for making a positive impact.

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79. Maniates, 2001, p.33
80. Norgaard, 2011
81. Sapiains et al., 2015

Conclusion

We conclude this chapter by discussing future research perspectives. Psychology and behavioral sciences have much to contribute to our understanding of the ecological (or human?) crisis. However, we face significant methodological challenges: how can we describe and analyze the complex interactions that lead individuals to feel anxiety or to sink into denial? What factors influence individuals to lean one way or the other? The answer likely lies in both group-level factors (how the culture, identity, and specific values of my social group shape my responses) and individual factors (what internal strengths and vulnerabilities drive me to face the emotional reality of the crisis or seek refuge in protective denial). It is imperative that our scientific disciplines evolve to address this complexity.

An interesting avenue for advancing research lies in new analytical techniques. While we mentioned agent-based modeling, we should also explore the applications of machine learning and artificial intelligence, which are increasingly influential in scientific production. AI presents tremendous opportunities by enabling the exploration of new ideas with unprecedented computational power, yet it poses challenges as it often operates as a "black box". In pursuit of open and transparent science, researchers must maintain control over the entire process, ensuring clarity in how results are produced and their implications regarding established hypotheses. This necessity extends to behavioral simulations, such as agent-based models; we must critically assess whether we accurately understand internal processes – like anxiety or denial – enough to simulate them effectively.

Given these complexities, it becomes clear that the epistemological foundations of psychology alone cannot capture the intricacies of this topic. This highlights the urgent need for interdisciplinary collaboration, integrating insights from social sciences (sociology, anthropology) and information and computer sciences (modeling, AI). Collectively, we can better address the significant challenges that lie ahead.

A few principles for taking action

ENHANCE PUBLIC COMMUNICATION

Balance alarming messages about the ecological crisis with solutions and clear calls to action to motivate behavioral change while managing anxiety levels.

FACILITATE COOPERATIVE DYNAMICS

Cultivate a community-oriented approach to environmental action, emphasizing the strength of collective efforts to alleviate individual guilt and isolation.

BUILD A STRUCTURED FRAMEWORK FOR COLLECTIVE ACTION

Create a coherent approach that prioritizes actions by sector with clear benefits at individual, local, national, and global levels, allowing individuals to feel they are contributing to an effective set of collective actions.

PROMOTE INDIVIDUAL AND COLLECTIVE AGENCY

Create initiatives that empower individuals with a sense of efficacy regarding their contributions to environmental actions, reinforcing their role in collective efforts.

FOSTER COLLECTIVE NORMS

Encourage the emergence of pro-environmental social norms that discourage anti-ecological behaviors and promote shared values within communities.

ENCOURAGE TRANSDISCIPLINARY RESEARCH

Promote collaboration between psychology, sociology, and environmental sciences to better understand the complex factors influencing eco-anxiety and behavior change.

Thesaurus

EMOTIONAL REACTIONS TO CLIMATE CHANGE

- **Eco-anxiety**: climate anxiety, environmental dread, green anxiety, climate distress
- **Fear**: apprehension, terror, concern, alarm, worry
- **Grief**: ecological grief, climate sorrow, mourning, environmental loss
- **Denial**: avoidance, disbelief, ignorance, dismissal, minimization
- **Anger**: frustration, rage, indignation, climate fury, resentment

COPING STRATEGIES

- **Problem-solving**: solution-focused coping, action planning, proactive strategies, adaptive behavior
- **Emotion-focused coping**: emotional regulation, stress relief, emotional expression
- **Meaning-seeking**: sense-making, narrative-building, existential reflection
- **Social support seeking**: emotional support, instrumental support, community connections

DENIAL-BASED COPING

- **Literal Denial**: Literal denial refers to the outright rejection or disbelief in the reality of climate change, often despite scientific evidence.
  - **Climate skepticism**: doubting the validity of climate data, questioning scientific models of climate change.
  - **Climate change denial**: refusal to believe that the climate is changing or that it poses a serious threat.
  - **Rejection of human causality**: denying the role of human activity in contributing to climate change.
  - **Conspiracy theories**: believing that climate change is a hoax or a conspiracy orchestrated by governments, scientists, or interest groups.
- **Implicatory Denial**: Implicatory denial accepts the reality of the facts but avoids acting on them, evading moral or behavioral consequences.
  - **Minimization**: acknowledging the issue but downplaying its severity or urgency ("It's not that bad", "there are bigger problems").
  - **Shifting responsibility**: blaming other actors, such as governments, corporations, or more polluting countries, for the problem.
  - **Rationalization**: justifying inaction by practical reasons ("I'm just one person", "My actions won't make a difference").
  - **Symbolic compensation**: engaging in small, green actions (like recycling) while avoiding more significant behavioral changes.
  - **Technological optimism**: believing that future technological advancements will solve the environmental crisis, thus postponing personal action.

- **Interpretive Denial**: Interpretive denial involves reframing or interpreting the facts in ways that render them less threatening or serious, often by distorting their meaning.
  - **Reframing the narratives**: interpreting climate change as a natural cycle, not a crisis requiring immediate action.
  - **Just-world fallacy**: believing that the world is inherently fair and that consequences, such as extreme weather, are deserved or unrelated to human activity.
  - **Cultural justification**: framing high-consumption lifestyles as normal or inevitable in one's culture or society.
  - **Social comparison**: downplaying one's own impact by comparing it to larger, seemingly worse offenders, thus avoiding responsibility.

BEHAVIORAL RESPONSES

- **Pro-environmental behavior**: eco-friendly actions, sustainability practices, green behaviors, climate-conscious choices
- **Collective action**: activism, social mobilization, community engagement, collective problem-solving
- **Resilience-building**: adaptability, resourcefulness, emotional fortitude, psychological resilience
- **Maladaptive behavior**: inaction, passivity, escapism, fatalism, withdrawal

PSYCHOLOGICAL MECHANISMS

- **Cognitive dissonance**: mental conflict, cognitive tension, ethical conflict, contradictory beliefs
- **Self-efficacy**: perceived competence, belief in one's ability, control belief, agency
- **Learned helplessness**: resignation, defeatism, passive acceptance, powerlessness
- **Cognitive restructuring**: reframing, perspective-shifting, reinterpretation, re-evaluation

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The role of implicit cognition in the development of a pro-environmental organizational culture

Ch.5

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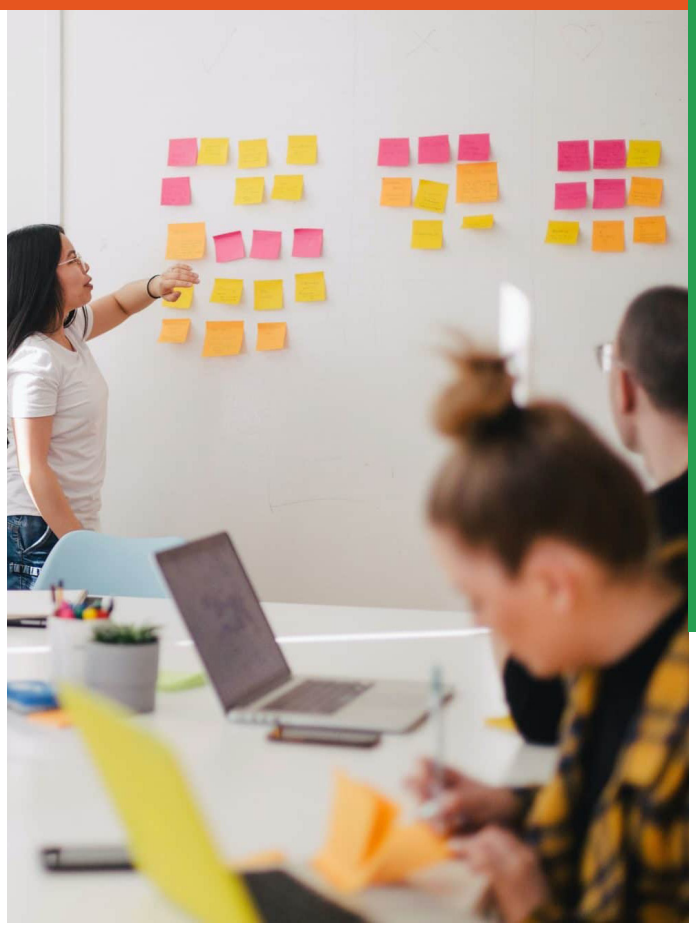


Disciplines:
Management sciences and cognitive psychology, organization theory

Introduction

Organizations in the 21st century must strive to achieve their core objectives while minimizing environmental damage and maximizing environmental benefits. This is not only because a healthy environment contributes to societal and planetary well-being, but also because satisfying both customers' and environmental needs strengthens a firm's economic (i.e., cost reduction, growth rate profits) and financial (i.e., profitability) performance [1]. Despite ongoing debate regarding the effectiveness of corporate efforts towards sustainable development, "there is a general consensus among academics, policy makers, and practitioners that corporations operate with a social sanction that requires that they operate within the norms and mores of the societies in which they exist" [2]. To navigate current systemic ecological transitions, top-level managers must integrate new systemic norms within their organizational structure and promote new behaviours among their personnel. This process can range from a narrow focus on purely financial objectives to a more expansive view that actively enforces recognized environmental policies. Deciding about new norms and values, and consequently modifying people's behaviours, lies at the core of a firm's organizational culture. This aligns with research highlighting the importance of creating of a pro-environmental organizational culture for achieving both economic and environmental goals simultaneously. Organizational culture provides – over the long-term – the firm's employees with values and beliefs that help them define the information to be collected, the levels of access to that information, and its uses for specific organizational activities [3, 4, 5].

An organizational culture manifests at different levels, from readily observable artefacts and behaviours to underlying, often unconscious, core values and beliefs [6]. These unconscious, implicit, values, such as the belief that "financial performance outweighs environmental responsibility", are the essence of an organization's culture [7]. They profoundly influence employees' behaviours, shaping their commitment to the environment, motivation, and ability to face environmental challenges successfully.

1. Zheng, L., & Iatridis, K. (2022). Friends or foes? A systematic literature review and meta-analysis of the relationship. between eco-innovation and firm performance. Business Strategy and the Environment, 31(4), 1838-1855.
2. Devinney, 2009.
3. Day 1994.
4. Deshpande, R., & Webster Jr, F. E. (1989). Organizational culture and marketing: Defining the research agenda. Journal of Marketing, 53(1), 3-15.
5. Homburg, C., & Pflesser, C. (2000). A multiple-layer model of market-oriented organizational culture: Measurement issues and performance outcomes. Journal of Marketing Research, 37(4), 449-462.
6. Hatch 1993; Schein 1990.
7. Homburg and Pflesser 2000.

However, implicit values and beliefs are rarely the direct focus of practitioners and researchers due to their unconscious nature, which makes them difficult to measure directly [8]. Instead, practitioners and researchers indirectly infer these values and beliefs at the firm level from subjective interpretations of visible artefacts, such as formal pro-environmental policies, and inconsistencies between artefacts, like offering a training program to raise environmental awareness as a citizen but lacking company-level pro-environmental policies. To cultivate a shared sense of environmental values and beliefs among employees (i.e., a pro-environmental organizational culture), it is crucial to create a supportive work environment [9]. This chapter proposes that research on implicit cognition can provide valuable insights to inform research on pro-environmental organizational culture.

Implicit cognition, referring to **COGNITIVE PROCESSES OCCURRING OUTSIDE CONSCIOUS AWARENESS OR CONTROL, FOCUSES ON INVESTIGATING DEEPLY ROOTED, IMPLICIT, VALUES AND BELIEFS AT THE INDIVIDUAL LEVEL**. We propose that creating and disseminating a pro-environmental organizational culture requires the assessment and regular monitoring of these implicit values and beliefs. A crucial first step towards altering implicit pro-environmental values and beliefs involves individuals becoming aware and acknowledging their own implicit assumptions that drive many of their behaviours [10]. Therefore, an objective and valid individual measure of these implicit values and beliefs is thus warranted. This chapter draws upon models of dual information processing, which contrast two qualitatively distinct information processing modes: one automatic and unconscious (System 1), the other thoughtful and conscious (System 2) (e.g., Kahneman, 2011; Type 1/Type 2 processes) [11]. Organizational culture, a powerful yet invisible force (i.e., societal and organizational), can be effectively understood through the lens of implicit cognition research. This approach provides valuable insights and tools to assess the unconscious essence of culture at the individual level, preventing from progressing blind.

This chapter is organized as follows. First, we review and discuss the existing literature on pro-environmental organizational culture, with a particular focus on the drivers of change and non-change. Second, we examine the role of implicit cognition in fostering a pro-environmental organizational culture. Finally, in a third section, we proceed to a critical analysis of the literature. This analysis will identify what works well, what does not, and what remains under-examined, while also exploring emerging research topics.

8. Schein 2010; Norton et al. 2015.
9. Norton et al. 201510 Banaji and Greenwald 2013.
10. Banaji and Greenwald 2013.
11. Evans and Stanovitch 2013.

1. Pro-environmental organization culture: literature review

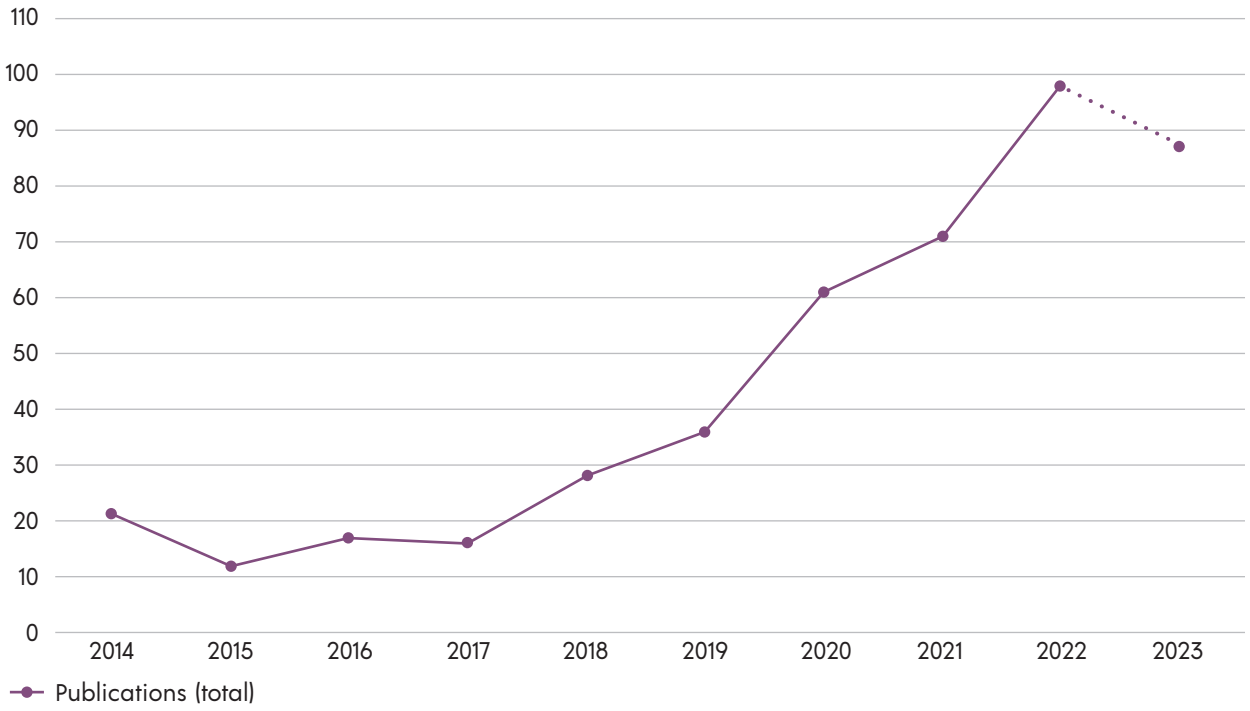
To ensure transparency, quality, and rigor in our literature review, we followed the PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-analyses). This widely accepted methodology provides a standard framework for reporting systematic reviews, aiming for clear and exhaustive documentation of the review process. The PRISMA protocol consists of a checklist of 17 items and a flow diagram that illustrates the stages and the results of the review process.

We considered research that falls within the "commerce, management, tourism and services" research category as suitable for inclusion in the present review. This category covers the core disciplines most relevant to our topic. We opted for a comprehensive approach, excluding any specific time constraint, to capture the evolution and the diversity of research on pro-environmental organizational culture over time. We conducted a systematic database search in Dimensions, which is a comprehensive and multidisciplinary database that provides access to millions of publications and citations across various sources and fields. To maximize the identification of relevant studies, we employed a broad range of search terms (keywords) encompassing synonymous and related concepts to pro-environmental organizational culture. These included terms such as "pro-environmental orientation", "pro-environmental culture", "green organizational culture", "green orientation", "sustainable market orientation", "sustainable orientation", "green culture", "environmental culture", "environmental orientation", and "green marketing orientation". After removing duplicates, one author (DG) screened the titles and abstracts against pre-defined inclusion criteria. This process yielded a total of 499 papers spanning from 1976 to 2023, accumulating 12,234 citations (with an average of 24.52 citations per paper).

Figures 1 and 2, shown below, depict an exponential trend in both publication and citation rates from 2014 to 2023. This indicates the growing interest and importance of sustainability and pro-environmental organizational culture in research. The urgency of addressing environmental degradation renders sustainability a critical area of research. Pro-environmental organizational culture emerged as a key factor in achieving sustainability, as it influences how organizations interact with their natural environments, and how they contribute to sustainable and responsible practices[12]. The increasing number of publications and citations on these topics reflects the increasing relevance and significance of this research field for both academics and practitioners.

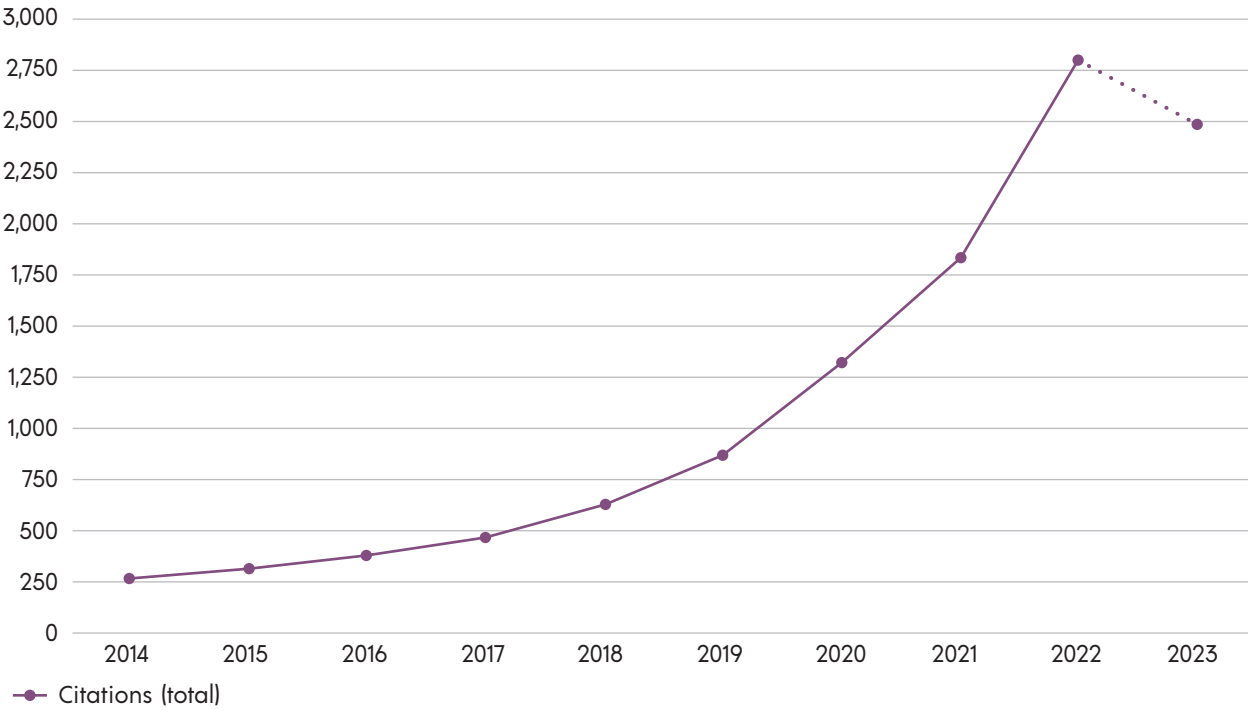
12. Ardito et al. 2021.

FIGURE 1: Number and trend of publications per year (until September 2023)



Source: https://app.dimensions.ai | Exported: September 11, 2023
Criteria: "pro-environmental orientation" OR "pro-environmental culture" OR "green organizational culture" OR "green orientation" OR "sustainable market orientation" OR "sustainable orientation" OR "green culture" OR "environmental orientation" OR "green marketing orientation" in title and abstract; Fields of Research (ANZSRC 2020) is 35 commerce, Management, Tourism and Services; Publication type is Article.

FIGURE 2: Number and trend of citations per year (until September 2023)



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To ensure the quality and rigor of our systematic review, we employed a multi-step selection process. Firstly, we screened papers based on publication in a peer-reviewed journal listed in the 2023 Journal Quality List (70th edition, Harzing). This list is recognized for its stringent editorial standards, robust peer-review processes, and strong commitment to academic rigor. Encompassing journals across diverse disciplines and domains, it ranks them based on quality. By prioritizing publications from the most highly reputable sources, we aimed to mitigate potential biases in the review by minimizing the inclusion of lower-quality research. This approach ultimately yielded a selection of 61 papers for analysis. We then proceeded to examine these papers, identifying their similarities and differences to synthesize a comprehensive and integrative overview of research on pro-environmental organizational culture. Three main questions serve as the organizing framework of the literature and guide this part:

Q1. How can we define concretely a pro-environmental organizational culture?

Q2. What are the impacts of a pro-environmental organizational culture on various dimensions of firm performance?

Q3. How can firms develop and sustain a pro-environmental organizational culture in a dynamic and complex environment?

Q1. What is a pro-environmental organizational culture?

There is no consensus on how to define pro-environmental organizational culture. Different authors employ different terms and concepts to describe it. Therefore, we begun by reviewing and comparing existing scholarly definitions of pro-environmental organizational culture. A sample of definitions, spanning various disciplinary perspectives (e.g., finance, marketing, strategy) and different time frames (2001-2023), is reported in **Table 1**. This diverse sample allows us to explore the multifaceted nature of pro-environmental organizational culture.

TABLE 1: Definitions of pro-environmental organizational culture

REFERENCES	DEFINITIONS
Ardito et al. (2021) [13]	Environmental orientation is "the strategic decision to integrate environmental priorities into a firm's tactical, operational, and innovative activities as a means to meet internal values and respond to the external market pressures" (p. 45)
Banerjee (2001) [14]	"Corporate environmentalism is the process by which firms address environmental issues and develop environmental management strategies. Corporate environmental orientation and environmental strategy focus are two themes of corporate environmentalism that emerge from the study" (p. 489-490)
Kühl et al. (2022) [15]	Internal environmental orientation refers to "managers' and employees' values and ethical standards in regard to environmental protection. It can be conceptualized as a "pro-environmental culture that manifests itself in a firm's mission statements, policies, procedures, and the training of employees"
Menguc and Ozanne (2005) [16]	"Three first-order dimensions, namely entrepreneurship, corporate social responsibility (CSR), and commitment to the natural environment" (p. 430-431)
Papadas et al. (2019) [17]	Green marketing orientation "comprises three dimensions: strategic green marketing orientation, tactical green marketing orientation and internal green marketing orientation" (p. 236)
Yang and Jiang (2023) [18]	"Firms' perception of the priorities of ecological issues facing them" (p. 1)

Note: references are presented in alphabetical order.

13. Ardito, L., Raby, S., Albino, V., & Bertoldi, B. (2021). The duality of digital and environmental orientations in the context of SMEs: Implications for innovation performance. Journal of Business Research, 123, 44-56.
14. Banerjee, S. B. (2001). Managerial perceptions of corporate environmentalism: Interpretations from industry and strategic implications for organizations. Journal of Management Studies, 38(4), 489-513.
15. Kühl, C., Bourlakis, M., Aktas, E., & Skipworth, H. (2022). Product-service systems and circular supply chain practices in UK SMEs: The moderating effect of internal environmental orientation. Journal of Business Research, 146, 155-165.
16. Menguc, B., & Ozanne, L. K. (2005). Challenges of the "green imperative": A natural resource-based approach to the environmental orientation–business performance relationship. Journal of Business Research, 58(4), 430-438.
17. Papadas, K. K., Avlonitis, G. J., Carrigan, M., & Piha, L. (2019). The interplay of strategic and internal green marketing orientation on competitive advantage. Journal of Business Research, 104, 632-643.
18. Yang, Y., & Jiang, Y. (2023). Does suppliers' slack influence the relationship between buyers' environmental orientation and green innovation?. Journal of Business Research, 157, 113569.

We analyzed these definitions to identify their similarities and differences, and to develop a comprehensive and integrative definition of pro-environmental organizational culture.
A notable common thread is the use of "environmental orientation" or its variants, such as "corporate environmentalism" (Banerjee, 2021), "internal environmental orientation" [19] or "green marketing orientation" [20]. Here, "corporate environmentalism" is synonymous with "environmental orientation", defined as "the process by which firms address environmental issues and develop environmental management strategies" [21]. The term "environmental (or "green") orientation" refers to the degree to which a firm is committed to the preservation of the natural environment through its business activities. It is prevalent in the literature, as it captures the essence of pro-environmental organizational culture. As Kühl et al. state, **AN ENVIRONMENTAL ORIENTATION CAN BE CONCEPTUALIZED AS A "PRO-ENVIRONMENTAL CULTURE THAT MANIFESTS ITSELF IN A FIRM'S MISSION STATEMENTS, POLICIES, PROCEDURES, AND THE TRAINING OF EMPLOYEES"** [22], allowing for interchangeable use of both terms.
The second noteworthy similarity is the profound impact of a pro-environmental culture on organizations, influencing both their strategic direction (macro level) and daily operations (micro level). This dual-level influence underscores the comprehensive nature of such a cultural orientation. **AT THE MACRO LEVEL, A PRO-ENVIRONMENTAL CULTURE PLAYS A PIVOTAL ROLE IN SHAPING THE STRATEGIC DIRECTION OF THE ORGANIZATION. IT FOSTERS THE ALIGNMENT OF ITS OVERARCHING GOALS WITH ENVIRONMENTAL VALUES** [23]**, MAKING SUSTAINABILITY A CENTRAL TENET OF THE LONG-TERM VISION, RATHER THAN A MERE ADD-ON.** This cultural shift enables organizations to anticipate and respond to changes in the environmental landscape, a complex social-ecological system encompassing natural and human-modified ecosystems. At the micro level, a pro-environmental culture influences not only the implementation of sustainability strategies [24], but also the daily processes and operations of the organization [25]. It filters down to the everyday actions and decisions of individual employees, empowering them to integrate environmental considerations into their core workflows. This fosters a sense of ownership and responsibility for environmental stewardship within the organization. The ultimate goal of this multi-layered influence is to empower organizations, and the individuals within them, to effectively address the complex and pressing issues posed by climate change and biodiversity [26]. By creating a pro-environmental culture, organizations are not just passively complying with environmental regulations; they are proactively shaping their future in harmony with the environment.

19. Kühl et al., 2021.
20. Papadas et al., 2019.
21. Ardito et al., 2021; Banerjee, 2001.
22. Ardito et al., 2021.
23. Kühl et al., 2022; Papadas et al., 2019.
24. Ardito et al., 2021; Yang and Jiang, 2023.
25. https://www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a3-landscapes/chapter-a3-1/en/
26. Kluckhohn, 1951.

This cultural shift enables organizations to anticipate and respond to changes in the environmental landscape. A landscape is "a social-ecological system that consists of a mosaic of natural and/or human-modified ecosystems, often with a characteristic configuration of topography, vegetation, land use, and settlements that is influenced by the ecological, historical, economic and cultural processes and activities of the area." [27] A pro-environmental culture is about recognizing the interconnectedness of these elements and the role of the organization within this larger system. It's about adopting practices that contribute positively to the sustainability of the landscape, ensuring that business activities do not disrupt but rather enhance the ecological and social fabric.

To develop a comprehensive definition of pro-environmental organizational culture, we first explore the foundational concept of organizational culture. The concept of culture, originally derived from sociology and anthropology [28], was introduced into the realm of organizational theory in the early 1980s. Numerous definitions of organizational culture have been suggested. Deshpandé and Webster (1989) widely accepted definition draws upon 100 studies across disciplines. They defined organizational culture as "the pattern of shared values and beliefs that help individuals understand organizational functioning and thus provide them with norms for behaviours in the organization" (p. 4). Similarly, Schein [29] defines is as "a pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration, which has worked well-enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" [30]. Notably, Schein emphasizes the learning process that shapes culture and its role in both external adaptation and internal integration. He views culture as a dynamic, not static phenomenon, evolving through collective problem-solving and experience-sharing. Organizational culture is not a given; it is actively created and influenced by internal and external forces. These forces, often referred to as « drivers », can either stimulate or impede cultural change. They act as catalysts for transformation, pushing the organization towards a new set of values, norms, and behaviours, or pulling it back to maintain the status quo. The third part of this section will explore how a firm can develop and cultivate a pro-environmental organizational culture.

27. Schein, E. H. (2010). Organizational culture and leadership. John Wiley & Sons.
28. Kluckhohn, 1951.
29. Schein, E. H. (2010). Organizational culture and leadership. John Wiley & Sons.
30. Shein, 2010, p. 18.

Case study 1: Bang & Olufsen

An illustration of how practices and artefacts may reflect organizational culture can be found in the study of Bang & Olufsen's corporate identity in 2006 by Ravasi and Schultz. They observed how people adhered to common tacit beliefs within the organization. "B&O was about simplicity and understandable products. They had no buttons but were flat and horizontal, as opposed to Japanese verticalism. The product had to enrich the experience by having a surprising feature. Products should be self-explanatory and communicate by themselves." This tacit belief has inspired product developers for decades, leading to milestones such as the audio system Beomaster 1900 and the one-thumb integrated remote control Belink 1000.

Organizational culture is a complex and multifaceted concept encompassing four key dimensions: values, norms, artefacts, and organizational behaviours [31]. The multiple-layer model of organizational culture provides a framework for understanding the interrelationships between these dimensions. This model posits that culture exists on several levels, with varying degrees of visibility and influence on the organization's behaviour and performance. The most visible layer is the level of organizational behaviours, which present the outward manifestation of the organization's values and norms. These behaviours are directly observable and often form the basis for external perceptions of the organization's culture. Values, however, form the foundation of the cultural hierarchy. They exert a strong and direct influence on the establishment of norms within an organization, as demonstrated by Homburg and Pflesser [32]. These established norms, in turn, shape organizational behaviours but do so indirectly. This indirect influence is often mediated by artefacts, which serve as tangible representations of the organization's values and norms, ultimately influencing behaviour patterns.

As Dutton and al. observed: "Organizations have a broad repertoire of cultural forms such as rituals, symbols, ceremonies, and stories that encode and reproduce shared organizational patterns of behaviour and interpretation." A pro-environmental organizational culture is thus rooted in values that emphasize the importance of environmental protection for the firm's economic and social performance. ***Values*** are defined as "a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available modes, means, and ends of action" [33].

31. Deshpandé and Webster, 1989; Homburg and Pflesser, 2000; Piwowar-Sulej, 2020; Schein, 1984.
32. Homburg and Pfesser, 2000; Ostroff et al., 2013; Schein, 2010.
33. Kluckhohn, 1951, quoted by Homburg and Pflesser, 2011, p. 450.

These deeply held values significantly influence how members of the organization think, act, and make decisions [34]. They serve as long-term standards and guiding principles for behaviour within the organization. These values reflect the ethical standards of the firm regarding environmental issues, such as biodiversity, climate change, pollution, and resource depletion. For example, a firm may prioritize environmental responsibility, actively considering and striving to reduce the environmental impacts of its actions. A firm with an environmental orientation may also view environmental sustainability as a competitive advantage, a way to differentiate itself from competitors and attract environmentally customers. However, firms may encounter conflict between an established set of values that prioritize profit generation and a new, emerging organizational culture emphasizing ecological goals. Real-world examples illustrate how some firms have navigated this tension by adopting more sustainable practices [35]. This begs the question: what factors drive the adoption or resistance to a pro-environmental organizational culture? We will address this question in the third part.

THE ORGANIZATION'S VALUES ARE INEFFECTIVE IN ENHANCING THE ORGANIZATION'S PERFORMANCE IF THEY DO NOT TRANSLATE INTO *NORMS AND ARTEFACTS*.

These are the more specific behavioural expressions of values that guide members' actions towards achieving success [36]. Norms are "expectations about behaviour or its results that are at least partially shared by a social group", namely, the organization [37]. Artefacts are the symbolic expressions of an organization, and "include stories, arrangements, rituals, and language that are created by an organization" [38]. A pro-environmental organizational culture has norms and artefacts that support environmental behaviours. These may include: eco-innovation, waste reduction, energy conservation, material recycling, compliance with environmental regulations, or environmental stewardship. These norms and artefacts improve the organization's performance [39] in several ways: enhanced competitive advantage (environmental commitment can attract environmentally conscious customers and investors), increased efficiency (practices like waste reduction and energy conservation lower operational costs), improved employee motivation (employees engaged in meaningful activities like environmental stewardship can experience higher satisfaction and commitment), boosted innovation (a focus on environmental solutions can encourage creative problem-solving), or enhanced social legitimacy (operating responsibly aligns an organization with societal values and expectations). The next section of the chapter will explore how a pro-environmental organizational culture affects various aspects of firm performance in greater detail.

To summarize the developments discussed above, **Table 2** shows the definitions and examples of the four components of a pro-environmental organizational culture.

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34. Schwartz, 1992.
35. See for instance: https://www.weforum.org/agenda/2020/01/sustainability-profitability-co-exist/ ; https://www.theguardian.com/environment/2018/sep/07/profits-v-planet-can-big-business-and-the-environment-get-along
36. Homburg and Pflesser, 2000.
37. Homburg and Pflesser, 2000, p. 450.
38. Homburg and Pflesser, 2000, p. 450.
39. Bansal and Roth, 2000; Ramus and Steger, 2000; Dangelico and Pujari, 2010.

TABLE 2: What is a pro-environmental organizational culture?

COMPONENT	DEFINITION	EXAMPLES
Values	"A conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available modes, means, and ends of action"	- Respect for nature and its resources - Commitment to environmental protection and conservation - Responsibility for the environmental impacts of one's actions - Innovation and creativity for finding sustainable solutions
Norms	"Expectations about behaviour or its results that are at least partially shared by a social group" *	- Recycling and reusing materials whenever possible - Reducing energy and water consumption - Reporting and correcting environmental problems or violations - Participating in environmental initiatives and programs
Artefacts	The symbolic expressions of an organization, and "include, stories arrangements, rituals, and language that are created by an organization" *	- Green logos, slogans, or labels - Environmental awards, certificates, or badges - Eco-friendly jargon, acronyms, or metaphors - Green spaces, plants, or recycling bins
Organizational behaviours	"Organizational behavioural patterns with an instrumental function" *	- Developing green products or services - Implementing environmental management systems or audits - Providing environmental training or education - Engaging in corporate social responsibility or stakeholder dialogue

Note: the components of a pro-environmental organizational culture are presented from the least visible one (values) to the most visible one (organizational behaviours).

* Homburg and Pflesser (2000).

Q2.
Why is a pro-environmental organizational culture important for the firm?

The relationship between a firm's pro-environmental culture and its performance has been extensively studied for decades [40]. To provide a comprehensive overview of the existing literature, we present the key findings of the 61 papers we selected for our literature review in the Appendix. The Appendix is divided into two sections: Research context and Principal results. The Research context section summarizes the main aspects of the research design, including the research method, sample characteristics, and data analysis. The Principal results section highlights the key findings related to the antecedents (drivers) and outcomes (consequences) of a pro-environmental organizational culture.

The reviewed papers examine the drivers and consequences of a pro-environmental organizational culture across diverse research contexts. These contexts include variations in country (such as China, Germany, North America, Pakistan, Sweden), industry (such as equipment manufacturing, green-tech, hospitality), and time period (such as 2013-2018, 2008-2019, 2017-2022). Additionally, the studies also employ a variety of sampling approaches. This includes variation in sample size (samples range from small to large), respondent type (studies draw data from CEOs, employees, loan officers, or managers), and level of analysis (the research examines effects at different levels, including dyad, firm, and individual). Finally, the studies utilize a range of data collection and analysis methods. These variations include data collection (case studies, questionnaire-based surveys, and secondary data analysis are all employed), data analysis method, and research design (cross-sectional, longitudinal, and mixed research designs). Despite these methodological variations, the literature reveals common patterns regarding the effects of a pro-environmental culture on firms. These commonalities are summarized in **Table 3**.

40. e.g., Menguc and Ozanne, 2005; Negi, Gupta and Gaur, 2023

TABLE 3: Pro-environmental organizational culture and organization's performance

CATEGORY	CONSEQUENCES OF A PRO-ENVIRONMENTAL CULTURE
Performance	• Improved environmental, financial, and innovation performance, which leads to enhanced competitive advantage, legitimacy, attractiveness. • Higher performance and competitiveness of the firm in the market and achievement of its goals and objectives
Quality	• Better environmental quality and lower environmental impact of the firm's activities • Fulfilment of the needs and expectations of the customers and provision of products or processes that are eco-friendly
Innovation	• Higher creativity and innovation of the employees and the firm in finding solutions for environmental challenges. • Development of products or processes that are beneficial for society and the environment, which is called responsible innovation
Attractiveness	• Attraction of potential employees and partners who share the same environmental values and vision

Our review of the literature suggests that a pro-environmental organizational culture should not be seen solely as a cost for the firm. Instead, it should be recognized as a source of long-term competitive advantage and value creation for the firm and its stakeholders, including the environment. This shift in perspective is crucial to appreciate the holistic value that a pro-environmental culture adds to organizations. A pro-environmental culture positively impacts various aspects of a firm's performance, such as:

- Its **financial** performance. A pro-environmental culture can improve financial performance by enhancing brand image and creating value for customers and stakeholders. Several studies demonstrate a positive long-term relationship between pro-environmental culture and financial performance [41, 42]. This positive effect has been observed across diverse countries and sectors, such as banks in Germany, manufacturing companies in Turkey, industrial firms in China, US industry, or Greek exporting firms (manufactured goods).
- Its **market** performance. A pro-environmental culture can enhance market performance by gaining a competitive edge. Offering eco-friendly, innovative products and services that meet evolving needs and preferences can lead to increased market share and customer satisfaction. Studies support a positive relationship between pro-environmental culture and market performance [43].

41. e.g., Bıçakcıoğlu, Theoharakis and Tanyeri, 2019; Chan,2010; Gabler, Landers and Richey, 2020; García et al., 2022; Leonidou et al., 2015.
42. De Mendonca and Zhou, 2019.
43. e.g., Bıçakcıoğlu, Theoharakis and Tanyeri, 2019; Gabler, Richey and Rapp, 2015; Menguc and Ozanne, 2005.

- Its **innovation** performance. Innovation culture and sustainability orientation are mutually reinforcing. A pro-environmental culture fosters a conducive environment for creativity and innovation. It motivates employees and the firm to tackle environmental challenges. This can lead to the development of new, socially and environmentally beneficial products or processes, and the adoption of eco-friendly technologies. Furthermore, a pro-environmental organizational culture improves resource allocation for innovation, especially within SMEs. Aligning internal and external objectives with environmental orientation can lead to better resource allocation, enhancing reputation and initiating a "virtuous innovation cycle" [44]. This cycle increases the likelihood of introducing product and/or process innovations in SMEs (as evidenced by their study of 369 North American SMEs).

- Its **attractiveness**. A pro-environmental culture can also help the firm attract and retain employees and partners who share similar value and vision. It enhances the firm's reputation and legitimacy among stakeholders, as demonstrated by Umrani et al. (2022) who found it increases employee engagement, organizational citizenship behaviour, and job satisfaction. Additionally, a pro-environmental culture can attract top talent seeking employers who align with their personal and professional goals and values.

Contrary to a simplified view, a pro-environmental organizational culture does not have isolated effects on the various aspects of a firm's performance, but rather creates a chain of positive outcomes, ultimately leading to higher financial returns. This interconnectedness explains why firms with a stronger environmental orientation often achieve higher financial performance: a pro-environmental culture fosters innovation, which translates into improved market performance and, ultimately, superior financial results [45].

However, despite the potential benefits, businesses still struggle to translate these ideals into practice. As argued by Mazutis and Eckardt [46], cognitive bias are a basis of inertia in corporate decision-making [47]. The authors further illustrate this point by citing findings from PwC's 2015 global CEO survey, titled "Do CEOs care about the Climate?" They note that "climate change does not even make the list of key organizational concerns or top strategic priorities." This statement does not mean that about ten years ago, business leaders did not recognize climate change as one of the major global risks. Rather, it may suggest that for some reasons, these types of priorities were not formally integrated in their list of strategic priorities, amongst other competing priorities. This lack of prioritization is further emphasized by the authors' statement that "more troubling, perhaps, are corporate decisions that appear to deliberately stall climate change action," exemplified Volkswagen' admission to manipulating emissions software on their diesel car models, resulting in the release of nearly one million extra tons of nitrogen oxide than previously thought. This disconnection between awareness and action highlights the crucial question: «How can we bridge the gap between recognizing the benefits of sustainability and effectively implementing it?» This question will be addressed in the subsequent section.

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44 Ardito et al. 2021. - 45. Rubera, G., & Kirca, A. H. (2012). Firm innovativeness and its performance outcomes: A meta-analytic review and theoretical integration. Journal of Marketing, 76(3), 130-147. - 46. 2017.
47. Mazutis, D., & Eckardt, A. (2017). Sleepwalking into catastrophe: Cognitive biases and corporate climate change inertia. California Management Review, 59(3), 74-108. p. 74.

Q3.
How can a firm engage and develop a pro-environmental organizational culture?

The complexity and dynamic nature of organizational culture make it challenging to understand and influence. Narver, Slater and Tietje [48] observed that "businesses report limited success in developing a specific organizational culture". Day [49] further emphasized that "even the best-intentioned senior managers find it difficult to translate those aspirations into action". In this context, we examine the barriers that hinder the development of a pro-environmental organizational culture and subsequently explore the processes of cultural transformation.

Drivers of non-change

A broad consensus across research disciplines emphasizes the necessity of substantial changes within business organizations to achieve environmental development goals. International communities acknowledge that institutional and economic motivators have proven insufficient to drive transformations, thereby emphasizing the need for actions at the corporate level. However, enacting radical changes to address climate change remains challenging. Mazutis and Eckardt aptly capture this tension: "In parallel with adaptation strategies, changing corporate behaviour now could help mitigate climate change risks. And yet, [...] most corporate action in this regard continues to be glacial." [50]. Even corporate leaders actively engaged in addressing climate change acknowledge, within their annual reports, the need for future investments in disruptive changes to achieve sustainability goals.

48. 1998, p. 241. - 49. 1999, p. 11.
50. https://journals.sagepub.com/doi/pdf/10.1177/0008125617707974, p. 78.

Case study 2: L'Oréal takes over The Body Shop

The story

« Founded in 1976, The Body Shop began with founder Dame Anita Roddick and her belief that business could be a force for good. The brand first opened in a little green-painted shop in Brighton and has since grown into global business serving over 30 million customers worldwide. In 2006, at the height of its success, The Body Shop was acquired by L'Oréal. However, over the next 11 years... it failed to thrive » [51].

What happened? A cultural shock!

The acquisition actually affected deeply The Body Shop values which resulted in the plunge of its popularity soon after L'Oréal took over. L'Oréal struggled to build on The Body Shop strengths and heritage – probably because of its market culture. The Body Shop's financial results lagged behind other brands thus limiting resource allocation to the new acquired entity. Basic processes like product development, customer experience and communication to educate a new market segment were not adapted by L'Oréal managers, still driven by economic performance only rather than by ethical issues. Then, the external environment evolved. The Body Shop is not revolutionary anymore since there are a number of brands with ethical and environmental values.

Haon, Gotteland and Nelson (2023) suggest two main challenges to fostering a pro-environmental organizational culture. Firstly, a pro-environmental organizational culture requires balancing external and internal organizational orientations [52]. However, the Competing Values Framework (CVF) suggests that these orientations are often opposing forces, creating inherent tension within the organization [53], [54]. This applies not only to private firms but also more generally to institutions and even universities. Quinn and Rohrbaugh (1983) introduced a valuable framework for assessing organizational culture before embarking on change initiative. Their model emphasizes the importance of understanding two key dimensions: internal versus external focus and control versus flexibility. **BASED ON THESE TENSIONS, THEY IDENTIFY FOUR PRIMARY TYPES OF ORGANIZATIONAL CULTURE:**

1. Clan Culture. This culture is characterized by flexibility and a focus on internal excellence. It fosters a positive work atmosphere with strong team spirit. Leaders are viewed as mentors, and key values include loyalty and tradition. Clan cultures emphasize a strong sense of community and shared history. Members in the organization view themselves almost like a family, and traditions act as a way to connect members to the past, present, and each other.

51. https://theindustry.beauty/will-the-body-shop-shine-now-aesop-is-out-of-the-picture/, 2024, jan 7th.
52. Griffiths and Grover, 1998
53. Moorman, 1995
54. Quinn, R. E., & Rohrbaugh, J. (1983). A spatial model of effectiveness criteria: Towards a competing values approach to organizational analysis. Management Science, 29(3), 363-377.

2. Adhocracy. This culture prioritizes flexibility and employee initiative, particularly in dynamic environment. It encourages experimentation and adaptation to external challenges. Building an adhocracy culture is considered crucial for organizational adaptability. Adhocracy culture is often found in start-ups. Start-ups typically operate in environments with rapid change and a high degree of uncertainty. An adhocracy culture, with its emphasis on flexibility, adaptability, and employee initiative, allows start-ups to experiment, respond quickly to new opportunities, and develop innovative solutions.

3. Market Culture. Driven by external focus and outperforming competitors, market culture emphasizes achieving business objectives like increased market share and financial results. Employees are results-oriented, and decision-making is often based on market trends. While acknowledging the potential distinctions between private and public companies, this chapter adopts a holistic approach by examining both sectors collectively. Our literature review suggests that the core concepts under investigation are broadly applicable to both organizational types, thus warranting a unified analysis. Although we recognize that private companies might exhibit certain unique characteristics, we prioritize identifying commonalities that transcend ownership structure in order to develop a robust understanding of the phenomenon.

4. Hierarchy Culture. Focused on control and internal operational excellence, hierarchy culture is characterized by a formalized and structured work environment with clear procedures and lines of authority. Core values typically include quality, cost control, and efficiency, with effective coordination being essential.

Today, the University is full of tension.

"The university is suspended in a limbo between tradition and modernity. Some researchers believe that the mission of higher education as the institution for bringing up and nurturing the nation to strengthen the state is dwindling in the economic, cultural, and social environment that is growing ever more globalized. Universities all over the world face numerous challenges, such as reduced public funds; changing requirements of stakeholders; the rapid growth of new technologies that change the foundations of education, research, and relationships with the surroundings; the focus on effectiveness and efficiency ("value for money"); the emphasis on perfection in education and research; and the urge for a greater social impact. The factors listed above dramatically change the internal and external context of university management." Gorzelany et al [55]. And "As universities follow the corporate model increasingly more, the understating of how corporate culture principles are compatible with university goals has become crucial. Corporate governance is becoming the characteristic feature of higher education in the USA, while leadership increasingly shifts university culture towards corporate culture. The latter is oriented towards teamwork, employee support, fostering creativity, and constant change. The introduction of corporate principles to universities clearly shows that what used to be a part of a covert university curriculum, the subordinate role of learning to market demands, is redefining education policies at all levels today." [56]

55. 2021, p.2-3. - 56. Idem, P. 6.

A pro-environmental organizational culture requires a balanced approach, fostering both external and internal orientations. External orientation ensures the organization is attentive and responsive to the environmental concerns and expectations of its stakeholders. These stakeholders can include shareholders, customers, suppliers, regulators, and society at large. For instance, a firm committed to a pro-environmental culture might conduct regular environmental audits to evaluate its environmental impact and identify areas for improvement. Internal orientation focuses on cultivating a sense of environmental responsibility and commitment among its members, such as managers, employees, and shareholders. This can be achieved through initiatives that motivate employees to participate in environmental programs like recycling, energy conservation, waste reduction, and water conservation [57]. By adopting both external and internal orientations, organizations can build a strong foundation for a pro-environmental culture. This fosters a sense of shared responsibility for environmental stewardship and positions the organization for long-term success in an increasingly environmentally conscious world.

Second, the development of a pro-environmental organizational culture is affected by a complex interplay of internal factors and external forces. While internal factors are within the organization's control, external forces are typically beyond its direct influence, and can either hinder or support the development of a pro-environmental culture. Here are some examples of external forces that can impact a pro-environmental organizational culture:

- **Government regulations and incentives:** These include taxes, subsidies, environmental standards, and penalties that are set by governments to encourage or enforce environmental protection and compliance [58].
- **Regulatory and enforcement bodies:** These include environmental protection agencies or certification bodies that monitor and enforce environmental laws and regulations applicable to the organization [59].
- **Societal norms and stakeholder expectations:** Media, NGOs, investors, can influence the organization's legitimacy and reputation through their expectations and norms related to environmental responsibility [60]. Shareholder expectations, particularly regarding environmental performance, significantly influence corporate behaviour. By examining how these expectations are communicated and internalized within organizations, we can gain valuable insights into the formation of a pro-environmental organizational culture. It is crucial to explore how shareholder activism, regulatory pressures, and public opinion shape these expectations, and how companies respond by aligning their strategies and operations with shareholder demands. Additionally, analyzing the relationship between executive compensation linked to ESG performance and the cultivation of a pro-environmental culture can provide further evidence of the impact of shareholder influence on organizational values and practices.

57. Purwandani et al., 2021.
58. See, for example, Bernal, Dominguez and Montero, 2021; Li et al., 2019.
59. Strannegard, 2000.
60. Strannegard, 2000.

To counterbalance external pressures and cultivate a pro-environmental organizational culture, firms can modify their internal factors. These factors include policies and procedures for human capital management, along with programs that support and reward employees for their environmental contributions [61]. By fostering shared environmental vision, trust, participation, and employee empowerment, such practices can pave the way for a pro-environmental organizational culture. However, achieving this transformation requires navigating a complex tension. **ORGANIZATIONS MUST BE ADAPTABLE TO EXTERNAL CHANGES WHILE SIMULTANEOUSLY MAINTAINING A SENSE OF IDENTITY. THIS NECESSITATES SENSE GIVING AND SENSE MAKING PROCESSES, WHICH HELP EMPLOYEES UNDERSTAND AND REINTERPRET CHANGES IN A WAY THAT MAINTAINS A SENSE OF CONTINUITY AND COLLECTIVE PURPOSE. ENVIRONMENTAL CHANGES, IN PARTICULAR, CAN TRIGGER A RE-EVALUATION OF SHARED SELF-DEFINITIONS. BY FOSTERING DIALOGUE AND PROVIDING MEANINGFUL OPPORTUNITIES FOR EMPLOYEES TO CONTRIBUTE TO ENVIRONMENTAL SOLUTIONS, ORGANIZATIONS CAN HELP NAVIGATE THIS PROCESS AND REAFFIRM A POSITIVE ENVIRONMENTAL IDENTITY** [62].

A crucial issue in promoting green practices lies in the adoption of pro-environmental values and norms within organizations. Bansal et al. (2000) categorized the drivers of corporate ecological responsibility into four main areas: legislation, stakeholders' requirements, economic opportunity and ethical motivations. Building on this framework, Purwandi et al. (2021) conducted a literature review on the adoption drivers of green business practices specifically in SMEs. Their findings reveal that internal motivations (e.g., environmental responsibility) are the most influential factors, followed by market and customers demands. Further research by Rahbauer et al. (2016) focused on the adoption of renewable energy by German SMEs. Their study identified entrepreneurs' personalities as a key factor, particularly their perceived internal responsibility for the environment. This suggests that personal values and beliefs can play a significant role in driving sustainable practices. However, not all barriers are internal. Gupta et al. (2018) discussed various external barriers to the adoption of pro-environmental practices by SMEs, specifically green innovation. They identified seven clusters of impediments, which should be addressed alongside fostering internal motivations and aligning with market demands. This combined analysis highlights the importance of a multi-faceted approach to promoting green practices. Encouraging internal pro-environmental values, responding to market demands and addressing external barriers are all crucial elements for successful corporate sustainability efforts:

1. Managerial, organizational and human resource barriers (e.g., lack of awareness among management about the environmental benefits of sustainable practices; limited leadership support for green initiatives due to competing priorities or lack of understanding; insufficient employee knowledge about environmentally friendly operations and best practices; high employee turnover leading to challenges in maintaining consistent green practices; lack of dedicated personnel to manage and implement environmental programs)

61. e.g., Muisyo et al., 2022; Roscoe et al., 2019.
62. Ravasi et al., 2006.

2. Technological and green resource barriers (e.g., access to limited or outdated technology that is not energy-efficient or environmentally friendly, high cost of investing in new green technologies such as renewable energy sources or pollution control equipment, difficulty in sourcing sustainable materials from reliable and affordable suppliers, lack of infrastructure to support green practices, such as recycling facilities or composting programs)

3. Financial and economic barriers (e.g., limited financial resources to invest in green initiatives due to tight budgets or lack of access to financing; short-term financial focus that prioritizes immediate profits over long-term environmental benefits; uncertain return on investment (ROI) for green initiatives, making it difficult to justify the initial costs; difficulty in competing with larger companies who have more resources to invest in sustainability)

4. External partnership and stakeholder engagement (e.g., limited collaboration with environmental NGOs or other organizations that can provide support and expertise; difficulty in engaging with customers about sustainability issues and building their buy-in for green practices; uncooperative suppliers who are unwilling or unable to provide sustainable materials or services; negative pressure from investors who prioritize short-term profits over environmental responsibility)

5. Lack of government support for green initiatives (e.g., inadequate government funding for research and development of green technologies; complex and bureaucratic regulations related to environmental compliance; lack of clear government policies or incentives that encourage SMEs to adopt sustainable practices)

6. Market and customers barriers (e.g., low consumer demand for sustainable products or services; leading to lower profits, price premium associated with green products that might discourage customers from purchasing them; limited consumer awareness about the environmental benefits of sustainable practices; difficulty in differentiating sustainable products from non-sustainable ones in a competitive market)

7. Insufficient knowledge and information barriers (e.g., limited access to reliable information about environmentally friendly practices and technologies; difficulty in understanding complex environmental regulations and compliance requirements; lack of training and educational opportunities for employees on sustainable practices; insufficient research and development within the SME itself to identify and implement appropriate green solutions).

Organizational and managerial-related barriers pose significant obstacles to the widespread adoption of green practices. A primary culprit is a lack of commitment from top management, who often prioritize short-term financial gains and established routines over the potential benefits of environmental sustainability. This prioritization reflects a fundamental temporal tension faced by firms: balancing immediate performance with long-term sustainability. The pressure to deliver quarterly results and satisfy shareholders can lead to a myopic focus on short-term gains, often at the expense of long-term investments in sustainability. This tension is exacerbated by the fact that the benefits of green practices, such as improved reputation, reduced costs, and enhanced risk management, may not materialize immediately, making it difficult to justify the upfront costs and potential disruptions. Slawinski et al. (2015) investigated this dynamic, highlighting the role of short-termism and uncertainty in driving inaction on climate change. They found that certain managerial characteristics, such as a lack of international experience, were linked to climate change inaction. This suggests that managers with broader perspectives may be more receptive to integrating environmental considerations into their decision-making. **THEY IDENTIFIED THREE PRACTICES THAT CAN HELP ORGANIZATIONS INTEGRATE DIVERSE TEMPORAL PERSPECTIVES:**

- **Long-range planning:** This involves incorporating long-term sustainability goals into strategic planning processes.
- **Stakeholder engagement:** Engaging stakeholders with different temporal horizons, such as community groups and environmental organizations, can broaden the perspective of decision-makers.
- **Cross-sector collaborations:** Collaborating with diverse organizations can allow businesses to learn from each other's experiences and develop more effective long-term sustainability strategies.

Therefore, addressing organizational and managerial barriers requires fostering leadership commitment to environmental sustainability and promoting practices that encourage broader consideration of both short-term and long-term impacts.

Creating a pro-environmental organizational culture is a process of organizational change

According to Burnes [63], there are two main approaches to organizational change: the planned and the emergent. The planned approach follows a formal and structured process. It involves defining a desired future state, diagnosing the present state, and then implementing a series of planned interventions to move the organization from its current state to the desired one. The emergent approach, on the other hand, relies on informal and spontaneous processes. Change emerges organically through ongoing interactions and adaptations within the organization, rather than being driven by a predetermined plan. It is important to note that both approaches can be used simultaneously.

The emergent approach is based on "the social identity model of organizational change" [64]. This model suggests that people in an organization have both a personal identity (as individuals) and a social identity (as members of the organization). Social identity is "that part of an individual's self-concept which derives from membership of a social group (or groups), and from the value and emotional significance attached to that membership" [65]. Therefore, the emergent approach to fostering a pro-environmental organizational culture emphasizes the importance of shared values and beliefs. This requires individuals within the organization to identify with a new set of values that reflect environmental responsibility. Top management plays a crucial role in facilitating this cultural shift by demonstrating environmental sensitivity and commitment [66]. Effective leadership goes beyond mere pronouncements. **TOP MANAGERS CAN ACT AS ROLE MODELS BY EMBODYING THE DESIRED BEHAVIOURS AND VALUES. WHEN LEADERS VISIBLY DEMONSTRATE THEIR COMMITMENT TO ENVIRONMENTAL RESPONSIBILITY, IT FOSTERS TRUST AND INSPIRES OTHERS TO FOLLOW SUIT** [67]. As a result, if top managers care about the environment personally [68], members in the organization are more likely to follow and agree with their values and beliefs, and may also become more pro-environmental. **CONVERSELY, A LACK OF GENUINE ENVIRONMENTAL COMMITMENT FROM TOP MANAGEMENT CAN HINDER THIS IDENTIFICATION PROCESS. IF LEADERS FAIL TO EXEMPLIFY THE DESIRED VALUES, THEIR MESSAGES MAY RING HOLLOW AND FAIL TO RESONATE WITH EMPLOYEES. THIS CAN CREATE A DISCONNECTION BETWEEN INDIVIDUAL AND ORGANIZATIONAL VALUES, MAKING IT DIFFICULT TO CULTIVATE A TRULY PRO-ENVIRONMENTAL CULTURE.**

63. Burnes, B. (2004). Managing change: A strategic approach to organisational dynamics. Pearson Education.
64. Mühlemann, N. S., Steffens, N. K., Ullrich, J., Haslam, S. A., & Jonas, K. (2022). Understanding responses to an organizational takeover: Introducing the social identity model of organizational change. Journal of Personality and Social Psychology, 123(5), forthcoming.
65. Tajfel, 1978: 68.
66. Leonidou et al., 2015; Li et al., 2019.
67. Bandura, 1977; Mühlemann et al., 2022.
68. Bansal and Roth, 2000.

Predicting and controlling the emergence of a pro-environmental organizational culture presents two significant challenges. First, top managers may hold diverse attitudes and values concerning environmental issues, influencing their approach to sustainability initiatives within the organization. This variability in individual perspectives can complicate efforts to establish a unified and consistent approach to environmental responsibility. Second, research suggests a relatively weak association (r = .29) between top managers' environmental sensitivity and the organization's overall environmental culture [69]. This implies that simply having environmentally conscious leaders may not be sufficient to effectively shape and reinforce an organization's values and norms around environmental responsibility. The planned perspective of organizational change has the goal of reducing the uncertainty that comes with the emergent process of developing a pro-environmental organizational culture.

Allen and Malekpour (2023) propose that deliberate transformations, which are intentional and systematic interventions designed to encourage sustainable behaviour, can be a key driver of sustainable development. Studies have shown that employees involved in environmental challenges such as "sustainability transformation" [70] - the process of enhancing the business's sustainability by minimizing risks and assessing its environmental impacts - tend to exhibit more pro-environmental behaviours. These behaviours include initiating eco-friendly actions that benefit both the financial performance and well-being of the employees [71]. Furthermore, encouraging teamwork through CSR (Corporate Social Responsibility) events can further stimulate employee inventiveness and enhance their contributions to environmental sustainability objectives [72].

Lewin's three-step process remains the most influential framework for planned change, despite ongoing research on the optimal sequence of actions within the change process [73]. Scholars in OD [Organizational Development] consider it "the most prominent approach to change discussed by scholars" [74], and "many theoretical and practitioner models of change explicitly or implicitly endorse Lewin's basic three-stage theory of change" [75]. Organizations can leverage Lewin's process to cultivate an organizational culture that support change initiatives [76].

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69. Leonidou et al., 2015.
70. https://www.bcg.com/publications/2022/the-challenges-of-a-sustainability-transformation.
71. Ahmed et al., 2020; Islam et al., 2019.
72. Waheed and Zhang, 2022.
73. Shah, N., Irani, Z., & Sharif, A. M. (2017). Big data in an HR context: Exploring organizational change readiness, employee attitudes and behaviors. Journal of Business Research, 70, 366-378.
74. Bartunek and Woodman, 2015, p. 159.
75. Sonenshein, S. (2010). We're changing—Or are we? Untangling the role of progressive, regressive, and stability narratives during strategic change implementation. Academy of Management Journal, 53(3), 477-512.
76. Gebhardt et al., 2006; Kennedy, Goolsby, and Arnould, 2003; Beverland and Lindgreen, 2007; Haon, Gotteland and Nelson, 2023.

Lewin's three-step model of change draws upon field theory, which explains how an organization's stability is a function of two opposing forces: restraining forces and driving forces. Restraining forces act to maintain the status quo and resist change, while driving forces push for change and propel the organization towards a new state [77]. **IN THE CONTEXT OF ORGANIZATIONAL CHANGE, RESTRAINING FORCES CAN ENCOMPASS VARIOUS FACTORS, INCLUDING EMPLOYEE RESISTANCE (FEAR OF THE UNKNOWN, JOB INSECURITY, OR A LACK OF UNDERSTANDING OF THE PROPOSED CHANGES CAN LEAD EMPLOYEES TO RESIST CHANGE EFFORTS), ESTABLISHED ORGANIZATIONAL CULTURE (DEEPLY INGRAINED NORMS, VALUES, AND BEHAVIOURS WITHIN THE ORGANIZATION CAN ACT AS A BARRIER TO CHANGE), ORGANIZATIONAL INERTIA (THIS IS THE TENDENCY OF ORGANIZATIONS TO RESIST CHANGE AND MAINTAIN THEIR EXISTING ROUTINES IN THE FACE OF ENVIRONMENTAL CHALLENGES OR OPPORTUNITIES), AND THE IMPERATIVE OF REGULATORY COMPLIANCE (EXISTING REGULATIONS AND COMPLIANCE REQUIREMENTS CAN SOMETIMES RESTRICT INNOVATION AND HINDER ORGANIZATIONAL CHANGE).**

Conversely, driving forces can be exemplified by dynamics such as customer feedback reflecting dissatisfaction (dissatisfied customers can create a sense of urgency for change within an organization), intensified market competition (increased competition in the market can pressure organizations to adapt and change their practices), and visionary leadership (a leader who champions change and can effectively communicate its benefits can be a powerful driving force).

The first step of Lewin's model, often referred to as "unfreezing", involves reducing the influence of restraining forces that create organizational inertia. Gilbert (2005) differentiates inertia into two categories: resource rigidity and routine rigidity. **Resource rigidity** refers to the reluctance to modify established patterns of resource allocation, even when the environment demands adaptation. **Routine rigidity** signifies the hesitation to change organizational processes that utilize these resources [78]. Identifying the specific types of inertia at play can be a crucial first step in creating motivation and readiness for change among organizational members.

The second step of Lewin's model, "moving", focuses on implementing the change per se and moving the organization to a new, environmentally conscious state, namely, to a pro-environmental organizational culture. Dismantling existing, unsustainable structures and processes («unfreezing») may be necessary to establish new and desirable ones («moving») that support a sustainable system configuration [79]. These two phases are interrelated and iterative, requiring constant feedback and adaptation to evolving contexts and challenges [80].

77. Endrejat, P. C., & Burnes, B. (2022). Kurt Lewin's ideas are alive! But why doesn't anybody recognize them?. Theory & Psychology, 32(6), 931-952.
78. Burnes, 2004; Hannan and Freeman, 1984.
79. Allen and Malekpour, 2023.
80. Lewin, 1951; Burnes, 2004.

The final stage, "refreezing", ensures the long-term stability and durability of the change by avoiding any regression. Examples of "refreezing" strategies include: clear and consistent communication of the change vision and values, leadership by example from upper management, employee involvement and empowerment, alignment of performance management, reward, and recognition systems with the new goals, and celebrating and sustaining the implemented changes.

In the planned perspective, top managers have a critical role in fostering a pro-environmental organizational culture [81]; like in the emergent perspective. This is supported by Li et al. (2019), who found a significant and strong positive effect of top management green leadership on the organization's pro-environmental culture (effect size = .643). **TOP MANAGERS CAN FOSTER A GREEN ORGANIZATION BY:**

(1) SETTING CLEAR ENVIRONMENTAL GOALS AND POLICIES. This involves establishing objectives and policies that facilitate green initiatives. Examples include reducing carbon emissions, increasing energy efficiency, or adopting renewable energy sources.

(2) INTEGRATING SUSTAINABILITY IN CORE BUSINESS PROCESSES. Environmental concerns should be incorporated into key business functions. This can be achieved by designing eco-friendly products, minimizing waste and pollution generation, or enhancing customer awareness of environmental issues.

(3) ENHANCING EMPLOYEE GREEN CAPACITY. Human resource management practices should be aligned with environmental goals. This includes selecting employees who share the organization's green values, providing them with the skills and knowledge to implement green practices effectively, evaluating their environmental performance, and recognizing their achievements in sustainability [82].

In the first part of this chapter, we highlighted that a pro-environmental culture positively influences various aspects of firm performance, including financial performance, market performance, and innovation. We next examined the drivers of resistance to change and the process by which firms can implement a pro-environmental organizational culture. As established in the first part, existing research on pro-environmental organizational culture primarily assessed it at the organizational level. The second part of this chapter examines the role of individuals in fostering a pro-environmental culture and introduces the role of implicit cognition.

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81. Ramus, C. A., & Steger, U. (2000). The roles of supervisory support behaviors and environmental policy in employee "Ecoinitiatives" at leading-edge European companies. Academy of Management Journal, 43(4), 605-626.
82. Roscoe, S., Subramanian, N., Jabbour, C. J., & Chong, T. (2019). Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development. Business Strategy and the Environment, 28(5), 737-749.

2. The relationship between individuals and pro-environmental organizational culture: the role of implicit cognition

As argued earlier, organizational culture helps employees understand the business strategy, and it motivates and nourishes interpersonal relationships. Culture frames what types of people are attracted by the organization and who can be successful in it. Dissemination of a pro-environmental organizational culture is successful if most employees individually hold pro-environmental values and beliefs and are ready to act upon them. In other terms, if most employees share the same basic assumption that they truly feel concern for the environment [83].

As presented in the first part of this chapter, existing research on pro-environmental organizational culture is almost exclusively assessed at an organizational level. Employees are considered explicit informants of the values and beliefs that they perceive to be shared by the organization. In the case of pro-environmental culture, they are for instance asked if they perceive that preserving the environment is a priority for their company. While organizational culture and individual beliefs and values are interrelated and mutually influential [84], it has been shown that an organization can appear quite coherent in terms of its overall organizational culture but be composed of individuals with low levels of coherence. Using a computational model, Ellinas et al. (2017) showed that the dynamics of network coherence (that considers the belief exchange process at the organizational level through socialization) and cognitive coherence (that focuses on the beliefs at the individual level) can be conflicting. **AN INCREASE IN ORGANIZATIONAL CULTURE COHERENCE CAN BE ACCOMPANIED BY A DECREASE IN COHERENCE AT THE INDIVIDUAL LEVEL. THIS LARGELY DEPENDS ON THE HIERARCHICAL STRUCTURE OF THE COMPANY. WHILE IN A RATHER "FLAT" STRUCTURE (I.E., WHEN MOST EMPLOYEES HAVE SIMILAR HIERARCHICAL LEVELS) INDIVIDUAL LEVEL AND ORGANIZATIONAL LEVEL COHERENCE TEND TO CONVERGE, IN A VERY "VERTICAL" STRUCTURE THIS IS LESS LIKELY**.

The authors found that increasing levels of social rank within a company significantly hampers the homogeneity of the organization in terms of overlapping beliefs. While social conformity increases coherence for a given rank, this is less the case between ranks. This is particularly problematic as individuals with beliefs and values that differ from the organizational culture might undertake harmful actions [85]. Employees with weak pro-environmental values and behaviours can hinder the development and maintenance of a pro-environmental organizational culture by affecting the selection, socialization, and retention of organizational members [86].

83. Schein 2010.
84. Norton et al. 2015.
85. Omar et al. 2015.
86. Song et al. 2023.

When this weak-environmental culture concerns middle managers this can for instance explain why the culture promoted by the top management does not diffuse to all employees. While top managers can feel concern for the environment, middle managers are often evaluated based on short term performance indicators and this can for instance explain a weaker pro-environmental orientation for some hierarchical levels. Some researchers thus suggest that a greater focus on individuals is warranted [87]. The misalignment between top-level environmental priorities and middle management's short-term focus underscores the critical role of governance structures. Effective governance can serve as a conduit for translating high-level objectives into actionable strategies at lower organizational levels. For instance, implementing clear performance metrics that balance short-term financial goals with long-term sustainability indicators can incentivize middle managers to adopt a more pro-environmental stance.

This focus on individuals is also reflected in the definition by Hofstede (1991) for whom organizational culture is "the collective programming of the mind". The extent to which values are shared by members of an organization are at the core of the effort to build and transform organizational culture. This is all the more challenging as individual values are also largely and sometimes predominantly influenced by one's everyday life outside the company. The internalization of values requires that they lead to consistent perceived goals by both managers and employees. Understanding pro-environmental organization culture at the individual level, and the way it relates to the collective, the organizational and the systemic levels emerges as an important research topic [88].

The assessment of individual values and beliefs should not only be performed at an explicit, thoughtful, and conscious level, but also at an implicit, spontaneous, level. The research contrasting these two qualitatively distinct ways of processing information (e.g., System 1/ System 2, Kahneman, 2011; Type 1/Type 2 processes, Evans and Stanovitch 2013) provides ample evidence that decision-making and behaviours are not only driven by higher-order and conscious preferences and beliefs but also by automatic (i.e., non-deliberate) preferences and beliefs [89]. Some spontaneous or less consciously controllable behaviours, like the ones performed under time pressure, stress or when cognitive capacity is limited, are sometimes only predicted by automatic preferences and beliefs [90]. While most people positively evaluate low carbon footprint products, this evaluation is often more positive at the explicit than at the implicit level and, when people are constrained by time during shopping, it is only the implicit evaluation (not the explicit one) that has been found to drive the choice of lower carbon footprints products [91].

87. e.g., Ahmad et al. 2021a, 2021b; Ellinas et al. 2017.
88. Ahmad et al. 2021a, 2021b.
89. Buttrick et al. 2020; Kurdi et al. 2019; Greenwald et al. 2009.
90. Dovidio, Kawakami, and Gaertner, 2002; Hofmann et al. 2008; Perugini, Richetin, and Zogmaister 2010.
91. Beattie and Sale, 2011.

To adequately assess pro-environmental organizational culture, it thus appears essential to consider **implicit cognition, that is cognitive processes that occur automatically and often outside conscious awareness or conscious control** [92]. Implicit cognition research focuses on the investigation of implicit values, preferences, and beliefs at an individual level. These implicit values, preferences and beliefs are often deeply rooted and can bias our understanding, actions and decisions in an automatic and often non-conscious way [93]. Additionally, emerging literature on mindsets (i.e., a way of thinking and being) highlights how these mental frameworks can significantly impact values, beliefs, and behaviour. By cultivating a mindset that prioritizes sustainability and long-term thinking, organizations can foster a pro-environmental culture that is more deeply ingrained and resilient to external pressures [94]. By nurturing a sustainable mindset, organizations can create a more sustainable future for themselves and society as a whole.

Taking into account these implicit values, preferences and beliefs of employees is all the more important that implicit measures that are used to assess these constructs are often weakly correlated with explicit, self-reported and declarative measures across domains [95]. This weak correlation can be explained by the fact that explicit and implicit constructs (e.g., values or beliefs) should be considered as related but distinct constructs because, for instance, some mental associations that inform implicit measures are unconscious and thus cannot inform explicit measures [96]. Yet, the strength of the correlation is also weaker when the target construct is socially sensitive and susceptible to self-presentation concerns [97]. Self-presentation represents the altering of a response for personal or social purposes. Individuals may consciously alter their responses because (a) they do not want to reveal their true feelings for instance because it goes against social norms or (b) the initial response conflicts with personal values. **Self-presentation** can thus either be socially deceptive (e.g., praising a sustainable practice to avoid social disapproval), or it can be genuine (e.g., consciously rejecting an initial negative reaction towards an environmentally-friendly practice as outdated or uninformed, and striving to adopt a more positive and informed response). When self-presentation concern is high, explicit responses may be altered but implicit responses much less, if at all [98]. Self-presentation concerns and in particular social desirability have often been viewed as a potential confounding variable in environmental psychology research [99] and recent meta-analyses suggest that the effect of social desirability when considered as an individual trait (i.e., a personal characteristic) is small but significant [100]. Moreover, self-presentation concerns are domain-specific and vary depending on the sensitivity of the environmental issue under investigation (one may care about animal welfare and biodiversity but less about energy consumption, and inversely) [101]. Thus, beyond explicit self-reported pro-environmental values, preferences, and beliefs, implicit counterparts at the individual level play a complementary role, offering deeper insights into personal motivations and guiding behaviours in nuanced ways.

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92. Augusto 2010; Greenwald and Banaji, 1995. - 93. Greenwald et al., 2022. - 94. Guyatt, 2023.
95. Cameron, Brown-Iannuzzi, and Payne, 2012; Greenwald, Poehlman, Uhlmann, & Banaji, 2009
96. Nosek, 2005. - 97. Nosek, 2005. - 98. Nosek, 2005
99. Kaiser et al. 1999. - 100. Vesely and Klöckner, 2020. - 101. Nosek, 2005

Research on implicit cognition has largely focused [102] on the study of **implicit bias** [103], sometimes referred to as "the thumbprint of the culture on our brain" [104], and it specifically refers to unconscious mental associations towards certain groups of people based on their social identity (e.g., race, gender, age). These biases often reflect negative stereotypes and prejudices (e.g., gender stereotypes). They can manifest in subtle behaviours and decisions that disadvantage or advantage certain groups, particularly if the individual is unaware of his/her bias [105]. Various factors like personal experiences, societal messages and cultural norms contribute to the development and expression of implicit biases. Because implicit biases are unavoidably acquired from the cultural atmosphere in which one is immersed daily, an individual might explicitly disagree with some of his unconscious biases, but these biases might still influence some of his decisions and behaviours [106].

Numerous studies investigated implicit bias in organizations [107]. Studies examined how specific cultural characteristics, like power dynamics, communication styles, and homogeneity, influence implicit bias expression and decision-making within organizations. Organizational culture has been shown to play a critical role in shaping and amplifying implicit biases, impacting employee experiences and organizational outcomes. Cultural factors like homogeneity, lack of diversity and inclusion initiatives and adherence to rigid norms can create fertile ground for these biases to flourish [108]. This can explain why several major companies like Google, Starbucks or Facebook (now Meta) have implemented implicit bias training to promote an inclusive organizational culture [109]. By fostering awareness and challenging stereotypical assumptions, organizations try to create a fairer environment where individuals are evaluated based on their contributions rather than unconscious prejudices [110]. Recent meta-analyses show that implicit bias trainings have some potential for reducing these biases, but their impact on explicit bias and behaviour change is less clear and depends on various factors [111]. Employees need to be intrinsically motivated to change (and not only externally motivated to validate some credits for instance) and the coaches that deliver these trainings need to have good interpersonal skills to build rapport with coworkers and clients. These trainings are all the more effective because they follow good teaching practices such as having clear educational goals adapted to the audience (e.g., increasing knowledge, increasing behavioural applications of knowledge and/or increasing motivation to apply knowledge) and using active learning strategies over long enough training duration [112].

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102. Research on implicit cognition is not limited to the study of implicit bias as it concerns the study of implicit mental associations in general (e.g., beliefs, values, evaluations).
103. Banaji and Greenwald 2013; Gawronski, 2019.
104. Banaji and Greenwald, 2013.
105. Oswald et al., 2013.
106. Greenwald et al., 2022.
107. Coe et al. 2019; Greenwald et al., 2022.
108. Dobbin and Kalev 2016.
109. Dobbin and Kalev 2016; Kim and Roberson 2022.
110. Kim and Roberson 2022.
111. Forscher et al., 2019; Paluck et al., 2021.
112. Lai et al., 2023.

When it comes to other aspects of organizational culture beyond inclusivity such as promoting a customer-oriented or innovation culture, the role of implicit cognition has been largely neglected. This is also true for the study of pro-environmental organizational culture. Yet implicit environmental values, preferences or beliefs of employees should significantly influence employee behaviours [113]. This is particularly the case because, like for social prejudices and stereotypes that are the focus of implicit bias, environmental issues are often linked to moral and ethical issues [114]. For instance, Mazutis et al. (2017) suggest considering climate change as a moral issue "***whereby one's actions, when freely performed, may either harm or benefit others or infringe on another's rights***" thus arguing that businesses' reaction or inaction to climate change is a moral issue. This is also consistent with the fact that climate change is not only considered a natural science issue but increasingly a behavioural science issue. This is aligned with researchers in many other disciplines like philosophy, environmental and social sciences, law, public policy, psychology and neuroscience stating that climate change is fundamentally a human and therefore, ethical, issue.

Looking at climate change and most environmental issues as moral and ethical helps understand the importance of individual characteristics and the way it determines one's sense of concern. Generally, such issues are felt immediately and viscerally upon their presentation and do not necessarily mobilize much cognitive effort to decide how to react. "Rather, issues with a high moral intensity trigger our moral reflexes about what is right and wrong [...] and they generally motivate some sort of action or response to the eliciting event" [115]. Some employees might also assume that firms exist to make profit and this might spontaneously appear in contradiction to making ecological efforts. Automatic and spontaneous pro-environmental values and beliefs of employees could thus be particularly diagnostic of pro-environmental behaviours within an organization.

Case study 3. Greenpeace vs chocolate? Mazutis et al. (2017), p.80-81.

"Simply reading about an injustice or seeing a photograph of a suffering child or animal heightens the moral intensity of the issue and can trigger feelings of anger, sympathy, or guilt. Because this mechanism is intuitive yet powerful, it is often used by NGOs to gain consumer support to boycott certain companies or products. For example, in a viral media campaign in 2010, Greenpeace successfully heightened the moral intensity of palm oil production by showing a man eating a bleeding orang-utan finger rather than a KitKat to trigger the sensation of disgust and guilt in the chocolate's consumers and hoping to incite action against deforestation."

113. Beattie and McGuire, 2012, 2015; Beattie and Sale, 2011; Thomas and Walker, 2016.
114. Greenwald et al. 2009.
115. Haidt, 2003.

Outside of the organizational domain, several studies confirmed that implicit measures of pro-environmental attitudes and values are useful to better understand environmental topics. Some studies investigated implicit attitudes toward nature [116], implicit biospheric values [117] or implicit attitudes toward environmentally friendly products [118]. As aforementioned, Beattie and Sale found that, when people are constrained by time during shopping, it is only the implicit attitude toward low carbon footprint products (not the explicit one) that explains the choice of these products. With a similar measure of implicit attitude toward low carbon footprint products, Beattie and McGuire (2012) found, using eye tracking, that only implicit attitudes predicted whether carbon footprint information on products was attended first or not. Similarly, Beattie and McGuire (2015) found a correlation between implicit attitude and how people focus their attention on iconic images of environmental damage and climate change. As a last example, implicit biospheric values were found to be a unique predictor of environmentalist status of a person even after controlling for explicit values and attitudes [119].

THESE EXAMPLES SUGGEST HOW STRONG IMPLICIT VALUES ARE AND THUS, THAT CONSIDERING IMPLICIT EMPLOYEE COGNITION TOWARDS ENVIRONMENTAL ISSUES COULD HELP TO FOSTER A PRO-ENVIRONMENTAL ORGANIZATIONAL CULTURE.

To assess implicit values, preferences or beliefs researchers should use implicit measures by opposition to explicit, self-reported and declarative measures typically used in questionnaires. Implicit measures are defined as the «outcomes of measurement procedures that are caused in an automatic manner by psychological attributes» [120]. Implicit measures typically use computer-based tasks that are designed to be automatic and measure reaction times or categorization accuracy as individuals respond to stimuli. The most used implicit measure is the Implicit Association Test (IAT) [121], but many measures were developed, and the choice of the measure should not only be based on its psychometric proprieties but also on some inherent feature of each measure like its relative or absolute nature [122]. While some qualitative techniques (e.g., semi-directive interview) sometimes pursue the same goal of assessing deeply rooted values, they are not considered part of implicit measures as the results of such interviews depends on the interviewer interpretation, while implicit measures results should not.

While assessing implicit employee cognition towards environmental issues represents a first necessary step to be able to adequately diagnose a company pro-environmental organizational culture, a second step is to propose activities, training, or implement organizational changes to improve or reinforce the implicit pro-environmental orientation of employees. Several recent academic research in social sciences concerning the modification of implicit associations provide insights about how to improve and/or reinforce implicit pro-environmental orientation at the individual level [123].

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116. Schultz, Shriver, Tabanico, and Khazian, 2004.
117. Thomas and Walker, 2014.
118. Beattie and McGuire, 2012, 2015; Beattie and Sale, 2011; Panzone, Hilton, Sale, & Cohen, 2016.
119. Thomas and Walker, 2014.
120. Greenwald et al. 2018.
121. Greenwald et al. 1998.
122. Van Dessel et al., 2020; for a review about their use in organizational research see Uhlmann et al., 2012.
123. Forscher et al., 2019; Forscher et al., 2017; Kurdi and Charlesworth 2023; Lai et al., 2014.

Importantly, **MOST OF THE STRATEGIES USED TO MODIFY IMPLICIT PREFERENCES OR BELIEFS THAT ARE EFFECTIVE IN THE SHORT TERM**[124] **ARE NOT EFFECTIVE IN THE LONGER TERM WHEN USED IN ISOLATION AND WITHOUT REPETITION**[125]**. EVEN ONE-DAY TRAINING SEMINARS, WHICH CAN CHANGE IMPLICIT BIASES IMMEDIATELY, ARE MOST OFTEN NOT EFFECTIVE IN THE LONG TERM**[126]. Furthermore, while it is possible to modify implicit beliefs and preferences quickly and sustainably, these cases are limited to new learning domains or to the use of extreme information or events (e.g., a traumatic experience) that are not applicable in organizations[127].

TO ACHIEVE A LASTING IMPROVEMENT IN IMPLICIT PREFERENCES AND BELIEFS, A FIRST STEP SHOULD BE TO MAKE PARTICIPANTS AWARE OF THEIR IMPLICIT PREFERENCES OR BELIEFS AND ALSO TO ENSURE THAT THEY HAVE A GOOD UNDERSTANDING OF THE ISSUES INVOLVED IN CHANGE AND ARE INTRINSICALLY MOTIVATED BY CHANGE[128]. Participants' awareness and motivation should be achieved through a clear explanation and appropriation of the personal and organizational stakes of change (educational phase), but also by taking an implicit test that measures implicit beliefs or preferences, followed by individual feedback on the results[129]. Most individuals are motivated to remove or improve some of their implicit associations, in the case of pro-environmental orientation they can be motivated to improve their implicit pro-environmental orientation, and providing feedback that is often not aligned with the image they have or wish to give of themselves, increases participants' intrinsic motivation[130].

After this first step, it appears important to use a combination of strategies over an extended period of time[131]. Several meta-analyses have examined the modification of implicit biases, or more generally implicit associations, and have identified effective (and ineffective) strategies for modifying these associations[132]. **AMONG INEFFECTIVE STRATEGIES, WE CAN CITE USING THREAT (PUTTING THE INTEGRITY OF A PERSON'S IDENTITY AT RISK), USING AFFIRMATION THAT INVOLVES PROCEDURES THAT SOUGHT TO MAINTAIN THE ADEQUACY OF A PERSON'S IDENTITY (E.G., BY GIVING POSITIVE FEEDBACK ABOUT WHAT ONE IS CURRENTLY DOING) AND USING EMOTIONS, POSITIVES OR NEGATIVES, NOT DIRECTLY RELATED TO THE TOPIC AT HAND (E.G., BY INDUCING SAD OR POSITIVE MOOD OR SPECIFIC EMOTIONS LIKE ANGER OR DISGUST)**.

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124. Lai et al., 2014; Röhner and Lai, 2021
125. Lai et al., 2016; Paluck et al., 2021
126. Lai and Lisnek 2023; Paluck et al., 2021.
127. Cone and Ferguson 2015; Cone, Flaharty and Ferguson 2021; Kurdi and Charlesworth 2023; Mann and Ferguson 2017.
128. Banaji and Greenwald, 2013; Carter et al. 2020; Devine et al., 2012; Forscher and Devine 2017; Forscher et al., 2017; Gawronski et al., 2020
129. Carter et al. 2020; Forscher and Devine 2017; Paluck et al. 2021.
130. Paluck et al. 2021.
131. Devine et al. 2012; Forscher et al. 2017; Paluck et al. 2021.
132. Forscher et al. 2019; Lai et al. 2014; Paluck et al. 2021.

Among possible strategies that could be implemented in the domain of pro-environmental culture we can cite the use of social norms and of mental imagery. Research has shown that making certain norms salient (e.g., making it explicit by stressing what a company is expecting or sometimes even rewarding) will increase individuals' motivation to go in the direction of the norm and will modify their implicit beliefs and preferences [133]. Consequently, if employees perceive that many people are strongly oriented toward the environment in their daily lives, they should tend to want to do the same, and this should improve their implicit pro-environmental orientation. Creating strong, positive mental images of a stimulus will favourably modify the associations that spontaneously come to mind about that stimulus [134]. These positive mental images will counter and replace pre-existing negative mental images in memory [135]. As such, circulating images that illustrate a positive aspect of pro-environmental orientation should create positive mental imagery and ultimately improve implicit pro-environmental orientation. Using imagery also enables to challenge existing stereotypical assumptions by stressing the use of images of environmentally friendly behaviours (e.g., travelling by train) and avoiding the use of images of non-environmentally friendly ones (e.g., travelling by plane) [136].

3. Critical review and implications

Corporate sustainability has received increasing attention worldwide for several decades. It is widely admitted that firms need to develop their abilities to play a more significant role in achieving sustainable development goals through the adoption of sustainability activities ensuring economic progress to become sustainable.

In the literature reviewed in this paper, organizational culture appears to be one of the essential drivers of enhancing firm's sustainability performance while also potentially affecting it negatively by hampering changes at operational and managerial levels. For instance, organizational culture can prevent firms from transforming manufacturing and supply chain processes or from redesigning products because of strong beliefs about established customer preferences. Looking more specifically at environmental issues, the concept of pro-environmental organizational culture has emerged during the last 10 years. Researchers from various disciplines acknowledge its importance in promoting sustainability principles, encouraging practices and behaviours that meet the needs of the present without compromising the ability of future generations to meet their own needs. Hence, relying mostly on Schein's model of corporate culture, extant literature focuses on studying organizational culture's specific attributes that are favourable to pro-environmental practices and their relationships with the achievement of sustainable environmental goals. As a result, generic internal attributes of organizational culture like ethical leadership, green human resource management practices, relational ties with targeted external communities or top management commitment and transparency appear to be important levers for sharing expected behaviours about the preservation of the environment and influencing members of the firm.

133. Forscher et al. 2019; Sechrist and Stangor, 2001; Wyer, 2010.
134. Blair, Ma and Lenton 2001; Forscher et al. 2019; Markland et al. 2015; Martin et al. 2011; Trendel, Mazodier and Vohs 2018.
135 Trendel, Mazodier and Vohs 2018.
136. https://www.epe-asso.org/representations-des-modes-de-vie-et-transition-ecologique-novembre-2021/

However, limitations are identified and require further research among which is the imperative to better take into account implicit cognition and the way it shapes the underlying assumptions of individuals while considering pro-environmental initiatives. Actually, empirical observations show that even the most engaged firms in the preservation of the environment (that is to say firms declaring changes in their mission, values and norms and translating them into concrete initiatives) are not delivering on their sustainable objectives. Merely adopting new practices and strategic principles is not enough. One major reason lies into the lack of sustained commitment of employees towards sustainable development. This raises at least three issues related to implicit cognition.

First limitation: an inadequate qualification and measurement of pro-environmental organizational culture prevents firms from appropriately understanding how corporate culture attributes enhance or hamper sustainability performance. The most invisible dimension of organizational culture, i.e. the underlying assumptions of individuals, may have a major impact on sustainability performance. The way pro-environmental organizational culture is qualified and measured does not reflect the realities of how individuals feel, think and behave while confronted to the adoption of green practices. Relying on artefacts, documents and declarations is not sufficient since people may rationalize their answers to cope with their firm's expectations and researchers may suffer themselves from their own interpretation biases. Hence, theoretical approximation due to focusing on visible attributes of organizational culture thus ignoring implicit cognition effects is not suitable to understand how corporate culture may enhance sustainability performance. For instance, employees may declare that using devices for recycling waste is a good initiative aligned with environmental corporate strategy. However, such declaration does not ensure that they implement changes in their behaviours in favour of recycling.

It is therefore essential to raise awareness about the gaps between explicit and implicit cognition to try to understand why individuals behave in certain ways due to their implicit cognition. This requires first to detect such gaps and then to understand individual values driving environmental behaviours. The literature review related to individual values underlines that it is a multi-dimensional concept depending upon internal and external factors, with the social context of each person making it difficult to understand individual priorities. Going further into addressing individuals values, there might be individual biases and differences in the way each member of a group interpret pro-environmental initiatives so that even the same declaration by people may not have the same meaning and the same value. This calls for fostering the qualitative expression of value with the objective to enhance a collective understanding and to co-create a common language to describe environmental initiatives.

Related to this is value diversity, also hardly addressed in the literature. **THE DIVERSITY OF INDIVIDUAL VALUES WITHIN AN ORGANIZATION MIGHT BE A SOURCE OF TENSION BLOCKING CHANGES AT THE COLLECTIVE AND ORGANIZATIONAL LEVEL**. Kent et al. (2019) suggests that value diversity is crucial to develop a pro-environmental organizational culture provided that conceptual framework help navigate value diversity and areas of tensions between individual versus collective values, social vs relational values, static vs changeable values,

held vs constructed values. Thinking of value diversity raises the issue of internal versus external factors of influence in promoting a pro-environmental organizational culture. Individual values are shaped outside the organization through processes that start at the earlier stages of education. As depicted previously, people might be reluctant to behave as expected by their organization because of a misalignment with the values of their own social community. Interestingly, research has shown that cognitive dissonance (e.g., dissonance between at work and at home pro-environmental practices) only changes explicit but not implicit attitudes [137]. Hence, even if an organization is able to alter the explicit pro-environmental values and beliefs of its employees, this might not be the case at an implicit level for employees that experience a cognitive dissonance between what is expected and done at work and in other contexts. This interaction between external and internal elements of pro-environmental culture is hardly evoked in the literature even though it is taken for granted that environmental issues are systemic by nature, embedding macro, meso and micro-level phenomenon at the organizational, collective and individual levels. The same question of internal versus external influence applies between different firms within the same ecosystem: the image of the firm shared by customers or by partners might be very important in the way the members of the firm behave. In the same vein, Hofstede (1991) in his work on national cultures explains that organizations have a broader commitment to social responsibility through external ecosystems of stakeholders that shapes their internal culture. Connecting research on pro-environmental organizational culture with transitions theories and system innovation dealing with institutional change, co-evolutionary approaches to innovation, path-dependency and lock-in mechanisms could bring insights about how to enable the development of more pro-environmental cultures in firms.

Second limitation: the valuation of pro-environmental initiatives by firm members is not addressed

Another reason why firms' environmental initiatives might not be adopted lies in the way individuals value initiatives themselves. Their intrinsic value might be positive however, as soon as people think about instigating changes in their own practices, they might find it difficult to relate the initiatives to their own values thus making the initiatives not worth adopting. This eventuality should be further explored by mobilizing the literature on the adoption of innovation. In particular, the perceived value of new proposals by its potential users plays a mediating effect on their intention to adopt the new proposal. The same may apply when it comes to adopting green initiatives in an organization. Instead of valuing the initiatives with a corporate model in mind, people may rely on their own individual criteria, coming from their social context, personal traits and past experience thus resulting in a different valuation. **COLLECTING INDIVIDUAL PERCEPTIONS ABOUT ENVIRONMENTAL INITIATIVES AND CONVERTING THEM INTO INDIVIDUAL AND COLLECTIVE VALUES MIGHT BE REQUIRED TO SUCCEED IN INSTIGATING CHANGE INTO ORGANIZATIONAL CULTURE. IT WOULD ENABLE THE IDENTIFICATION OF THE PRO-ENVIRONMENTAL CULTURE ATTRIBUTES THAT INDIVIDUALS MAY VALUE MOST IN RELATION WITH A GIVEN INITIATIVE.**

137. Festinger, 1957; Gawronski and Strack, 2004.

For example, reducing toxic waste through improved recycling processes might be related to reducing environmental pollution for people living around the plants or to improving worker's health for certain employees and their families. These two potential environmental benefits are intrinsically related to each individual's social context and values. Two collaborators of the same firm may rely on different criteria to assess the same initiative, without being aware of it thus preventing them from understanding their divergence. These different value attributes can be reflected into norms and stories to be shared with others. Depending on the individuals and what values they prioritize, the valuation of the same initiative by different employees might differ significantly. This is why value and valuation diversity are crucial to evaluate. It could mean, for example, that different lenses may apply in the way people value environmental initiatives. Understanding the reasons why individuals value pro-environmental proposals in different ways depending on their social value lenses could act as a lever of change at the collective level. The explicit formulation of different social lenses will help to develop an understanding of how words and expressions about the preservation of the environment might hold different meanings, and which value criteria apply in the valuation mechanisms. This raises the question of communicating and promoting environmental initiatives in a convincing way so that most collaborators would better perceive their benefits and develop their intention to adopt new practices and behaviours. Beyond the formulation of key messages relying on an appropriate language (reflecting collaborators' valuation criteria), the identification of individuals willing and able to transmit these messages in favour of change remains unexplored.

Third limitation: the value integration model of new practices into business operations is unclear

One argument to explain why even the most engaged firms do not deliver on their environmental objectives refers to a kind of divergence about time horizon. For business leaders, it is too early to expect visible impact on climate change whereas for climate change leaders, firms are too slow in transforming themselves. **QUESTIONING TIME HORIZON IS QUITE RELEVANT AND NEW FOR OVERCOMING SHORT-TERM MICRO VERSUS LONG-TERM MACRO PERSPECTIVES. IT IS ALSO USEFUL TO DIG INTO HOW TO CHANGE CULTURE STEP BY STEP AND HOW TO MEASURE CHANGES, ESPECIALLY AT THE INDIVIDUAL LEVEL, IN A WAY THAT WOULD ENABLE FIRMS TO ADJUST THEIR STRATEGIES**. Some researchers look at how to shift to a more pro-environmental organizational culture through a mix of bottom-up and top-down and planned vs emergent approaches. As suggested by Gorzelany et al. (2021), there is ***"a research gap to find connections between organisational culture and innovativeness in higher education institution"*** [138]. Kenter et al. (2019) state that the transformational model of organizational culture is unknown. Since there might be strong individual barriers coming from value tensions, there is a great deal of chance that implementing change initiatives is finally not successful. Many initiatives for enhancing pro-environmental organizational culture are proposed in the literature. However, they are disconnected from their integration into practices.

138. https://doi.org/10.1371/journal.pone.0257962 p.3.

These initiatives often require changes in the way things are done, otherwise they might not be effective. However, specifying whether it requires emergent or planned approach and whether it amounts to continuous evolution or to radical change is not adequately addressed.

It is noteworthy that most researchers dealing with ecological transitions seem to take the continuous nature of environmental change for granted, where both planned and emergent actions should take place. While this may allow ways to trace and rationalize changes in organizational culture to align with established market and environmental conditions, however, the process might be much more complex and ongoing than what is described. To support meaningful culture change, it is beneficial to define at the outset the problem and to identify what can and what should be done in a given time horizon, considering whether a radical or a continuous change is required. This process is about leaders' vision and dependence on stakeholder short-term expected value. The way the leaders perceive the required change - and the way they are perceived by employees - will determine the chosen pathway and the allocation of resources, such as promoting environmental innovation or hiring more CSR specialists. Most researchers on sustainable business models consider implementation as a radical innovation project. **THERE ARE EMERGING SIGNS IN THE LITERATURE THAT CURRENT KNOWLEDGE IS FAR TOO « COLD », MEANING THAT APPROACHES ARE MECHANISTIC, LEAVING APART EMOTIONAL AND SUBJECTIVE INPUTS. THE ABSENCE OF EXPLICIT FRAMEWORK OF CHANGE PREVENTS LEADERS FROM BUILDING APPROPRIATE STRATEGIC VISION TO ENGAGE CULTURAL CHANGE. THIS IS PROBABLY ONE OF THE MOST IMPORTANT DRIVERS OF NON-CHANGE (IN THE FORM OF CONTINUITY OR INERTIA) IN ORGANIZATIONS** – with the lack of appropriate measures to monitor change. As a consequence of the absence of planning actions to enhancing a pro-environmental organizational culture, measuring and monitoring the necessary cultural transformation in relation to concrete initiatives is absent, as well as emotional regulation practices to cope with tensions. So far, research does not provide firms with actionable and robust foundations for action and integration of new environmental values and sustained behaviours in their operational processes and practices.

Conclusion

The major implications of this literature review are twofold.

First, there is a call for complementary research methodologies, inspired by Simon's Sciences of Artificials. As stated by Dimov and al. (2022), « ***Human systems make an exclusively scientific approach inadequate for studying and improving them. Research informed by design science can effectively address human systems and practices, by engaging in both creative design and scientific validation as complementary and equivalent research activities.*** » This means that practically, managers should engage into organizational and business experiments, in close interaction with employees and external stakeholders, in order to learn which and how to instigate new pro-environmental practices and behaviours. Such approaches are not common in the management communities except in certain innovation unit. This leads to a second managerial implication to disintegrate the silos of CSR, HR and innovation functions.

The next implication is the necessity to understand the role of cognitive biases rather than underestimate their importance which is more than common in business and management communities. These disciplines are mostly "cold and mechanistic", far from considering the regulation of emotions as part of the job. However, there are many potential mitigation strategies to foster a pro-environmental organizational culture, relying on individual change agents within organizations to tackle hidden human causes of inertia that lie within cognitive biases. Through practices like bringing awareness to one's own ecological, social and economic implicit biases, engaging individuals in perspective-taking exercises or launching structured training programs specifically targeting implicit biases, observing how employees' viewpoints influence their attitudes and behaviours in a variety of settings is of utmost importance.

Firms entering field observations of the adoption and integration of their pro-environmental initiatives thus capturing value perception and tensions would:

(1) Better understand the dynamics of internalisation and socialisation processes in favour of pro-environmental organizational culture,

(2) identify triggers of pro-environmental value-changes and levers of changes and relate them to the attributes of their organizational culture;

(3) Shed light on crucial areas of conflict where specific attention is required,

(4) be able to foster the co-creation of specific shared languages dealing with new ecological issues that would be more reflective of individual and relational perspectives, drawing on multiple value lenses. Such new language may consist in logos and images or new wordings to describe pro-environmental initiatives at the firm level. For example,

a group of MBA students actively involved in defining the value proposition of a self-energy consumption initiative suggested a new wording: rather than talking about calculation of energy gains, they suggested to highlight the "free-of-hurdles" value of the initiative since calculation of energy gains is not what provides value to users. Rather, the value comes from helping people implement new practices in their own context, removing hurdles of complexity.

Bridging together sustainable mindset shift, design science and attention to cognitive biases can provide researchers with highly valuable data linking practical initiatives with new behaviours and practitioners with valid and actionable transformational models. The methodological approach could focus on developing a measurement tool used at the individual and collective levels over long periods of time to monitor the performance of ways of forming pro-environmental organizational culture. Mazutis et al. (2017) formally suggest that "***exactly quantifying the exact proportion of decisions that are affected by these biases***" [139] would be very useful however impossible. A way to cope with this could be to focus on dynamics of change, including evolution of implicit cognition as suggested in the second part of this chapter. This would also enable the identification of actions worth taking together to shape pro-environmental organizational culture, taking into account internal and external conditions.

139. https://doi.org/10.1177/0008125617707974 p.102.

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Beyond data: the role of mindsets in closing the climate financing gap

Ch.6

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Introduction

It is now scientifically accepted that climate change is a threat to human well-being and planetary health, and that the window of opportunity to secure a liveable and sustainable future for all species is rapidly closing. The goal of the Paris Agreement to "limit global warming to well below 2°C and pursue efforts to limit the temperature increase to 1.5°C compared to the pre-industrial age" requires escalated action and prioritisation by governments, businesses, investors and civil society [1]. Achieving the objective agreed in the Paris Agreement requires a whole economy transition, where all businesses and investors will have to adjust their business models, develop credible plans for the transition and more importantly, implement them [2].

There is a minor yet growing recognition within the financial sector of the need for action to redress the imbalances in the global ecosystem, with a raft of collaborative initiatives emerging to target various social, environmental and climate change issues. Many institutional investors have pledged their public support and made commitments to achieve net zero by 2050 across their investment decision making processes, yet the gap between commitment and the level of climate finance that is being allocated to mitigation and adaptation activities remains wide. Some of the challenges to acting have been widely debated and often cited, such as lack of consistent signals from government policy makers on climate change, the need to upscale new technology advances, a lack of suitable investable opportunities or lack of data, models, or suitable metrics.

These insights have propelled several industry developments and regulatory reform efforts that focus on fulfilling 'informational' needs, such as best practice processes, developing new data, tools and metrics in the hope that knowledge and information will propel investors to act. Indeed, the FSB's Task Force on Climate-related Financial Disclosures' (TCFD) recommendations and the Network for Greening the Financial System efforts go to the heart of the lack of data and metrics and provide a useful framework for regulators, companies and investors to move forward on their actions and disclosure in relation to climate change.

1. WMO, 2023
2 Carney 2020

However, there are additional obstacles to investor action on climate change beyond those most cited external conditions, and these relate specifically to investor behaviour itself ('inner' conditions). Putting it another way, **THE ASSUMPTION THAT IF DECISION MAKERS 'HAVE INFORMATION, WILL ACT' IS STILL PREDICATED ON THE ASSUMPTION OF RATIONALITY, EVEN WHEN THERE IS CLEAR EVIDENCE THAT THIS IS NOT THE CASE, INCLUDING AMONG INVESTORS**. There is very little consideration or research on the inner conditions that influence institutional investor behaviour in relation to climate change, and the potential impact of mindsets, cognitive biases, and the psychological, social, and cultural underpinnings of these conditions.

This chapter reviews the literature related to both the external and internal barriers that impede change in terms of how the finance sector allocates capital to climate financing activities, as well as some of the conditions that are supporting and enabling change. The review examines the external conditions that influence behaviour, such as government policy, technological developments, as well as emerging industry and regulatory standards. These conditions are the most widely cited and discussed factors in the literature and indeed, amongst policy makers and industry regulators.

In contrast, the internal conditions that influence investor behaviour in the context of climate change are often overlooked or under-examined. **THESE INCLUDE, BUT ARE NOT LIMITED TO, THE CONNECTION BETWEEN INVESTMENT BELIEFS AND A BROADER SENSE OF PURPOSE, THE LEVEL OF COMFORT IN MANAGING COMPLEXITY, SOCIAL AND PEER GROUP CONFORMITY PRESSURES, REFLECTION AND UTILISATION OF PERSONAL AGENCY, PREVAILING ORGANISATIONAL AND INDUSTRY CULTURE, PERCEIVED TENSION BETWEEN THE SHORT AND LONG-TERM, AND PERCEPTION OF RISK (SPECIFICALLY IN RELATION TO A FEAR OF FAILURE)**. The final part of the review considers the literature on mindsets, and the conditions that could support a mindset shift within the financial sector as a catalyst to close the climate financing gap with the urgency that is required.

The chapter is structured as follows:

1. Climate finance gap
2. Investor commitments and actions gap
3. External barriers to climate financing
4. Internal barriers to climate financing
5. Literature on behavior change through shifting mindsets
6. Conclusions, potential application, and implications.

1. Climate finance gap

Climate finance refers to local, national, or transnational financing—from public, private and alternative sources—that supports mitigation and adaptation actions that will address climate change. Climate finance is needed for mitigation because large-scale investments are required to significantly reduce emissions. Climate finance is equally important for adaptation, as significant financial resources are needed to adapt to the adverse effects and reduce the impacts of a changing climate. **A FINANCING GAP IS DEFINED AS THE DIFFERENCE BETWEEN CURRENT FLOWS AND AVERAGE NEEDS TO MEET THE LONG-TERM GOALS OF THE PARIS AGREEMENT (IPCC, 2023). ESTIMATES OF THE FINANCING GAP ARE UPDATED REGULARLY AS NEW DATA AND EVIDENCE EMERGES**.

As the OECD (2021) observed and has been arguing for some time now, institutional investors are a natural fit to help finance the transition and resilience to climate change, as they not only have a large pool of capital available to invest, but they also have a long-term time horizon that sees them often described as "patient capital" or long-term investors. This is not always the case as extreme market conditions and liquidity needs may occasionally lead to shorter time horizons, but in large part, institutional investors will have a longer time horizon than other private sector investors, such as corporations, commercial finance institutions or households/individuals. There are also domestic regulations in different jurisdictions that may limit investments into some markets and types of assets. Nevertheless, the role of institutional investors in financing the climate transition warrants further attention given their strong commitment to combat climate change, and the substantial pool of capital that they have available.

Songwe, Stern and Bhattacharya (2022) note that there is significant potential for private sector finance to increase, particularly given the fiscal constraints that many governments around the world are under. Institutional investors collectively manage more than USD $100 trillion of assets in the OECD countries, which is approximately 45% of the global capital markets as at end 2022[3]! It was also noted that while momentum is growing among mainstream investors, the level of private finance being mobilised today is "far too little and will have to increase many times over" (2022:9). Indeed, estimates by the Climate Policy Initiative (2022) indicate that **LESS THAN 1% OF INSTITUTIONAL ASSETS UNDER MANAGEMENT IN 2021 WITHIN THE OECD COUNTRIES WAS ALLOCATED TO CLIMATE MITIGATION AND ADAPTATION ACTIVITIES**, which is very low and not proportionate to the systemic risks posed by climate change. Institutional investors can thus play a pivotal role in closing the climate financing gap by increasing their capital allocation to climate mitigation and adaptation activities as a high priority[4].

3. OECD. (various). Global Pension Statistics, OECD Global Insurance Statistics and OECD Institutional Investors Statistics databases.
4. BloombergNEF. (2023). The Biodiversity Finance Factbook. A report published by BloombergNEF.

Mitigation financing gap: The IEA Net Zero Roadmap (2023) noted that to achieve net zero emissions by 2050, average annual investment in climate mitigation activities needs to increase to around US$4.5 trillion per year by 2030, an increase from around US$1.8 trillion per year in 2023.

- The IEA (2023) estimates indicate that private sources need to contribute around three quarters of the investment needed by 2030 in the NZE Scenario, an over threefold increase from current levels.

Adaptation financing gap: According to the UNEP Adaptation Gap Report (2023), annual climate adaptation investment needs in developing countries are estimated in the range of US$194–366 billion by 2030 and US$340–600 billion by 2050, with the IPCC (2023) reporting actual global public finance flows at $US21 billion in 2021.

- Based on this assessment there is a significant and growing adaptation financing gap, with an increase of between 10 and 18 times needed from the current levels, every year to 2030. It is also of concern that the adaptation finance gap continues to widen every year that the UNEP reports are published.
- Other studies by the OECD, World Bank and UNEP (2018) estimated the overall infrastructure investment needed to be $US6.9 trillion a year to 2030 to meet climate and development objectives, with an estimated investment gap of $US2.5-3 trillion per annum.
- Most of the adaptation needs are currently financed by the public sector, with very little contribution from the private sector.

The question is therefore: how can we, on the individual level, explain the gap in view of the pressing need and the depth of the crisis?

2. Investor commitments and actions gap

Examples of the commitments and the conditions that support behaviour change amongst investors with respect to climate change include, but are not limited to:

1. Collaboration to integrate ESG issues

2. Pledges to support international Net Zero by 2050 and the Sustainable Development Goals

3. Commitments to address biodiversity loss

4. Reporting in alignment with the TCFD recommendations

5. Supporting the development of sustainability taxonomies

6. Compliance with increased financial standards and regulations to promote sustainability; and

7. Supporting a wider interpretation of fiduciary duty.

As the review indicates, not all these changes have resulted in clear action or progress in terms of responding to climate change, which is leading to increased criticism and concern about the authenticity of some of these initiatives. Despite the raft of various initiatives and public commitments within the financial sector, the speed and scale of change that has resulted from these actions falls short of what is needed to address climate change in the time that we now have left, according to the scientific consensus [5]. Towards the end of the review, the gap between investor commitments and actions is highlighted in relation to greenwashing, and the persistence in the climate financing gap. This sets the foundation to further explore the barriers that may be slowing down action by investors, despite their commitments and the various initiatives that exist.

1. Collaboration to integrate ESG issues

The financial sector has become increasingly aware of how its activities impact on society and the environment. This has given rise to several industry-led developments and collaborative initiatives, including the UN-backed Principles for Responsible Investment (PRI), the international investor groups on climate change in different jurisdictions (Ceres, IIGCC, IGCC, AIGCC), the Carbon Disclosure Project, and the International Corporate Governance Network, to name a few. In 2006, the then United Nations Secretary-General, Kofi Annan invited a group of the world's largest institutional investors to join a process to develop the PRI, whose mission is defined as follows:

We believe that an economically efficient, sustainable global financial system is a necessity for long-term value creation. Such a system will reward long-term, responsible investment and benefit the environment and society as-a-whole.

The PRI will work to achieve this sustainable global financial system by encouraging adoption of the Principles and collaboration on their implementation; by fostering good governance, integrity and accountability; and by addressing obstacles to a sustainable financial system that lie within market practices, structures and regulation [6].

As part of the PRI's evolution, the terminology of Environmental, Social and Governance (ESG) emerged from a series of interactions between international sustainable investment specialists, and six Principles for Responsible Investment were created. There were 5,345 signatories (4,827 investors and 518 service providers) to the PRI on 31 March 2024, representing asset owners (pension funds, superannuation funds, insurance companies, charities and endowments), asset managers, and service providers with a combined US$121 trillion in assets under management. Signatories make a commitment to the PRI and agree to abide by the six principles which centre around integrating ESG into investment processes, examples of which are provided in **Figure 1**.

5. IPCC Sixth Assessment Report (2023) https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/
6. Source: PRI, www.unpri.org/about-us/about-the-pri

FIGURE 1: Examples of ESG issues

ESG ISSUE	EXAMPLES
Environmental (E)	Issues relating to the quality and functioning of the natural environment and natural systems. These include biodiversity loss; greenhouse gas (GHG) emissions, climate change, renewable energy, energy efficiency, air, water or resource depletion or pollution, waste management, stratospheric ozone depletion, changes in land use, ocean acidification and changes to the nitrogen and phosphorus cycles.
Social (S)	Issues relating to the rights, well-being and interests of people and communities. These include human rights, labour standards in the supply chain, child, slave and bonded labour, workplace health and safety, freedom of association and freedom of expression, human capital management and employee relations; diversity; relations with local communities, activities in conflict zones, health and access to medicine, HIV/AIDS, consumer protection; and controversial weapons.
Governance (G)	Issues relating to the governance of companies and other investee entities. In the listed equity context these include board structure, size, diversity, skills and independence, executive pay, shareholder rights, stakeholder interaction, disclosure of information, business ethics, bribery and corruption, internal controls and risk management, and, in general, issues dealing with the relationship between a company's management, its board, its shareholders and its other stakeholders. This category may also include matters of business strategy, encompassing both the implications of business strategy for environmental and social issues, and how the strategy is to be implemented[7].

7. Source: www.unnpri.org

2. Investor pledges on Net Zero by 2050 and the Sustainable Development Goals

There is increasing recognition that achieving the objective of the Paris Agreement and more fundamentally, a sustainable and manageable new human-ecology equilibrium requires an economy as a whole transition. **MORE THAN 5,000 COMPANIES AND 400 INVESTORS HAVE COMMITTED TO ACHIEVE NET ZERO BY 2050 BY ADJUSTING THEIR BUSINESS MODELS AND IMPLEMENTING CREDIBLE PLANS FOR THE TRANSITION TO A LOW-CARBON, CLIMATE-RESILIENT FUTURE** (UN Climate Change, 2022). Similarly, the 2030 Agenda for Sustainable Development adopted by all United Nations Member States in 2015, has been supported by hundreds of business leaders and financial institutions worldwide, as the SDGs provide the opportunity for the private sector to contribute to supporting a more sustainable, fair, and secure world.

3. Commitment to address biodiversity loss

Biodiversity loss has received much less attention from the financial sector than climate change. However, this is changing as the risks from biodiversity loss are increasingly being recognised. In 2021, participants in the financial sector launched an international initiative, the Taskforce on Nature-related Financial Disclosures (TFNFC, 2023). The aim was to develop a risk management and disclosure framework for organizations to report and act on evolving nature-related financial risks, similar to the TCFD framework for climate-related financial disclosure. Biodiversity is also attracting the attention of financial policymakers. In March 2022, the Network for Greening the Financial System published a statement (NGFS, 2023), acknowledging that biodiversity loss could lead to significant macroeconomic and financial stability risks.

The Task Force on Climate-related Financial Disclosures (TCFD) was established as an industry-led, multi-stakeholder process to improve financial disclosure around climate change including, but not limited to, an organisation's governance, strategy, risk management processes and utilisation of metrics/targets. The recommendations have received widespread attention, with more than 3,723 companies and 237 other organizations (e.g., industry associations, governments) with a combined market capitalization of $26 trillion (as reported in 2022). This includes over 1,500 financial institutions, responsible for assets of $220 trillion. In addition, as reported in 2022, 92 of the 100 largest public companies support the TCFD, report in line with the TCFD recommendations, or both (TCFD, 2022).

4. Emergence of sustainability taxonomies

Taxonomies are definitions that aim to provide a comprehensive set of criteria for classifying finance, lending, investment and underwriting activities as having certain sustainability attributes. They can be used for bond issuance, portfolio and product development, providing a framework for labelling financial products as sustainable and promoting transparency and disclosure. while definitions of sustainable finance are less ambitious in scope (OECD, 2020 and ASFI, 2022).

As the OECD observed, the potential benefits of sustainable finance definitions and taxonomies include:

- Improve market transparency, consistency and comparability about what sustainable finance is, and is not across different types of assets and jurisdictions.
- Reduce the risk of greenwashing by corporations and financial institutions by providing further clarity over classification of green and socially beneficial activities.
- Improve the confidence of retail investors to invest in sustainability-labelled funds or companies.
- Encourage financial institutions to allocate capital to sustainable activities, to demonstrate their commitment to achieving stated goals, such as the attainment of the SDGs by 2030, a Just Transition and Net Zero by 2050 (as examples).
- Improve tracking of sustainable finance flows and the financing gap, such that policy makers and regulatory bodies can design appropriate policy measures and incentives to divert capital to where it is most needed to achieve sustainable development and alignment with the goals of the Paris Agreement.

According to ASFI (2022), there are 12 international taxonomies and a further 15 under development – collectively representing more than 55% of global GDP. While most of the taxonomies focus on environmental issues ("green"), there are also some emerging classifications that focus on "social" issues in the EU and China.

5. Shift in financial regulators and standard setting bodies

ANOTHER FACTOR SUPPORTING CHANGE AMONGST INVESTORS ARE THOSE THAT THE INTERNATIONAL STANDARD SETTING BODIES, CENTRAL BANKS, PRUDENTIAL AND FINANCIAL REGULATORS ARE INTRODUCING TO SUPPORT DISCLOSURE AROUND THE MATERIAL CLIMATE-RELATED IMPACTS FOR THE ORGANISATIONS AND ENTITIES WITHIN THEIR JURISDICTIONS. Some highlights of note:

- While the TCFD remains a voluntary, market-led initiative, many governments and regulators are taking steps to require or encourage disclosures based on the TCFD recommendations. Over 120 regulators and governments from around the world are TCFD supporters, including Belgium, Canada, Chile, Denmark, France, Ireland, Japan, New Zealand, Sweden, and the United Kingdom (UK) [8].
- Central banks and supervisors from across the globe – through the Network for Greening the Financial System [9] – have encouraged companies issuing public debt or equity to disclose their investment practices and policies in alignment with the TCFD recommendations.

8. Task Force on Climate-related Financial Disclosures. (2022). TCFD Status Report: Task Force on Climate-related Financial Disclosures. https://www.fsb.org/2022/10/2022-tcfd-status-report-task-force-on-climate-related-financial-disclosures/
9. Banque de France. (2019). NGFS publications. https://www.ngfs.net/en/liste-chronologique/ngfs-publications.

- In November 2021, the International Financial Reporting Standards Foundation announced the establishment of the International Sustainability Standards Board (ISSB), with the aim to develop a comprehensive global baseline of sustainability disclosure standards to meet investors' information needs. In March 2022, the ISSB published two exposure drafts for consultation. One sets out general sustainability-related disclosure standards and the other specifies climate-related disclosure standards. Both exposure drafts build upon the TCFD recommendations, with the latter covering elements of all 11 recommended disclosures.
- The Financial Stability Board published a stocktake of whether and how financial authorities incorporate climate-related risks into their financial stability monitoring [10]. The FSB also stated its intention to conduct further work to assess the channels through which physical and transition risks could impact the financial system, and how they might interact.
- The UN Sustainable Stock Exchanges Initiatives launched a database that provides information on 78 stock exchanges that are taking actions to support enhancing climate- related financial disclosures in line with the TCFD recommendations in their markets. The most common action taken – by 50 stock exchanges – is providing TCFD training, followed by referencing the TCFD recommendations in the stock exchange's ESG disclosure guidance.
- In April 2022, the European Financial Reporting Advisory Group released the draft EU Sustainability Reporting Standards for public comment. The related disclosure requirements correspond to the pillars of the TCFD recommendations and ISSB standards.

While the emergence of international financial reporting standards that encompass climate change, environmental and social issues are an important building block to establish a consistent set of metrics for disclosure across the corporate and financial sectors – in reality, these developments have proven to be very slow and cumbersome to implement across the different jurisdictions. They are not delivering the change in the way the financial system values climate change risks and opportunities at the speed and scale that is required. We will explore later on why.

6. Wider interpretation of fiduciary duty

As industry standards evolve across the institutional investment community and financial regulators continue to develop guidelines and frameworks, the management of sustainability issues is seen as being essential to trustees' fiduciary duty to act in the best financial interest of members [11].

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10. Financial Standards Board. (2020). Stocktake of financial authorities' experience in including physical and transition climate risks as part of their financial stability monitoring. https://www.fsb.org/wp-content/uploads/P220720.pdf.
11. Ratajczak, Z., Collins, S. L., Blair, J. M., Koerner, S. E., Louthan, A. M., Smith, M. D., ... & Nippert, J. B. (2022). Reintroducing bison results in long-running and resilient increases in grassland diversity. Proceedings of the National Academy of Sciences, 119(36), e2210433119.

Fiduciary duties (or equivalent obligations) exist to ensure that those who manage other people's money act in the interests of the end beneficiaries, rather than serving their own interests. Insofar as sustainability issues carry material financial risks, Trustees need to consider these issues as a core part of fiduciary duty but do not systematically do so while changes can be noted. UNEP FI and the PRI published a report on the changing landscape of fiduciary duty in 2019[12]. The report specifically noted the need for ESG issues to be considered as part of the investment process and identified the potential for Trustees to come under greater scrutiny in terms of their capacity, competency, and professionalism in this regard (**Box 1**).

These first observations show that there are changes at the international level in this sector, related to the formal aspects but there are several weaknesses can be identified.

Box 1: Modern Fiduciary Duty

Fiduciary duties (or equivalent obligations) exist to ensure that those who manage other people's money act in the interests of beneficiaries, rather than serving their own interests. The most important of these duties are:

- **Loyalty** – Fiduciaries should:
  - Act honestly and in good faith in the interests of their beneficiaries or their clients.
  - Understand and incorporate into their decision-making the sustainability preferences of beneficiaries and/or clients, whether or not these preferences are financially material.
  - Impartially balance the conflicting interests of different beneficiaries and clients.
  - Avoid conflicts of interest.
  - Not act for the benefit of themselves or third parties.
- **Prudence** – Fiduciaries should act with due care, skill and diligence, investing as an 'ordinary prudent person' would. This includes:
  - Incorporating financially material ESG factors into their investment decision-making, consistent with the timeframe of the obligation.
  - Being an active owner, encouraging high standards of ESG performance in the companies or other entities in which they are invested.
  - Supporting the stability and resilience of the financial system.

Fiduciaries should disclose their investment approach to clients and/or beneficiaries including information on how preferences are incorporated into the investment strategy and the potential risks and benefits of doing so[13].

12. Ward, K. (2019). For wilderness or wildness? Decolonising rewilding. Rewilding, 34-54.
13. Source: PRI (2019a).

Considering the gaps between commitments and actions

WHILE ALL THESE EXAMPLES OF COMMITMENTS MADE BY INSTITUTIONAL INVESTORS ARE IMPORTANT STEPS TO CREATE THE FRAMEWORKS THAT SUPPORT CLIMATE ACTION, THEY ARE FOCUSED PRIMARILY ON ADDRESSING THE EXTERNAL CONDITIONS THAT INFLUENCE THE CORPORATE AND FINANCIAL SECTORS AS THEY CURRENTLY OPERATE – that is, information, data, metrics, standards, best practice, regulations, taxonomies, reporting, etc. There is little attention given to the internal conditions that might be slowing down behaviour change that no amount of data or information will address (Guyatt, 2023).

McDonnell et al (2022) argued that many of the investor initiatives are falling short of expectations due to:

1) a lack of internal accountability measures,

2) minimal transparency into their goals and timelines,

3) an unwillingness to take action that is sufficiently ambitious to achieve climate goals and an emergence of a multitude of initiatives with similar goals, which...

4) undermines the position of significant power and legitimacy that various initiatives occupy, and

5) a lack of consideration around the inner drivers behind decision making that often go unexamined and unquestioned.

It is not surprising therefore that alongside these observed changes to the industry standards and practices is the emergence of greenwashing and the persistence in the climate financing gap, indicating that there is a gap between the commitments being made at a higher level by investors, and how their investment decisions are made, and their capital is allocated.

Greenwashing

While there is positive momentum building amongst some financial institutions, there are also growing concerns of 'greenwashing' reverberating across the globe [14], from exaggerated claims of activities and outcomes.

MANY OF THE ANTIDOTES TO 'GREENWASHING' THAT ARE WIDELY DISCUSSED AND BEING ADOPTED INCLUDE TIGHTER REGULATIONS, PENALTIES, AUDITING AND CLEARER DEFINITIONS AND CLASSIFICATION OF SUSTAINABILITY ACTIVITIES. SUCH MEASURES ARE AIMED AT FOSTERING GREATER ALIGNMENT AND CONSISTENCY IN SUSTAINABILITY PRACTICES AND DISCLOSURES ACROSS ORGANIZATIONS AND JURISDICTIONS, WITH GREATER VISIBILITY AND POTENTIAL PENALTIES BEING THE 'STICK' THAT PREVENTS ORGANIZATIONS FROM PUBLICLY OVERSTATING THEIR ACHIEVEMENTS.

14. Powell, D. (2022). Wishing or washing? Green investment claims under spotlight. [online] The Sydney Morning Herald. https://www.smh.com.au/money/investing/wishing-or-washing-green-claims-under-spotlight-20220711-p5b0o8.html.

The problem of course is that even with enhanced reporting and auditing processes in place, it will be very difficult for regulators to keep up with the myriad ways that organizations could find to present themselves in a favorable light. The definitions of 'green' or 'sustainable' are still evolving and vary across regions, with some jurisdictions being more stringent than others. This makes comparability and reporting quite challenging for global financial institutions, even when sustainability taxonomies exist. Many of the initiatives that organizations publicly commit to, such as the SDGs or Net Zero by 2050, are aspirational initially with a significant time lag before any signs of progress or outcomes need to be demonstrated.

IT HAS BEEN ARGUED THAT IF THE 'STICK' TO COMBAT GREENWASHING IS TOO HEAVY HANDED, IT COULD HAVE THE PERVERSE EFFECT OF SLOWING DOWN PROGRESS AND ACTION, AS THERE IS A GREATER PERCEIVED RISK AROUND COMMUNICATION OF SUSTAINABILITY ACTIVITIES THAT CAUSES SOME ORGANIZATIONS TO QUIETLY WITHDRAW. THIS IS EMERGING AS THE SO-CALLED 'GREEN HUSHING' EFFECT, WHERE ORGANIZATIONS ARE GOING QUIETLY ON SUSTAINABILITY ISSUES, OR EVEN WITHDRAWING FROM INITIATIVES THAT THEY FEAR MIGHT PUT THE SPOTLIGHT TOO MUCH ON THEM[15].

The potential role of building the supporting inner conditions to reduce the risk of greenwashing is an emerging field that warrants greater attention given the public commitments that many institutional investors have made to respond to climate change. Some of the literature related to mindset shift and the supporting conditions to achieve that are reviewed in Section 4 of this chapter.

Section 1 summary

The financial sector has a key role to play in shifting the global economy towards a more sustainable trajectory. A growing number of international financial institutions are collaborating to integrate ESG issues into decision-making processes, align with the SDGs, support a 'just and fair' Net Zero by 2050, reduce habitat and biodiversity loss, and engage in relevant policy debates to help achieve these goals. These actions are being encouraged and reinforced by new industry standards and norms, industry collaborative initiatives, evolving reporting standards and regulatory requirements, to name a few. Despite these developments, there is also increased scrutiny on the potentially exaggerated claims made by some financial institutions with respect to climate change, with growing concern about greenwashing. Most importantly, the evidence shows that investors are not increasing their allocation of capital to mitigation and adaptation activities at the speed and scale that is in alignment with their public commitments.

15. Wilkes, T. (2023). Insurers' climate alliance loses nearly half its members after more quit. Reuters. https://www.reuters.com/ business/insurers-climate-alliance-loses-nearly-half-its-members- after-more-quit-2023-05-30/.

2. External barriers to climate financing

The OECD, the PRI, various climate change investor groups and industry bodies have explored some of the barriers to the finance sector increasing its allocation of capital to climate financing [16]. **THE MOST WIDELY CITED EXPLANATIONS TEND TO FALL INTO THE FOLLOWING CATEGORIES, ALL OF WHICH RELATE TO THE EXTERNAL ENVIRONMENT IN WHICH FINANCIAL INSTITUTIONS MAKE THEIR CAPITAL ALLOCATION DECISIONS**. These categories include (but are not limited to):

1. Inconsistent government policy
2. Lack of information
3. Lack of common definitions
4. Lack of expertise
5. Liquidity barriers
6. Market pricing
7. Difficulty with access

Some of the literature and evidence related to each of these barriers will now be reviewed. But as made evident in this IPBC report, other disciplines reach a similar conclusion: **NOT ENOUGH ATTENTION HAS BEEN PAID TO THE DEEP EFFECTS OF 'INTERNAL', 'SUBJECTIVE', DRIVERS OF CHANGE AND NON-CHANGE**.

16. Principles for Responsible Investment. (2022). Closing the funding gap: The case for ESG incorporation and sustainability outcomes in emerging markets. Published by the PRI. Available at: https://www.unpri.org/sustainable-development-goals/closing-the-funding-gap-the-case-for-esg-incorporation-and-sustainability-outcomes-in-emerging-markets/9430.article.
OECD. (2013). Financing Climate Change Action. An OECD publication. www.oecd.org/env/cc/financing.
OECD. (2015). Mobilising private investment in clean-energy infrastructure. An OECD publication. https://www.oecd.org/daf/inv/investment-policy/Private-investment-in-clean-energy-infrastructure.pdf.
IGCC. (2022). Making the Transition Happen: Investment policy for a net zero economy. An IGCC publication.
Bloomberg NEF. (2022). Mobilizing Capital into Emerging Markets and Developing Economies. Commissioned by GFANZ. https://assets.bbhub.io/professional/sites/24/Mobilizing-Capital-to-EMDEs.pdf.

1. Inconsistent government policy

One of the most common explanations for the lack of capital allocation to climate finance from the perspective of the financial sector and institutional investors, is the prevailing inconsistency in government policies. This is the starting point for most interactions and dialogue between investors and governments.

A good example to illustrate this is The Investor Agenda's Global Investor Statement (2024) to G20 leaders, which was signed by hundreds of international investors with more than US$29 trillion of assets under management, evidently a large and powerful network that has the potential to make a significant dent in closing the climate financing gap.

According to the letter presented to government leaders (drafted by the financial sector) investors are taking the following actions:

- Investors have made commitments to address environment-related financial risks in their portfolios, including both climate and nature
- Are seizing the growing opportunities associated with the net zero transition
- Many are making net-zero commitments
- Embedding science-based net zero goals and strategies into portfolio decisions
- Setting investment targets
- Laying out Investor Climate Action Plans
- Engaging companies to support them in their transition plans, and
- Urging governments to take robust action.

The letter urges governments to take further action on climate change, noting that"... to make this transition effectively and at the rate and scale necessary, markets must be conducive to private sector investment with the appropriate legal, policy, and regulatory conditions". The network also noted in its letter that:

Effective policies are essential at all levels of government to accelerate the private capital flows needed for a climate-resilient, nature-positive, just net zero transition. Therefore, we encourage a whole-of- government approach to implement policies in line with countries' nationally determined contributions (NDCs) and a 1.5°C scenario, recognizing common but differentiated responsibilities and respective capabilities between emerging and developed economies, which will accelerate private sector action and large-scale investment [17].

17. 2024 Global Investor Statement to Governments on the Climate Crisis, https://theinvestoragenda.org/wp-content/uploads/2024/08/2024-Global-Investor-Statement-to-Governments-on-the-Climate-Crisis.pdf, p.2.

There is evidence that government policies need enhancement and ongoing refinement to tackle the critical risks that climate change presents. However, **IF THE FINANCE SECTOR WAITS UNTIL ALL THESE POLICY REQUESTS ARE MET, THEN THE CLIMATE FINANCING GAP WILL REMAIN WIDE FOR SOME TIME, OR EVEN SO WIDE THAT IT MAY NOT BE CLOSABLE**. It is quite common for there to be inconsistencies in government policies on a range of issues (think of social welfare and taxation policies; global inequality and tax havens, for example); this need not be a reason for inaction on climate finance. **AS THE LITERATURE ON MINDSET SHIFT HIGHLIGHTS, INVESTORS HAVE OPTIONS AND ALTERNATIVE WAYS TO THINK ABOUT AND APPROACH THESE PERCEIVED BARRIERS AND TO INCREASE CAPITAL ALLOCATION WITHIN THE EMERGING (AND IMPERFECT) POLICY CONTEXT**.

2. Lack of information

Another prominent explanation put forward by the finance sector as a barrier to climate finance is the lack of information on the financial impact of climate change. Investors have long argued that the key to addressing the investment risks and opportunities associated with climate change is having accessible, reliable climate-related data to measure and analyse them.

The information gap was indeed one of the founding principles for establishing the TCFD and the recommendations for reporting and disclosure that continue to follow on from that process. **THIS ARGUMENT ABOUT THE LACK OF INFORMATION IS ALSO FOUND IN EVERY SECTOR OF TRANSITION EFFORTS, INCLUDING ADAPTATION TO CLIMATE CHANGE. YES, AGAIN, EVERY CHAPTER IN THIS REPORT ARGUE THAT THIS IS ENTIRELY TOO LIMITED TO EXPLAIN ACTION OR INACTION**. The TCFD concluded that more effective, clear, and consistent climate-related disclosure is needed from companies around the world. This includes:

- Information about the governance framework to oversee and manage climate impacts
- The long-term strategy with respect to managing and mitigating climate impacts
- The risk management processes that are used by an organization or entity to manage these impacts, and
- Information about a company or asset's metrics and targets that are used to assess and manage the financial impacts of climate change.

The TCFD's recommendations focused on improving the quantity, quality and comparability of climate-related disclosures, by developing a common framework across all regions and sectors of the global economy.

The rationale put forward by the convening group behind the TCFD (which was represented by corporations, insurance companies, banks, asset managers and asset owners) included:

- Market function – one of the essential functions of financial markets is to price risk to support informed, efficient capital-allocation decisions. Without the right climate policies and information about climate change, investors and others may incorrectly price or value assets, leading to a misallocation of capital.
- Complexity – the large-scale and complex nature of climate change makes it uniquely challenging, especially in the context of socioeconomic and political decision-making processes.
- Transparency – information is needed to help stakeholders to better understand the concentrations of carbon-related assets in the financial sector and the financial system's exposures to climate-related risks. Including regulators' exposures.
- Valuations – the concern that present asset valuations did not adequately factor in climate-related risks because of insufficient information.
- Investment decisions – the expectation that more information would promote more informed investment, credit, and insurance underwriting decisions.

By improving disclosure and increasing transparency, the rationale underpinning the TCFD recommendations was that investors, lenders and insurance underwriters would have adequate information on how companies are preparing for a lower carbon economy and be better equipped to value assets and make the necessary investments.

Since the TCFD recommendations were initially released in 2017, there has been an ongoing process of review and adoption of the recommendations around the world, with the TCFD framework becoming the new standard for financial reporting on climate impacts by companies and financial institutions. This has been reinforced by financial regulators, financial standard-setting bodies and central banks, and supported by governments in developed and emerging economies. The TCFD (2022) undertook an annual review of progress for 2022 which highlighted that:

- Disclosure has improved somewhat.
  - For fiscal year 2021 reporting, 80% of companies disclosed in line with at least one of the 11 recommended disclosures.
  - The percentage of companies disclosing the TCFD recommendations in financial filings or annual reports has increased; over 70% of companies implementing the TCFD recommendations disclosed climate-related information in financial filings or annual reports for fiscal year 2021 (compared to 45% for fiscal year 2017).

- The availability and quality of climate-related financial disclosures has increased since June 2017.
  - 95% of survey respondents saw an increase in the availability of climate-related financial disclosures since the release of the TCFD recommendations, with 88% of respondents citing improvements in the quality of disclosures.

- Investors and others use disclosures in decision-making and pricing.
  - Based on the TCFD survey, 90% of investors and other users incorporate climate-related financial disclosures in financial decision-making, and 66% of these indicated such disclosures factor into the way they price financial assets.
  - Over 615 investors with more than $60 trillion in assets under management committed to engage with the world's largest corporate greenhouse gas emitters to strengthen their climate-related disclosures by implementing the TCFD recommendations as part of Climate Action 100+.
  - Over 680 financial institutions with more than $130 trillion in assets have asked 10,000+ companies to disclose via CDP, which has aligned its questionnaires with the TCFD recommendations.
  - In addition, **THERE IS SOME EVIDENCE THAT CLIMATE-RELATED RISKS ARE BEGINNING TO AFFECT PRICES FOR CERTAIN TYPES OF ASSETS**[18].

18. Karydas, C. and Xepapadeas, A. (2022). Climate change financial risks: Implications for asset pricing and interest rates, Journal of Financial Stability, Volume 63, https://doi.org/10.1016/j.jfs.2022.101061.
Chava, Sudheer. 2014. "Environmental Externalities and Cost of Capital." Management Science 60, no. 9: 2223–2247.
Delis, Manthos D., Kathrin de Greiff, and Steven Ongena, (2019). "Being Stranded with Fossil Fuel Reserves? Climate Policy Risk and the Pricing of Bank Loans." EBRD Working Paper 231.
Goldsmith-Pinkham, Paul S., Matthew Gustafson, Ryan Lewis, and Michael Schwert. (2020). "Sea Level Rise Exposure and Municipal Bond Yields." Available at SSRN: 3478364.
Griffin, Paul A., et al. (2015). "Science and the Stock Market: Investors' Recognition of Unburnable Carbon." Energy Economics 52, part A: 1–12.
Painter, Marcus. (2020). "An Inconvenient Cost: The Effects of Climate Change on Municipal Bonds." Journal of Financial Economics 135, no. 2: 468–482.

Evidence of Climate Risks Impacting Asset Values

A comprehensive review and summary of evidence that climate related risks are impacting asset values was undertaken by Gorte and Donovan (2023) of Impax Asset Management. In that review, the authors summarised the growing body of evidence of the magnitude and timing of such effects, the highlights of which are summarised below:

1. **Lian & Moran** (2022) estimated that severe natural disasters have caused 2% average losses in GDP per capita in countries more vulnerable to them, and those losses persist for five years on average.
2. **Collender & Gan et al** (2022) found that countries with lower emissions have lower borrowing costs, all other things being equal, reflecting better management of transition risks.The yields on both municipal bonds and sovereign bonds show that investors are factoring in climate risks.
3. **Pankratz & Bauer et al**, (2022) found evidence to suggest that exposure to extreme heat has reduced companies' revenues and operating income in over 93 countries.
4. **Acharya & Johnson et al** (2022) found that heat stress can increase municipal bond yield spreads, making debt more expensive for cities that are more vulnerable to the impact of climate change.
5. **Sato & Gostlow et al** (2023) found evidence to show that climate litigation has reduced firms' market values by an average of 0.4%, exceeding 1.5% in some instances.
6. **Fitch Ratings** (2023) announced that almost one-fifth of global companies might see downgraded ratings by 2035 depending on their vulnerability to transition risks Fitch Ratings, 2023: Corporate Climate Vulnerability Scores Overview: Climate Vulnerability Scores Calculated for All Rated Non- Financial Corporates.
7. **Bauer & Huber et al** (2023) found that within the G7 nations, companies with lower-emissions have provided better returns for their investors than high-emissions companies over much of the past decade.
8. **Lin & Shi** (2023) examined R&D and found evidence of a "sustainable and gradual growth effect", signalling that markets and companies regard the low-carbon transition as a long-term value driver.
9. **Sautner & van Lent** (2023) examined earnings calls and found information on exposures to climate change is used for pricing in options and equity markets.

This seems to indicate that progress has been made. Information availability on climate impacts has increased, and it seems that investors are increasingly using this information to engage further with companies. There is also growing evidence that climate change is impacting on asset valuations, reaffirming the need for investors to incorporate climate impacts into their investment and capital allocation processes.

The industry identified lack of information as a barrier to increasing capital allocation to climate mitigation and adaptation, whereby more information would reportedly lead to better valuation frameworks and increased financial flows. Despite this improvement in information, there is strong evidence suggesting that the climate finance gap remains wide and the allocation of capital by institutional investors is miniscule in terms of their assets under management. The increased flow of information has not increased investor's capital allocation to climate finance.

It is possible that while the climate-related financial information has improved, other factors are holding investors back in terms of how they interpret that information and how it is used. In other words, **IT IS NOT ONLY THE INFORMATION THAT MATTERS, BUT HOW PEOPLE INTERPRET (FI THEY DO) AND USE (OR NOT USE OR MISUSE) THAT INFORMATION**. The literature on inner conditions and mindset shift explores these barriers and enablers of change and provide answers (cf. below).

3. Lack of common definitions

The next obstacle to capital allocation that the financial sector has spent a great deal of time trying to solve over recent years is **THE LACK OF COMMON DEFINITIONS WHEN IT COMES TO CLASSIFYING WHAT IS A CLIMATE MITIGATION / ADAPTATION ACTIVITY**. This closely relates to the TCFD quest for information, but in this case the policy makers, regulators, corporations, and financial sector are seeking clarity on how to define sustainable economic activities.

The most prominent of these efforts has been the development of a taxonomy on sustainability in the EU that commenced in 2017 and is ongoing, with other countries following suit with a similar quest to define and categorise activities in this way. Some of the taxonomies are focused on narrowly defining 'green' assets, others have a broader sustainability focus. But invariably climate mitigation and adaptation activities are an important component of the 20+ taxonomies that exist or are under development. The rationale for such activities is various, with the EU (2023) and ASFI (2023) explaining that taxonomies:

- Provide a set of common definitions for sustainable economic activities, which can be used to define sustainable investments.
- Provide companies, investors, and policymakers with definitions for which economic activities can be considered environmentally sustainable.

- Provide confidence and assurance for investors.
- Enable comparability between Investment products and portfolios to help protect private investors from greenwashing.
- Help companies to become more transparent in disclosing their activities.
- Shift investments are most needed to support the achievement of climate, environmental and social objectives.

Globally, they offer a stable and common language and conditions for various actors, thus reducing the uncertainty and variability issues. It is thus anticipated that a taxonomy would (inter alia) help to improve the financial analysis of climate-related impacts, shifting capital to where it is most needed, which would include closing the climate financing gap. This outcome sits alongside other objectives as set out, nevertheless, it is one of the often-cited reasons why a taxonomy or set of common definitions is needed. However, there are some red flags to consider regarding how much impact taxonomies and common definitions are having on capital flows into climate finance activities.

THE FIRST RED FLAG IS THE TIME INTENSIVE AND LABORIOUS PROCESS THAT IS INVOLVED IN NEGOTIATING A SUSTAINABILITY TAXONOMY AND SET OF COMMON DEFINITIONS THAT CAN BE APPLIED WITHIN EACH JURISDICTION. For example, the EU taxonomy took more than 3 years from when discussions commenced to publication of the taxonomy regulation that set out the high-level goals and scope of developing a taxonomy (in 2020), and a further 2 years before a first delegated act of listed activities was published (in 2022). There were thousands of hours of meetings, analysis and research that went on in that time, and the negotiation process became quite heated on some topics (on the treatment of gas and nuclear as transition assets, in other jurisdictions there will be different sensitivities depending on the industry base of the country) [19].

What this means is that the dozen or so countries that are now just starting their journey to negotiate a taxonomy in their jurisdictions could agree and codify a taxonomy by 2025 at the earliest (if we assume that the process in other countries runs quicker than the EU, perhaps learning from the EU process). Given that one of the goals underpinning the taxonomy is to close the climate financing gap by 2030, this leaves a very short window of time for investors to escalate their capital allocation decisions (maximum of five years!). **IT ALSO RUNS THE RISK THAT INVESTORS MIGHT DECIDE TO WAIT UNTIL THE TAXONOMIES ARE AGREED UPON AND PUBLISHED, BEFORE PRIORITISING THE ALLOCATION OF CAPITAL TO CLIMATE FINANCE**, which would mean the taxonomy process brings the unintended consequence of delaying investment decisions that need to be addressed with urgency.

19. S&P Global. (2022). What the inclusion of gas and nuclear in the EU taxonomy could mean for investors and asset managers. An article published by S&P Global. www.spglobal.com.

A second red flag is **THE LACK OF COMMON DEFINITIONS THAT ARE EMERGING ACROSS JURISDICTIONS**. The industry and policy makers started out with the goal to agree common definitions to allow for comparability and consistency, yet already we are seeing that each region and country is developing their own unique set of definitions, to reflect the local context and industries in their jurisdictions. This lack of common definition undermines the usefulness of taxonomies for capital allocation purposes at the global level, as it means that each company and asset will disclose its activities in alignment with the definitions that prevail in each of the jurisdictions that they operate in. In a globalised world, this will make it very difficult for investors (or any agent for that matter) to aggregate what this means in terms of transition and adaptation activities, which was one of the fundamental reasons for developing a taxonomy in the first place. It is for this reason that the EU established the International Platform on Sustainable Finance, of which one of its activities is to find common ground in the prevailing sustainable taxonomies between the EU and China. A summary of this work was released [20], but it has not been validated by any country nor used as a common set of definitions. It is unclear how this work will progress in the future, but for now, it is fair to conclude that it has had very little impact in terms of mobilising private sector finance.

A third red flag is **THE POTENTIAL FOR SELF-INTEREST AND CORPORATE / ECONOMIC INTERFERENCE TO WATER-DOWN THE DEFINITIONS WITHIN EACH JURISDICTION**. As we have seen from the EU process, there is a risk that the taxonomy negotiation process becomes heavily influenced by industry and economic interests, rather than being based on the widely accepted IPCC's body of scientific evidence as to what is a transition or adaptation activity. This lends itself to corporate interference, where the dominant industries in different regions place pressure on stakeholders (including governments) as part of the 'dialogue and engagement' process to water-down the recommendations so that it does not harm or penalise their industry or economy. The controversial decision to include natural gas and nuclear as climate transition assets in the EU taxonomy is one example of this; palm oil plantations are included in the Malaysian Principles Based Taxonomy, and South Africa is following the EU approach by reportedly treating gas as a transition asset. **EACH JURISDICTION WILL HAVE ITS OWN AGENDA, SO THE WATERING-DOWN NOT ONLY MOVES DEFINITIONS AWAY FROM BEING 'COMMON DEFINITIONS' ACROSS JURISDICTIONS, BUT THE TAXONOMIES ALSO MOVE AWAY FROM REPRESENTING WHAT GENUINELY IS A SUSTAINABILITY ACTIVITY (ACCORDING TO SCIENTIFIC EVIDENCE, NOT ECONOMIC INTERESTS)**.

20. International Platform on Sustainable Finance. (2022). Common ground taxonomy. https://finance.ec.europa.eu/system/files/2022-06/220603-international-platform-sustainable-finance-common-ground-taxonomy-instruction-report_en.pdf

4. Lack of expertise

A number of industry and academic studies that have attempted to unravel the barriers to sustainable investment, including the mobilisation of capital into climate finance, have identified a lack of expertise in translating the implications of climate change into financial impacts as a possible obstacle, such as being less familiar with the type of data and information that is required, the complexity of undertaking scenario analysis and how to interpret such analysis, as well as the longer time horizon than they might typically consider in their decision making processes. Here are some examples of the observations that have been made:

- "Institutional investors often lack the resources and experience, particularly in private markets, to commit substantial capital [21]."
- "Barriers to private investment in green infrastructure include lack of familiarity, limited information and knowledge, and limited expertise on green infrastructure [22]."

THERE IS SOMEWHAT OF A PARADOX IN THIS REASON FOR INACTION, AS THE FINANCIAL SECTOR IS ONE OF THE MOST HIGHLY TRAINED AND COMPENSATED PROFESSIONS IN THE WORLD, OFTEN PRAISED (AND/OR PILLORIED) FOR BEING CREATIVE AND INNOVATIVE IN GENERATING FINANCIAL RETURNS FROM ALMOST ANY SITUATION. Indeed, there is a widely used term of 'smart money' of which institutional investors and other professional investors are included, meaning that they have a fuller understanding of the market and a better chance of success in investing compared to non-expert investors. Despite this base of expert knowledge, when it comes to financing climate change activities, the indications are that there may be a knowledge gap or that more experience is needed.

It would be impossible to estimate the multitude of industry guides and reports have been produced by the various investor networks (such as the PRI, UNEP FI, IIGCC, Ceres, ICCC, CDP) to try to build this knowledge base through case studies and practical tools. The CFA Institute has also embedded sustainability into its training as have most universities around the world across a multitude of disciplines, including finance and economics. The central banks through the Network for Greening the Financial System are also making their contributions. However, the knowledge gap still arises as an explanation in different contexts to explain one of the barriers to capital allocation.

Lack of knowledge on climate change would now be viewed as a failure to adequately exercise fiduciary duty in a world where there is a voluminous quantity of information, evidence and data on climate mitigation and adaptation. Certainly, the risks of claiming not to know about the issue are higher than denying it exists. It is well documented and agreed that the financial flows to combat climate change and adapt to its effects are a vital part of the actions that are needed, and that the financial sector can play a central role in closing the financing gap. Any financial institution that has committed to align with or support a

21. PRI, 2022:12.
22. OECD, 2021:1.

just and fair Net Zero by 2050 pathway and climate resilience and who is failing to allocate capital to combat the problem is clearly behaving in a contradictory manner, which will be a harder position to justify as the scrutiny on climate finance intensifies.

Wilful blindness (or conscious ignorance) is another possible explanation underpinning the 'lack of expertise' explanation. As Heffernan (2019) observed, **THERE IS A TENDENCY FOR PEOPLE TO IGNORE THE OBVIOUS TO FEEL SAFE, AVOID CONFLICT, REDUCE ANXIETY AND PROTECT PRESTIGE. EMBEDDING CLIMATE CHANGE INTO CAPITAL ALLOCATION DECISIONS MAY THEREFORE BRING A DEGREE OF DISCOMFORT, AS THE DATA AND THE METHODS MIGHT BE LESS FAMILIAR AND HARDER TO JUSTIFY OR EXPLAIN TO OTHERS**. While this is slowly changing over time as the data and expertise improves, as we will discuss further on the internal barriers to action on climate change, **THERE IS STILL A LEVEL OF DISCOMFORT AND RELUCTANCE IN THE INDUSTRY TO DEVIATE FROM FAMILIAR ASSET ALLOCATION FRAMEWORKS THAT RELY HEAVILY ON PAST DATA AND HISTORICAL RELATIONSHIPS**, even when those frameworks are widely seen as being limited in their practical application to a dynamic and changing world.

5. Liquidity barriers

Another barrier to climate financing is the illiquid nature of many investment opportunities, such as infrastructure, private equity, private debt, property and other 'real' assets such as agriculture and timberland. To put this into context, financial institutions must comply with various capital requirements that exist for different types of financial institutions and jurisdictions that limit how much capital can be invested in illiquid assets (those assets which are not listed on an exchange and cannot be readily realisable). As the OECD (2021) noted, many of the investment opportunities are focused on mitigation and adaptation in infrastructure assets, which tend to be long-term in nature and illiquid, with nascent secondary markets that need to deepen. The OECD also noted that this is true for developing economies and is even more pronounced in the emerging market and developing economies where the financing needs are also the greatest.

What this means is that, as it stands today, **INSTITUTIONAL INVESTORS WHO RELY ON INVESTING THROUGH FUND STRUCTURES AND WHO MUST COMPLY WITH REGULATORY CONSTRAINTS REGARDING LIQUIDITY AND CAPITAL REQUIREMENTS ARE CONSTRAINED IN HOW MUCH CAPITAL CAN BE ALLOCATED TO SUCH OPPORTUNITIES**. To invest in climate finance currently, investors need to expand their investments into project finance, green bonds and other (predominantly) illiquid asset classes, such as sustainable agriculture, sustainable timberland, green infrastructure, green and climate efficient buildings and green private equity/private debt. There are new equity index funds that are focused on sustainability issues, although many of these have a broader remit than climate finance and tend to result in a broad-ranged set of exposures into companies with higher ESG 'scores', higher green revenue, or low carbon footprints. In this way, the sector is still directed towards minimising harm, rather than investing in the solutions that are needed to mitigate and adapt to climate change.

These are challenges that have been widely debated in the industry and amongst financial regulators for some time, with calls for consideration of actions such as preferential capital requirements for climate finance activities (European Banking Federation, 2017), collaboration between private and public sector agencies (including development banks) to build secondary market liquidity (OECD, 2021), and other forms of blended finance between different types of financiers (public, private and DFIs for example) to build alternative structures to access the investments through funds structures and third party managers [23].

Whilst liquidity needs are real and present, this issue could also be viewed as a transitory constraint as the market depth and breadth expands (as is the case for any new or growing market). For the climate financing gap to be reduced at the scale and pace that is required, there is a need to move beyond the explanations of anchoring to the existing portfolio structure as a justification for the slow pace and flow of capital into the climate mitigation and adaptation activities that is needed.

In addition to the easing of regulations, collaboration and blended finance approaches that the industry is pursuing, further enquiry invites an exploration of how investors think about this perceived barrier. For example, **INVESTORS COULD CONSIDER HOW THEY CAN REORIENT THEIR INTERNAL PROCESSES TO PRIORITISE THE ALLOCATION OF CAPITAL TO CLIMATE FINANCE OPPORTUNITIES VERSUS OTHER TYPES OF ILLIQUID ASSETS THAT THEY MIGHT CONSIDER. THIS COULD HELP TO DIVERT NOT ONLY NEW FUND INFLOWS INTO CLIMATE FINANCE ACTIVITIES, BUT IT COULD ALSO STEER THE REDEMPTIONS OF EXISTING INVESTMENTS IN ILLIQUID ASSETS INTO CLIMATE FINANCE. IN ADDITION, INVESTORS COULD BUILD EXPERTISE TO INVEST MORE CAPITAL INTO PRIMARY AND DIRECT CLIMATE FINANCE INVESTMENTS, COMPARED TO THE MORE TYPICAL FUND AND THIRD-PARTY STRUCTURES**. There is a myriad of alternative perspectives to tackle this issue, one of which is the potential role of innovation to foster new ways to think about old problems differently (as the mindset literature reviewed in Section 4 further explores).

6. Market pricing

Another driver of non-change is the challenge with pricing of some climate mitigation and adaptation assets. It is not straightforward to examine this claim, as many of the deals are still project finance based and hence there is limited visibility on pricing. However, there is literature related to market pricing and efficiency that can be reviewed in this context.

23. Bloomberg NEF. (2022). Mobilizing Capital into Emerging Markets and Developing Economies. Commissioned by GFANZ. Published by BloombergNEF. Available at: https://assets.bbhub.io/professional/sites/24/Mobilizing-Capital-to-EMDEs.pdf.

The work of some economic psychologists and behavioural financiers suggests that human behaviour does not always conform to the expected behaviour of a rational economic agent, and financial assets are not always able to reflect all public information correctly. Indeed, asset prices can be mispriced for a significant period, often resulting in bubbles in asset prices that precede a collapse; the technology bubble and the global financial crisis being recent examples of these tendencies. For example, counter-examples of the efficient and rational market model have been found to be systematic, robust and fundamental, suggesting that we may need a new paradigm that reflects investor behaviour and how markets operate. Indeed, as Shiller (2005) observed, there can be periods where it is obvious to some that there is a systemic mispricing of asset values, yet such a situation can persist for some time. The awareness by investors that a mispricing exists does not necessarily mean that such a situation will be corrected any time soon. As Shiller noted in relation to over-priced assets in the lead up to the bursting of the technology bubble in 1999/2000, highlighting the importance of subjectivity in 'rational' financial decisions:

Those who doubt the value of these [mis-priced] stocks could try to sell them short…but their willingness to do so is limited, partly since there is always a possibility that the stock would be bid up even further by enthusiastic investors…. Absurd prices sometimes last a long time [24].

All of this points to a greater level of complexity when we think about investors that are behind the investment decisions than the Efficient Markets Hypothesis (EMH) allows for. In the context of climate change, there is a growing sense of concern and evidence of the potential for some high carbon assets to become stranded or significantly re-priced downwards in the shift to a low carbon economy. Likewise, many low carbon assets may not have fully priced in their (true) long-term potential upside in a carbon constrained world.

THE PERCEPTION AROUND MARKET PRICING OR CLIMATE RISK IS INFORMATIVE AS IT INDICATES THE EXTENT TO WHICH INVESTORS _BELIEVE_ (OR NOT) THERE IS A PERSISTENT MARKET MISPRICING THAT DOES NOT ADEQUATELY INCORPORATE CLIMATE-RELATED IMPACTS. According to the EMH, a rational response to persistent market mispricing would be to exploit or position portfolios to take advantage of that situation. When a mispricing persists whilst the awareness of such a situation is building amongst investors, it suggests **THERE ARE BARRIERS TO MARKET RE-PRICING BEYOND PURELY TECHNICAL OR INFORMATION-BASED EXPLANATIONS, INCLUDING COGNITIVE, PSYCHOLOGICAL, CULTURAL AND SOCIAL INFLUENCES** [25].

24. 2005:181

25. Shiller, R.J. (2005). Behavioral Economics and Institutional Innovation. Southern Economic Journal, 72: 269-283. https://doi.org/10.1002/j.2325-8012.2005.tb00702.

7. Difficulty of access

Another possible explanation for slowing down climate finance is the reported difficulty in accessing investment opportunities. The combined effect of the concentration of investment needs in emerging and developing countries where local knowledge and networks are key, the 'off market' nature of the project-based deal flow, the lack of liquid and 'fund' based solutions and the sometimes-small scale of the investments, are often cited by investors in various forums on this topic [26].

The work of some of the GFANZ [27] members on this topic is targeting these specific challenges, with clear solutions and a pathway for reducing the access issues for investors. Some examples of this work include the establishment of FAST-Infra - Finance to Accelerate Sustainable Transition in Infrastructure (FAST-Infra) (Climate Policy Initiative, 2021). This is a collaboration between HSBC, the OECD, the IFC, the Global Infrastructure Facility (GIF) and the Climate Policy Initiative to make sustainable investment in infrastructure accessible. It is supported by more than 80 public and private institutions and focuses on each of the obstacles that have been identified, including the importance of local networks and knowledge, increasing visibility on deal flow, and improving the options for accessing these deals.

The GFANZ network also recommended to G20 leaders that a country platform-based approach be adopted to address the climate financing gap in each jurisdiction. A detailed set of recommendations for both policy makers and the financial sector in each country was proposed [28], with examples of such activities already underway in Columbia and India [29]. A study focused on the opportunities in climate mitigation investment in the emerging markets and developing economies for Australian-based investors also set out several detailed recommendations and pathways for action, including blended finance, increasing offtake certainty, and investing via debt or pooled funds to minimise risk [30].

THERE ARE SOME VERY WELL CONSIDERED FRAMEWORKS AND RECOMMENDATIONS THAT HAVE BEEN PUT FORWARD BY REPUTABLE ORGANISATIONS AND PEOPLE INSIDE THE FINANCIAL SECTOR, AND INDEED COMMITMENTS THAT HAVE BEEN MADE TO ADDRESS THE CHALLENGES WITH ACCESSING THE OPPORTUNITIES IN CLIMATE FINANCE. THE QUESTION REMAINS AS TO WHETHER INVESTORS ARE LEVERAGING AND RESPONDING TO THIS BODY OF KNOWLEDGE AND GUIDANCE, AND THE EXTENT TO WHICH THE INNER BARRIERS TO CHANGE MIGHT BE PLAYING A ROLE IN SLOWING DOWN THE FLOW OF CAPITAL INTO CLIMATE FINANCE ACTIVITIES.

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26. Carney, M. (2020). Building a financial system for net zero, Priorities for private finance for COP26. UN Special Envoy for Climate Action and Finance and the Prime Minister's Finance Adviser for COP26.
27. https://www.gfanzero.com/
28. Glasgow Financial Alliance for Net Zero. (2023). The potential for country platforms to mobilise capital for net-zero transitions in emerging markets and developing economies. Draft Private Sector Statement.
29. Climate Finance Leadership Initiative. (2023). Financing sustainable infrastructure in emerging markets. https://www.bloomberg.com/cfli/mobilizing-investment/
30. IGCC. (2023). Mobilising climate investment in emerging markets: Opportunities for Australian pension and superannuation funds. An IGCC publication.

Section 2 summary

This section has explored some of the literature and evidence related to the most cited behavioural barriers to climate finance from the perspective of the financial sector. We have seen some of the explanations that are often put forward to explain the slow pace of capital allocation, ranging from inconsistent government policies, lack of information and standardised definitions, lack of expertise, liquidity implications, market pricing, and difficulty in accessing opportunities.

ALL THE BARRIERS COMMONLY IDENTIFIED IN THE LITERATURE FOCUS ON CONDITIONS THAT IMPACT THE EXTERNAL ENVIRONMENT IN WHICH INVESTORS OPERATE IN, RATHER THAN SOMETHING THAT INVESTORS THEMSELVES MIGHT BE DOING OR COULD APPROACH DIFFERENTLY (the 'internal' conditions that we will discuss in the next section). The limit of these explanations is that some of the complex internal barriers to change can be overlooked, and hence the appropriate mechanisms and policies are not put in place to also redress these.

3. Internal barriers to climate financing

The internal barriers to change are much less widely discussed in the context of the financial sector and climate finance. Very little attention is given to how knowledge is processed by investors and interpreted through their mental models. The psychological underpinnings of investment decisions, the prevalence of cognitive biases, culture and personal relationships (both at the individual level and inside and outside organisations) and how these might impact on the level of action on climate change warrants greater attention (Guyatt, 2023).

This section focuses on how and why the mind processes and responds to information in the way it does and the relevance of these insights for investors in the context of climate change. This section firstly explores some of the relevant literature on this topic, which is emerging and not as extensive as the literature on the external barriers to change amongst investors. Secondly, some examples and evidence are provided, drawing from a research project on Institutional Investors and the Behavioural Barriers to Taking Action on Climate Change supported by ClimateWorks Foundation in 2019.

Relevant literature

There is a growing body of academic and industry literature on the behavioural barriers that undermine climate change action. Most of the research does not directly address the institutional investor community (with a few exceptions) [31], rather focusing on the role of consumers and political agents in mitigating climate change. Nevertheless, there is a plethora of literature relevant to better understanding the behavioural barriers to acting on climate change that can be drawn upon, which has been clustered in this review according to:

1. **Perception of risk**: investors' varying levels of willingness to incorporate climate-related impacts into valuation frameworks, portfolio construction and investment decision-making processes.
2. **Cognitive biases**: The prevalence of behavioral biases (short termism, heuristics, herding and cognitive dissonance) to explore some of the practical challenges to shifting behavior.
3. **Psychological, social and cultural underpinnings**: The psychological, social and cultural influences that impact on the extent to which investors are willing and/or able to incorporate climate change into investment processes.

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31. Daumas, L. (2023). Financial stability, stranded assets and the low-carbon transition – A critical review of the theoretical and applied literatures. Journal of Economic Surveys, 00, 1– 116. https://doi.org/10.1111/joes.12551

1. Perception of risk

Beyond the volatility of financial returns, **INVESTORS' PERCEPTION OF RISK IS ALSO INFLUENCED BY SUBJECTIVE CONSIDERATIONS SUCH AS CAREER RISK, PEER RISK**, reputation risk – or as Keynes' aptly observed in the beauty context analogy – that is, the fear of being different to consensus and being wrong: "Worldly wisdom teaches that is it is better for reputation to fail conventionally than to succeed unconventionally [32]." In the context of climate change and investment decisions, taking a pro-active stance on the issue and/or adapting investment frameworks that differ from the prevailing market norms brings a perceived risk of failure, if such an approach results in lower investment returns.

Indeed, the perception of risk has been identified by psychologists and behaviouralists as a key driver that impacts on an individuals' willingness to act on climate change, both at the conscious and unconscious level. Van der Linden (2017) proposed a useful schematic that attempts to bring the strands of risk perception research together into a unified framework that can be used to measure and operationalise risk perception. This includes a distinction between social and personal level judgements (broad impact versus personal risk). These are important insights for researching investor behaviour and climate change, as perception of risk is a key driver of investor behaviour across all investment issues, not only climate change (**Figure 2**).

FIGURE 2: Perceived risks of changing behaviour

FUNCTIONAL	Perceived control, my actions might not work, not sure how to do it, too many options.
FINANCIAL	Loss aversion, it might cost me money to act and endowment effect, I don't want to give up on what I already have.
PSYCHOLOGICAL, SOCIAL AND CULTURAL	This makes me feel uncomfortable, it is outside my comfort zone, not directly relevant to me others are not taking action, it might harm my reputation.
COGNITIVE	Heuristics or rules of thumb, it doesn't fit into my day-to-day activities, it is complex and difficult, requires a lot of effort [33].

32. Keynes, J.M. (1936). The General Theory of Employment, Interest and Money. Macmillan: London.
33. Source: Carvalho, 2010; APA, 2009 and Van der Linden, 2017.

2. Cognitive biases

Behavioural finance, economic psychology and related disciplines have identified several cognitive biases that may impact on how investors make decisions that further challenge the assumptions of the EMH and rationality. Many, though not all, have relevance for how investors respond to managing climate change risks and opportunities. Four biases that are of particular interest and relevance for examining the internal barriers to capital allocation to climate finance include:

A. Myopia (or short-termism), there is growing recognition within the investment and regulatory communities that **THE SHORT-TERM TIME HORIZON OF INVESTORS AND THE MARKET MORE BROADLY IS PROBLEMATIC WHEN ADDRESSING SYSTEMIC ISSUES SUCH AS CLIMATE CHANGE THAN SPAN MULTIPLE HORIZONS**[34]. Academic literature also supports this recognition, for example, Black and Fraser (2000) found evidence of short-termism across international markets, whilst Nickell and Wadhwani (1987); Miles (1993); and Cuthbertson et al (1997) found some evidence of its existence in the UK. Short-termism will potentially impact on all agents along the investment chain, including asset managers, asset owners, Boards and Trustees to the extent that short-term performance is given precedence or priority over longer-term outcomes and risks.

B. The heuristics or rules of thumb tendency to **RELY ON A NARROW SET OF PARAMETERS OR GUIDEPOSTS TO UNDERPIN DECISIONS** as researched through the seminal work of Tversky and Kahneman (1982) and Thaler, Sunstein & Balz (2013) who coined the term "***choice architecture***" where people tend to prefer choice between options that favor simplicity, have a limited attention span and go out of their way to avoid hassles. This tendency to simplify decisions could potentially thwart efforts to integrate climate change into investment processes. This relates also to ***narrow framing***, where investors seek to reduce their decisions' complexity, which is particularly the case for Boards and Trustees where there is limited time when the Board comes together and hence may have less capacity to go deeper into issues such as climate change.

C. Herding, group think, or ***gravitation to defensible decisions***, where investors have **THE TENDENCY TO MIMIC THE BEHAVIOR OF OTHERS AND ACT ACCORDING TO THE "RULES OF THE GAME", WHETHER CONSCIOUSLY OR UNCONSCIOUSLY**[35] and in pension funds[36]. As the Keynes (1936) beauty contest analogy posited, there is safety in numbers, if everyone gets it wrong then they all go down together, there is less reputational risk than going alone, which is not 'rational'. To the extent that climate change is not yet 'conventional' amongst

34. Carney, M. (2015). BIS central bankers' speeches Mark Carney: Breaking the tragedy of the horizon – climate change and financial stability. Available at: https://www.bis.org/review/r151009a.pdf.
35. Grinblatt, M., Titman, S., and Wermers, R. (1995). Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior. American Economic Review, 85, 1088-1105. Wermers, R. (1999), Mutual Fund Herding and the Impact on Stock Prices. The Journal of Finance, 54: 581-622. https://doi.org/10.1111/0022-1082.00118.
36. Lakonishok, J., Shleifer, A., and Vishny, R.W. (1992). The Impact of Institutional Trading on Stock Prices. Journal of Financial Economics 32 (1).Nofsinger, J.R. and Sias, R.W. (1999), Herding and Feedback Trading by Institutional and Individual Investors. The Journal of Finance, 54: 2263-2295. https://doi.org/10.1111/0022-1082.00188.

investors in terms of day-to-day investment decision making, it may feel riskier for investors to take decisive action (although it is increasingly become part of their rhetoric which is an indicator that change in market conventions and groupthink are underway). This applies to all layers of the investment decision chain, for fund managers and CIOs it is about potential impact on relative performance against benchmarks and potentially their reputation, for trustees and Boards it is fear of litigation risk, reputation and/or a performance penalty.

D. Cognitive dissonance or inconsistency, whereby **CONFLICTING ATTITUDES, BEHAVIORS, AND BELIEFS PRODUCE A FEELING OF DISCOMFORT, WHICH CAN RESULT IN AN ALTERATION OR INTERNAL SHIFT IN SOME WAY OR IN DENIAL OF THE DISCOMFORT'S SOURCE** (Festinger, 1957). In the context of climate change and investor action, this is highly relevant, particularly as awareness of the scale and magnitude of the challenge continues to spread. However, the emergence of a tension between attitudes and behavior does not automatically mean that decisive action on climate change will emerge. Indeed, when a feeling of discomfort or dissonance arises, there are multiple ways for people to respond, such as pushing it away, denying it, becoming defensive or even going back and questioning or placing doubt on the initial cognitive judgement that caused the feeling of discomfort, rather than admitting they were wrong [37].

3. Psychological, social and cultural underpinnings

Not all behavioural anomalies can be fully understood by considering individual heuristics, rules of thumb and other non-random biases. We must also consider the social, cultural, organisation, political economy and market-wide contexts in which decisions are being made. Insights from economic psychologists such as Farr (1997) and Lewis (2001) remind us that beliefs and values (which ultimately influence decision making) are shared with others and are a social, not an individual, phenomenon. Indeed, this was an important observation made by Keynes: decisions to invest are largely governed by the average expectation of the market, rather than the genuine expectation of the investor. Therefore, to reduce and manage uncertainty, investors rely on the maintenance of an industry convention that can be relied upon, even if it sustains unhelpful behaviours and outcomes.

Thus, investment becomes reasonably 'safe' for the individual investor over short periods, and hence over a succession of short periods however many, if he can fairly rely on there being no breakdown in the convention and on his therefore having an opportunity to revise his judgement and change his investment, before there has been time for much to happen [38].

37. Schneider, F. W., Gruman, J. A., & Coutts, L. M. (2005). Applied social psychology: Understanding and addressing social and practical problems. Thousand Oaks, Calif: SAGE Publications.
38. Source: Keynes, 1936:153.

With climate change not yet a 'conventional' and widely accepted core driver of company or asset allocation decisions based on the present economic system, there is still a need for affirmation from the wider market around its legitimacy. Until we reach a point of critical mass and perceived legitimacy, the allocation of capital to climate mitigation and adaptation activities will continue to fall short of what is needed to close the climate financing gap.

Norgaard (2006) identified several psychological barriers in responding to climate change and classified these in terms of identified barriers versus the underlying drivers. Norgaard focuses on "knowing and not knowing" where society has the information, but most people are not thinking about climate change in their everyday lives. Another wide-ranging review of the psychological, social and cultural underpinnings that limit climate change action was carried out by the APA (2009), which identified a sequence of barriers as summarised in **Figure 3**.

FIGURE 3: Psychological, social and cultural barriers that limit climate change action.

Ignorance and uncertainty	Informational barriers, lack of awareness and underestimation of the risks.
Mistrust and reactance	People do not trust the message or its source, skeptical.
Denial	Belief that they cannot do anything about it, perhaps a deeper fear of mortality.
Judgmental discounting	Belief that changes can be made in the future, it is worse elsewhere.
Habit	This is how we do things around here; I've always done it this way.
Perceived control	Belief that they have little control over the outcome, defeatist.
Perceived risks	Changing behavior brings risks (see perception of risk discussion).
Tokenism	Take some token action, no real meaningful change (recycling).
Social comparison and norms	Compare their actions to others (Festinger, 1954), peer orms a strong influence.
Conflicting goals	Having multiple goals and values that are perceived to be conflicting.
Belief in solutions	Belief that others will take care of it, it will be ok [39].

39. http://www.apa.org/science/about/publications/climate-change.aspx

4. Evidence

Research on Institutional Investors and the Behavioural Barriers to Taking Action on Climate Change, supported by ClimateWorks Foundation [40] analysed the behavioural drivers that impact on institutional investors' ability and/or willingness to integrate climate-related risks and opportunities into their investment decisions.

Some of the key findings are summarised in **Figure 4**, mapped alongside each of the cognitive and psychological underpinnings. Evidence of cognitive biases and psychological underpinnings was identified, including myopia, herding and reliance on heuristics and rules of thumb. In addition, open-ended responses to a survey and follow up interviews revealed other subjective drivers that are slowing down investor's response to climate change.

Figure 4: Internal barriers to taking action on climate change.

THEME	KEY FINDINGS	COGNITIVE BIASES	PSYCHOLOGICAL UNDERPINNINGS
1. Disconnect between beliefs and broader purpose	Evidence of acknowledgment of climate change as a systemic risk, but in practice at the day-to-day level, there is a degree of separation from the issue in terms of their sense of purpose	**Myopia, cognitive dissonance**	Uncertainty, denial, judgmental discounting, perceived control
2. Uncomfortable with complexity	Evidence of growing effort and momentum in some areas (such as engagement with companies on climate change), yet it is complex and hard to incorporate into investment analysis	**Narrow framing, heuristics, loss aversion**	Habit, conflicting goals
3. Conforming to peer group	Some people do not think their peers are taking strong action on this issue in terms of capital allocation, there is a lack of motivation to go beyond what others are doing	**Herding, loss aversion**	Social comparison, norms, conformity
4. Failure to reflect on personal agency	When it comes to taking action to try to change "the other" (external fund managers or companies) then some people perceive this to be easier. When it comes to changing their own practices (i.e. valuation frameworks or capital allocation decisions) then some investors consider this to be much more difficult	**Status quo bias, narrow framing**	Denial, lack of self-awareness

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40. ClimateWorks. (2019). Institutional Investors and the Behavioral Barriers to Taking Action on Climate Change. A research project authored by Guyatt, D., and Poulter, J. Published by ClimateWorks Foundation. https://www.climateworks.org/wp-content/uploads/2019/10/Institutional_Investors__BehavioralBarriers_to_TakingAction_on_ClimateChange_101619.pdf

5. Not embedded into culture	Climate change was found to be generally not high on the priority in day-to-day decision-making processes, with a perception that specialist teams take care of those issues	**Status quo bias, confirmation basis, recency bias**	Adherence to team norms, conventions, habit, denial
6. Tension between the short and long term	There was evidence of a recognition that climate change exists and is in the background, although the shorter-term focus on financial performance can override these concerns which are perceived to be longer term	**Overconfidence effect, myopia**	Habit, social comparison, norms and conformity, conflicting goals
7. Fear of failure	Some people felt that it can be very difficult to evaluate climate change impacts and that it takes more time, energy and motivation to change investment frameworks, and that it will also be harder to justify if it goes wrong [41]	**Heuristics, rules of thumb, anchoring**	Fear of failure, habit, perceived risk of taking action, mistrust

Section 3 summary

The literature and research evidence indicates that the barriers to capital allocation to climate finance is more complex than investors simply needing additional information, government policies or regulations to support such actions. There are a multitude of internal conditions that influence investor behaviour that warrant closer attention by investors themselves, as well as by academics, policy makers and financial regulators. **THESE INCLUDE, BUT ARE NOT LIMITED TO, THE CONNECTION BETWEEN INVESTMENT BELIEFS AND A BROADER SENSE OF PURPOSE, THE LEVEL OF COMFORT IN MANAGING COMPLEXITY, SOCIAL AND PEER GROUP CONFORMITY PRESSURES, REFLECTION AND UTILISATION OF PERSONAL AGENCY, PREVAILING ORGANISATIONAL AND INDUSTRY CULTURE, PERCEIVED TENSION BETWEEN THE SHORT AND LONG-TERM, AND PERCEPTION OF RISK (SPECIFICALLY IN RELATION TO A FEAR OF FAILURE)**. Further research is needed on the inner dimensions that drive behaviour and the ability and/or willingness of investors to utilise their agency and appropriately respond to the challenges that climate change presents.

41. ClimateWorks (2019).

4. Literature on behaviour change through shifting mindsets

MINDSETS ARE THE MENTAL MODELS THAT PEOPLE UTILISE PLAY AN IMPORTANT ROLE IN DETERMINING WHETHER THE FINANCE SECTOR WILL ALLOCATE CAPITAL TO CLOSE THE CLIMATE FINANCING GAP AT THE SPEED AND SCALE THAT IS REQUIRED. A review of the literature related to the mindsets of individuals inside financial institutions is useful to help unravel some of these complex internal drivers of behaviour change (or non-change) [42]. The literature is reviewed as follows:

1. Defining mindset

2. Fixed and growth mindset literature

3. Sustainability mindset literature

4. Emotion, cognition and behavioral literature

1. Defining mindset

What is mindset, and why does it matter?

- Mindset refers to the way we think, and the way we view the world, what motivates us.
- A mindset is a mental attitude. It shapes our actions and our thoughts [43].
- Mindset is the lens through which we view the world and our role/place in it, including the underlying assumptions, beliefs, and values that inform that lens [44].
- Mindsets are a set of assumptions that help you distill complex worldviews into digestible information and then set expectations based on this input.
- Mindset matters as we may not be fully aware or able to articulate it, but it will reveal itself in our words and our actions.
- Mindsets can and do change over time as our brains and neural responses are adaptive, especially if we are willing to learn and grow [45].
- Mindsets influence how quickly and effectively we are willing to adapt our thinking in response to new industry developments, such as the rapid adoption of sustainability principles into corporate and investment frameworks.

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42. Guyatt, D. (2023). Cultivating a sustainable mindset in finance: Mobilising the capital needed to combat climate change. Ethics International Press, Cambridge, UK.

43. Meier, J. D., & Kropp, M. (2010). Getting Results the Agile Way: A Personal Results System for Work and Life. Bellevue, WA: Innovation Playhouse.

44. Kassel, K., Rimanoczy, I. and Mitchell, S.F. (2016). The sustainable mindset: Connecting being, thinking, and doing in management education. In Academy of management proceedings (Vol. 2016, No. 1, p. 16659). Briarcliff Manor, NY 10510: Academy of Management.

45. Ng, B. (2018). The Neuroscience of Growth Mindset and Intrinsic Motivation. Brain Sciences 8, no. 2: 20. https://doi.org/10.3390/brainsci8020020

- Many efforts to transform organizations have failed due to a lack of focus on understanding the mindsets that drive behavior. "Unless you first identify the mindsets, both limiting and enabling your people, your transformation initiatives may be wasting resources, time and energy" [46].
- Mindset shifts are linked to the highest impact behaviors a person wants to change. Organisations that take the time to identify and shift deep-seated mindsets were 4x more likely to rate their change programs as successful [47].

Dweck and Yaeger (2021) noted that mindset research originated from two lines of enquiry, namely learned helplessness or defeatism [48] and attribution theory [49]. **LEARNED HELPLESSNESS SHOWED THAT EXPOSURE TO NEGATIVE EVENTS CAN RESULT IN PASSIVE BEHAVIOUR AND A SHUTDOWN OF SORTS WHEN PEOPLE GIVE UP IN THE FACE OF DIFFICULT SITUATIONS**. In the context of climate change, we can see that if the message is too negative and alarming, it could have the perverse effect of closing people down and turning away from climate action, as they become de-motivated and feel defeated by the enormity of the challenge.

Attribution theory showed the importance of people's perceptions and beliefs in shaping their motivations to act in a certain way. In the case of Dweck's research, this focused on a student's belief about their own intelligence, and how that impacted on their performance at school and later in life. In the context of climate change action, a person's perceptions and beliefs about climate change will influence how motivated they are to act.

These two foundations of knowledge have provided the platform for further mindset research over the past three decades, which extended this line of enquiry to examine how people's perceptions influence their motivation, and how that could be changed to alter behaviour. Businesses and organisations have also applied the mindset research in relation to the motivation and performance of employees [50]. Other related fields of research have emerged. For example, **NEUROSCIENTISTS HAVE STUDIED THE CONNECTION BETWEEN MINDSETS AND NEUROPLASTICITY AND THE BRAIN'S NEURAL NETWORKS, PROVIDING NEW PERSPECTIVES ON HOW MINDSETS ARE RELATED TO HOW BRAINS CHANGE** [51]. The research has also been extended and applied to consider how to build a more sustainable world, led by Rimanoczy (2010, 2020) in the development of the sustainability mindset principles.

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46. Baggio, A., Digentiki, E., and Varma, R. (2019). Organizations do not change. People change! McKinsey & Company. People and organisational performance. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/the-organization-blog/organizations-do-not-change-people-change
47. McKinsey & Company. (2021). How to develop a growth mindset. https://www.mckinsey.com/featured-insights/themes/how-to-develop-a-growth-mindset.
48. Seligman, M. E., & Maier, S. F. (1967). Failure to escape traumatic shock. Journal of Experimental Psychology, 74(1), 1–9. https://doi.org/10.1037/h0024514
49. Weiner, B., & Kukla, A. (1970). An attributional analysis of achievement motivation. Journal of Personality and Social Psychology, 15(1), 1–20. https://doi.org/10.1037/h0029211
50. McKinsey, 2021.
51. Ng, 2018).

2. Fixed and growth mindset literature.

Dweck's work combines developmental, social and personality psychology to research the education sector by focusing on the mindsets of students and what enables or inhibits their learning abilities. The framework resulted in a growth/fixed mindset schematic which has gained widespread adoption and utilisation in the education sector and other settings, including in the business world. The distinction between the fixed and growth mindset as defined by Dweck (2017) is a now widely cited and utilised framework in the academic and business settings. The characteristics of a growth or fixed mindset are set out by Dweck (2012) as follows. One needs to understand that these are not formal definitions but rather are characteristics perceived by individuals who tend to be either in the growth mindset or in the fixed mindset category:

INTELLIGENCE

- A growth mindset sees intelligence as something that can be developed.
- A fixed mindset sees intelligence as a fixed and static asset.

MISTAKES

- A growth mindset embraces flaws and mistakes as an opportunity to improve.
- A fixed mindset hides flaws and mistakes.

SETBACKS

- A growth mindset accepts setbacks as part of the learning process.
- A fixed mindset is ashamed of failure and unmotivated to achieve set goals.

FEEDBACK

- A growth mindset welcomes feedback from others as an opportunity to grow.
- A fixed mindset views feedback as personal criticism.

CHALLENGES

- A growth mindset freely embraces challenges and risks probable failure.
- A fixed mindset avoids challenges to avoid the possibility of failure.

SUCCESS OF OTHERS

- A growth mindset sees other people's success as inspiration.
- A fixed mindset sees other people's success as a threat to success.

RESOLVE

- A growth mindset doesn't give up easily.
- A fixed mindset gives up easily even at the slightest challenge.

In reality, individuals will tend to illustrate characteristics that lean more towards a growth or a fixed mindset and will not be completely one way or the other across these dimensions. The growth mindset is represented in the literature as being the more favorable mindset in different contexts, as it predisposes individuals to learn, aspire, be passionate and resilient.

As Dweck noted:

Why waste time proving over and over how great you are, when you could be getting better? Why hide deficiencies instead of overcoming them? Why look for friends or partners who will just shore up your self-esteem instead of ones who will always challenge you to grow? And why seek out the tried and true, instead of experiences that will stretch you?

The passion for stretching yourself and sticking to it, even (or especially) when it's not going well, is the hallmark of the growth mindset. This is the mindset that allows people to thrive during some of the most challenging times in their lives [52].

Dweck argued that a growth mindset can help people to be more adaptable and responsive to the changing demands and complexities of life. Many business schools and consultants have also embraced the notion of a growth mindset and its appeal for 'business success'. For example, Wolfe (2022) set out five business benefits of a growth mindset to be:

1. Become a lifelong learner
2. Embrace challenges
3. Deal with setbacks
4. Become a better leader
5. Find meaning in your work.

It is interesting to observe that most of these benefits are expressed in terms of the benefits to the business and the 'self' and not beyond that, although 'finding meaning in your work' invites a wider sense of purpose beyond the self. In contrast, a fixed mindset is represented as being negative, characterizing someone who shirks away from challenges:

A fixed-minded person usually avoids challenges in life, gives up easily, and becomes intimidated or threatened by the success of other people. This is in part because a fixed mindset doesn't see intelligence and talent as something you develop – it's something you «are».

Fixed mindsets can lead to negative thinking. For instance, a person with a fixed mindset might fail at a task and believe it's because they aren't smart enough to do it. Whereas a growth mindset person might fail at the same task and believe it's because they need to spend more time practicing [53].

52. 2017:7.
53. Smith, 2020:2.

BUT NEITHER IS A GUARANTOR OF TRANSITION COMPATIBLE CHANGE. THE DOMINANT NARRATIVE THAT PREVAILS IS THEREFORE ONE IN WHICH THE GROWTH MINDSET IS PREFERABLE TO A FIXED MINDSET, PRIMARILY BECAUSE IT WILL BE OF BENEFIT TO THE 'SELF' AND WILL HELP PEOPLE TO THRIVE IN THEIR LIFE AND THEIR CHOSEN PROFESSION. For example, executives of multinational oil companies could have a growth mindset and be very adept at maximizing the business opportunities for profit and personal financial rewards. If such executives are rewarded for increasing extraction and refinery activities, and their personal values are not in conflict with such activities, then they are likely to steer the business in that direction. Consequently, their actions would contribute to increasing CO2 emissions and accelerating climate change outcomes, rather than reducing emissions and enabling a net zero by 2050 outcome. Kenner and Heede (2021) found evidence to suggest that executives have personal ownership of shares in fossil fuel companies, which can create a carbon mindset and a misalignment of compensation structures that may discourage a reduction in carbon emissions.

This is just one example to illustrate why **HAVING A GROWTH MINDSET CAN BE PREFERABLE TO A FIXED MINDSET BUT IS NOT SUFFICIENT TO ADDRESS THE SUSTAINABILITY CHALLENGES OF OUR TIME**. Due to misaligned business and personal incentives, some executives are inadvertently encouraged to continue to 'grow' the extraction and utilization of fossil fuels, rather than innovate to shift to low carbon alternatives. If an executive's personal motivation to act on climate change was sufficiently strong, they could resist this temptation and invest more time and effort in seeking lower carbon alternatives to fossil fuels. But it would take more than just a 'growth' mindset to make that change.

One example of how leaders of an organization with a growth mindset can produce not only environmental damage but also social harm is the expansion of Rio Tinto's iron ore mining activities that resulted in the destruction of an ancient indigenous heritage site, the Juukan Gorge in Western Australia. In the immediate aftermath of the destruction of the site, the then-CEO Chris Salisbury defended the action by pointing out that the project was legal as it had government approval and the indigenous community had been consulted but that "Clearly, there was a misunderstanding" (Wahlquist, 2020). There was little in the way of personal regret expressed by the then CEO. According to media reports at the time, the project appears to have been driven by a growth mindset that pursued the financial benefits of expanding iron ore mining activities in the Pilbara region. However, the public backlash in the aftermath of the destruction led not only to the CEO resigning, but also a holistic rethink of the values of Rio Tinto to change how the company does business. The incumbent CEO stated in 2022:

In the two years since the tragic destruction of the rock shelters at Juukan Gorge, on the land of the Puutu Kunti Kurrama and Pinikura people in Western Australia, we have been changing the way we work in every part of our business. While we have made progress, we know it will take time to transform our culture and regain trust. But, together with the Indigenous peoples of the lands on which we operate, we are committed to ensuring cultural heritage is respected, valued and conserved for future generations [54].

54. Jakob Stausholm, Chief Executive, https://www.riotinto.com/en/news/inquiry-into-juukan-gorge

These examples show that leaders can set the tone and direction of an organization, and that a growth mindset will not be sufficient to achieve sustainable outcomes. This brings us to the emerging body of research on sustainability mindset specifically.

3. Sustainability mindset literature

Rimanoczy [55] (2010) studied sustainability leaders in the corporate sector and observed that their actions related to a combination of their knowledge, how they thought about sustainability issues, their values and sense of purpose. Rimanoczy also observed that the laudable **GOALS UNDERPINNING THE SDGS AND THE PURSUIT OF SUSTAINABILITY WERE PREDOMINANTLY FOCUSED ON SOLUTIONS RELATED TO THE EXTERNAL, OR "VISIBLE" PARTS OF SUSTAINABILITY – SUCH AS KNOWLEDGE AND INFORMATION, REGULATIONS, POLICIES, BENCHMARKS, AND BEST PRACTICE STANDARDS. IN CONTRAST, THERE WAS LITTLE FOCUS ON THE INTERNAL OR "HIDDEN" PARTS OF SUSTAINABILITY (OUR BELIEFS, HOW WE THINK, HOW WE MAKE SENSE OF THE WORLD), ALTHOUGH THE PREVAILING RESEARCH ON MINDSETS SHOWED HOW IMPORTANT THESE INTERNAL PROCESSES ARE** for understanding our motivations and behavior. So, Kassel, Rimanoczy and Mitchell (2016) defined "sustainability mindset" by as:

A way of thinking and being that results from a broad understanding of the ecosystem's manifestations, from social sensitivity, as well as an introspective focus on one's personal values and higher self and finds its expression in actions for the greater good of the whole.

It therefore relates not only to a person's knowledge and understanding about the ecosystem, but also **HOW INFORMATION IS PROCESSED AND THE MEANING THAT IS GIVEN TO THIS KNOWLEDGE, THAT IS, A PERSON'S VALUES AND BELIEFS**. In building this understanding, the sustainability principles invite a shift in individual and collective behaviours through a process of enquiry and questioning. Rimanoczy [56] set out four content areas and **12 principles** that comprise a **sustainable mindset** as summarised in **Figure 5** below.

Ecoliteracy	Creative innovation
My Contribution	Reflection
Long term thinking	Self-awareness
Flow in cycles	Purpose
Both-and	Oneness with nature
Interconnectedness	Mindfulness

55. Convener of the UN PRME Working Group on the Sustainability Mindset, https://www.unprme.org/working-group/prme-working-group-on-sustainability-mindset
56. 2020:21.

Ecological worldview

The ecological worldview refers to our understanding of the state of the planet and how we feel about it. It is comprised of two underlying principles, namely Ecoliteracy and My contribution:

1. Ecoliteracy - Understanding the state of the planet to be more fully aware of the challenges, the complexity and interlinkages, and to explore what it means to us. It goes beyond an understanding of the scientific evidence and encourages a deeper understanding of interconnections, personal engagement and emotional reactions.

2. My contribution – Identify the ways in which we are unintentionally contributing to the problems, so that we are in a better position to do something about them. It increases awareness and aims at building the habit of exploring unintentional contribution to our thoughts and actions.

Systems perspective

The systems perspective focuses on processing information using a systemic lens, looking at the flows, processes and feedback loops and systems nested in larger systems and how they integrate into a dynamic whole. Within this school of thought, the sustainability mindset highlighted the principles of Long-term thinking, Both+ and thinking, Cyclical flow and Interconnectedness.

3. Long-term thinking – Every action has consequences that are not immediately visible. Considering the long term when analyzing situations and making decisions has a positive impact on global sustainability. It aims to build the habit of considering long-term impacts.

4. Both+ and thinking – Allows us to understand paradoxes and calls for creative solutions that are inclusive of all stakeholders. To see the either/or factor at play and intentionally promote both+ and thinking.

5. Flow in cycles – Everything flows in cycles of birth, growth, death and rebirth. Many aspects of human unsustainability of the planet are a result of the misconceptions that we are not governed by this law of Nature. The aim is to develop the cognitive habit of seeing the larger cycles.

6. Interconnectedness – When we see interconnectedness between all living organisms and species, we understand the importance of diversity, and our decisions and actions become more inclusive, which contributes to the sustainability of the whole.

Emotional intelligence

Emotional intelligence refers to introspective practices to increase self-awareness and explore personal values. It includes the principles of Creative innovation, Reflection and Self-awareness.

7. Creative innovation – Resilience is based on creativity, innovation and experimentation. We look to enhance our personal potential for creative imagination, to experiment with new ways of doing things and solving problems.

8. Reflection – Reflective practices help to pause and ponder the situation and its implications before jumping into our automatic response and behavior. Explore our assumptions and the paradigm that we work within and consider alternative perspectives.

9. Self-awareness – Explore our personal values, beliefs, assumptions and motivations to gain greater control over our actions, and to see alternative behaviors. Uncover and question the tacit assumptions that guide our behaviors.

Spiritual intelligence

Spiritual intelligence is the lesser known and expected of these categories. It refers to our innate wisdom on questions of purpose, transcendence and oneness. It includes principles of Purpose, Oneness with nature and Mindfulness.

10. Purpose – Defining our purpose provides an unconscious compass, and when it is grounded in values of our higher self, we actively shape a better world. Identifying what we feel passionate about and which can make a difference for the greater good.

11. Oneness with nature – Understanding that we are one with Nature can shape behaviors, leading to a more harmonious relationship with each other and all beings. And inversely, lack of connection with nature can be detrimental to individual psychological and physical health [57].

12. Mindfulness – Being fully present, experiencing connectedness with all that is. Mindfulness enhances awareness and compassion and predisposes to social and environmental actions. The positive impacts of mindfulness on well-being, self-worth and health are now widely recognized across disciplines.

In summary, the 12 sustainable mindset principles provide the scaffolding for how to think about sustainability through a lens that invites self-examination and exploration, to look closer at our inner workings and see if there is a different way to respond to the complexities that the sustainability challenge presents. As Rimanoczy noted, the sustainable mindset principles are intended to be general in nature, allowing the application and emphasis of the principles to be utilised, as appropriate, in different contexts:

There is no one way to develop a mindset for sustainability….The vision was to have a few principles, clear and easily understandable statements, which could guide educators around the world to find ways to embed sustainable mindset goals…Yes, a mindset shift is urgent, but HOW can we do that [58]***?***

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57. Alvarez, E. N., Garcia, A., Le, P., (2022). « A review of Nature Deficit Disorder (NDD) and its disproportionate impacts on Latinx populations". Environmental Development, Vol. 43, https://doi.org/10.1016/j.envdev.2022.100732
58. 2021:4

We will now apply this scaffolding to explore how these dimensions interact with the financial sector, as a pathway to consider how a widespread mindset shift in the financial sector can emerge. We will start by exploring some of the literature that is relevant to developing the sustainability mindset in the context of the financial sector, before moving on to look at a proposed framework that brings these insights together.

4. Additional literature relevant to mindsets in finance

Additional literature and evidence that is relevant to the consideration of mindsets in the context of the financial sector has been distilled into three areas, namely:

a. Emotion

b. Cognition; and

c. Behavior.

By considering the literature and evidence related to each of these areas for the financial sector, we can better understand the internal barriers to behaviour change for this sector.

Emotion

In neoclassical economics, emotion is a subject that is usually treated as an external factor to rational decision-making, as a barrier to the homo-economicus construct [59]. As we will see from the literature and evidence, emotion can indeed deviate markedly from the notion of rationality, but this does not necessarily reflect a 'bias' that needs to be redressed, it is rather illustrative of the complexity of the human condition and what makes us function. There is no question that emotions influence decision-making (Damasio, 1994), they do, but not necessarily in transition compatible manners. The point is to acknowledge that emotions are an inseparable component of our decisions and choices.

Some of the research on emotion in the context of investors has discovered that emotion can in fact be a dominant driver behind short-termism and other cognitive patterns of behaviour. Feeling or emotion-based automatic judgements have also been found to explain attribution errors and problems of self-control, such as fear of risky choices or innovation [60].

Our emotional brain is a key part of building an understanding as to why we are pulled towards the short term. People have difficulty imagining the future, even though our logical brain clearly sees the future consequences of our current actions. For example, our emotional brain wants to push our credit card to its limit or smoke cigarettes, whereas our logical brain knows we should save for retirement and quit smoking. To understand why we feel internally conflicted and how this could be managed, it therefore helps to know how the emotional and abstract reasoning parts of the brain talk to each other [61].

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59. Dixon, W., and Wilson, D. (2013). A History of Homo Economicus: The Nature of the Moral in Economic Theory, Routledge.
60. Hirshleifer, D. (2001). Investor Psychology and Asset Pricing. The Journal of Finance, 56(4), 1533–1597. http://www.jstor.org/stable/2697808
61. Schultz, S. (2004). Brain battles itself over short-term rewards, long-term goals. An article published by Princeton University. http://pr.princeton.edu/news/04/q4/1014-brain.htm

Studies have explored the possibility of re-biasing behaviour by "intelligently" working on emotions to improve the quality of decisions [62]. The cultivation of emotional intelligence in the financial sector means that we can take action to harness the emotions that support positive behaviours and outcomes and reduce those that are harmful. While there is no magic recipe for achieving emotional intelligence in the financial sector, Bouzguenda (2018) suggested that education and training on emotional intelligence could help to improve decision-making processes and change how people react to situations on a day-to-day basis. This includes including training in the context of schools, colleges, academic and industry education as well as integration into organisational training programs.

ORGANISATIONS COULD ALSO INCLUDE EMOTIONAL INTELLIGENCE IN HUMAN RESOURCE POLICIES AND PRACTICES, AS WELL AS HIRING TECHNIQUES, SUCH THAT A CULTURE EVOLVES WHEREBY "EMOTIONAL INTELLIGENCE BECOMES NOT ONLY A VALUE BUT ALSO A FACTOR OF PERFORMANCE ON-THE JOB" [63].

In the context of climate change, emotions can at times undermine our actions (fear of change can lead to resistance, for example). It can also be a powerful motivator for action and central to the sustainable mindset change process if it is recognised and harnessed in the right way. This process starts with cultivating emotional intelligence which includes building increased self-awareness, self-regulation, motivation, empathy and social skills [64] to help people and organisations adapt and change [65].

One of the ways that the investment community has approached their emotional connection to climate change is to consider definitions around purpose and beliefs. These considerations are often put into the governance category in the investment context, which typically refers to the people and structures in place to ensure there is effective oversight and management of the investment processes. For example, in the context of the Taskforce on Climate-related Financial Disclosure (TCFD, 2017) recommendations specific to climate change, governance was one of the four pillars of the recommendations. The recommended actions include describing the board's oversight of climate-related risks and opportunities and describing management's role in assessing and managing climate-related risks and opportunities. Nowhere in the text is there reference to how people think, what attitudes they bring to the issues, how their emotions, feelings and assumptions might be influencing how they make decisions. This is quite typical of other guidance on investment actions specific to governance and is not a criticism specific to the TCFD.

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62. Bouzguenda, K. (2018). Emotional intelligence and financial decision making: Are we talking about a paradigmatic shift or a change in practices? Research in International Business and Finance, Elsevier, vol. 44(C), pages 273-284.
63. Bouzguenda: 2018:19
64. Goleman, D. (2007). Emotional Intelligence (10th ed.). Bantam Books.
65. For a detailed consideration of the role of emotions in decisions to accelerate transition, see V. C. Ho, A. H. Berman, J. Andrade, D. J. Kavanagh, S. La Branche, J. May, C. S. Philson, D. T. Blumstein, 2024. "Adding immediate emotions to the Theory of Planned Behavior: A proposal for augmenting pro-environmental behavioral prediction". Frontiers in Climate, Vol. 6, 2024.

Consequently, while reference to **GOVERNANCE IS A VALUABLE AND MUCH NEEDED ADDITION TO THE INVESTMENT FRAMEWORKS AS THEY AT LEAST ACKNOWLEDGE THAT THERE ARE PEOPLE INVOLVED IN THE PROCESS, THEY STILL GLOSS OVER THE INNER DIMENSIONS OF THE HUMAN CONDITION. BY REMAINING ON THE OUTER EDGE OF ENQUIRY INTO HOW INVESTORS FEEL ABOUT CLIMATE CHANGE AND HOW THEIR EMOTIONS INFLUENCE THEIR BEHAVIOUR, WE MAY ALSO BE OVERLOOKING HOW WE CAN GENUINELY SHIFT TO A SYSTEM THAT INCORPORATES SUSTAINABILITY INTO ITS CORE**.

Embracing a broader sense of purpose

On the connection to purpose, much of the debate within the financial sector resides in the definition and interpretation of "fiduciary duty". Many international legal experts have studied the laws in their regions and generally agree (with some variation) that the fiduciary duty of a financial institution is to act in the best interest of their stakeholders, which has been interpreted to mean best financial interest [66]. Additional text has been added to reference ESG and sustainability issues as being financially material considerations, therefore an integral part of these duties.

Legal cases have proliferated to challenge investors who have failed to consider sustainability as part of their purpose, with no cases (at the time of writing) existing because they acted on sustainability [67]. This means that from a purely legal perspective, the risk of inaction on sustainability is higher than the risk of action. Organisations do, however, need to demonstrate that they are integrating sustainability and ESG issues in a genuine way, to avoid accusations of greenwashing and the potential legal ramifications of that. But to be clear, legal action against greenwashing poses a risk only to organisations that say they are doing something when they are not doing it. So, there is only a risk if there is an element of deception or exaggeration. In all cases, the onus will be on investors to have a clear process and rationale in place for why they are acting on sustainability, how they are acting and what they hope to achieve. Honesty and clarity are principles that apply to the incorporation of any issue that impact on investment decisions and outcomes, sustainability should not be considered a unique or additional source of risk from that perspective if it is embedded into processes in a genuine way.

What the **DISCUSSIONS ON FIDUCIARY DUTY ARE MISSING IS A WIDER ACKNOWLEDGEMENT OF THE EMOTIONAL CONNECTION TO A SENSE OF PURPOSE THAT WARRANTS ATTENTION**. As we will see when we turn to examine short-termism, the brain's urge to make short term decisions is dominated by an emotional drive to do so, as it seeks short-term reward and feedback. The logical inference is therefore not to deny that emotion exists or needs to be stamped out, but to consider how investors can harness their emotions to personally feel connected to a broader sense of purpose that guides their day-to-day behaviour.

66. Principles for Responsible Investment. (2019). Implications for strategic asset allocation.
A paper published by the PRI as part of a program of work on the Inevitable Policy Response to climate change.
67. https://www.clientearth.org/latest/documents/10-landmark-climate-change-cases/

As the Institute of Chartered Accountants in England and Wales observed in the aftermath of the global financial crisis, the financial sector needs to develop a clear understanding and belief in purpose. This will provide people and organisations with the context and resilience to make difficult decisions and help to cement good culture and conduct. ICAEW noted that purpose needs to be easily understood by everyone, so that it can provide a coherent approach to implement change and new initiatives, developments and practices. As Basford and Schaninger noted, (2016:3):

Believing in the "why" behind a change can inspire people to change their behaviour. In practice, however, we find that many transformation leaders falsely assume that the "why" is clear to the broader organization and consequently fail to spend enough time communicating the rationale behind change efforts [68]**.**

According to Sinek (2019), most organisations and people start with the 'what' and think about more functional aspects of what they do. They are also able to articulate 'how' they do what they do, listing goods/services that they provide and tools that they use. However, genuine behaviours that can be sustained over time need to start with the 'why' a person is doing what they are doing, what it personally means to them. The 'why' is your purpose, what one believes in, it will run through everything one does and provide the common thread to one's decisions; it is part of one's mindset. Discrepancies can however be felt as a cognitive dissonance and cause interior tension and unease.

The former director of the IMF and current President of the European Central Bank, Lagarde (2019) stated in her speech in the 32nd World Traders' Tacitus Lecture that a broader sense of purpose was needed for the financial sector:

I believe that we can build a better financial sector - one that is safer, more sustainable, and ethically sound. A financial industry with a broader sense of purpose.

This goal is not just morally just; it is economically right. Why? Because a better financial sector is more important than ever to help deliver on what our 21st century so badly needs: higher employment, greener growth, and good living standards for all.

The key to achieving this goal is to reshape finance into something that is more aligned with societal values and more connected to the interests of all stakeholders: from customers, to workers, to shareholders, to local communities and future generations.

68. Basford, T., and Schaninger, B. (2016). The four building blocks of change. An article published by McKinsey Quarterly. Page 3.

Lagarde also observed that for finance to become safer and more trustworthy, it needs to harness innovation, better regulation and a broader sense of responsibility. She spoke about the importance of values and ethics and moral conduct, where each person working in finance needs to feel a broader sense of purpose that they are connected to and feel inspired to be creative and innovative to overcome obstacles and help achieve that reality.

Realisation and alignment of beliefs

Defining investment beliefs is another important component of developing a solid foundation for the development and implementation of a sustainability policy and program of work, for any financial institution. Investment beliefs generally refer to what investors know, or think they know, about how investment returns are generated. Investment beliefs are just that - beliefs - as such they cannot be proven and there is some degree of uncertainty underpinning investment beliefs. For a more integrated approach to sustainability, it is important that beliefs around climate change and sustainability are reflected in an organisation's investment beliefs, and that these beliefs acknowledge that there is an element of subjectivity and uncertainty that goes beyond the data and quantitative analysis. The Thinking Ahead Institute noted:

The complexity of implementing a strategy for sustainability is considerable. Given the impossibility of reducing market behaviour and portfolio uncertainty to a series of equations, a system of beliefs is needed as the foundation of an accountable, methodical investment process [69].

This perspective is generally accepted and endorsed by financial regulators, industry bodies and investor groups across different jurisdictions [70]. For example, the PRI (2016) noted that investment beliefs set the direction for investment policy, practice, and organisational culture. Beliefs can not only help define how value will be created in the context of uncertainty, but they also help to guide capital allocation decisions.

Most financial institutions have gone through a process of defining their investment beliefs, with invariably some integration of sustainability and climate change issues as part of this process. Some financial institutions might have a stand-alone set of sustainability beliefs that go into considerable detail on specific ESG issues (EAPF, n.d.), while others will stay at a higher, principle-based level (BCI, n.d.). In almost all cases, the main challenge for organisations is to ensure that beliefs are more than just words written on paper, and they are internalised by the individuals who make the day-to-day investment decisions.

69. Thinking Ahead Institute (2017:6).
70. Norton Rose Fulbright. (2022). UK Pensions Briefing: Where are we now on ESG and Climate Change?

While there is some variation in terms of the way that the industry goes about defining their beliefs and how this relates to sustainability issues, typically a board or committee will be guided (often by external advisors) to discuss and debate a range of sustainability issues. The result will normally set out the issues that the individuals inside the organisation (and their stakeholders) are most concerned about, the strength of their beliefs, and what that means in terms of the investment decision-making process [71].

The motivation or discussion as to 'why' a certain belief is important or has been adopted also links back to the broader sense of purpose that we discussed. Often the most contentious points will be the extent to which people see the pursuit of sustainability as being in alignment with (and necessary to) achieving strong financial outcomes, versus those that are less sure and envisage a trade-off of some kind. This tends to give rise to a case-by-case approach, or the preference towards implementation through actions that are not specific to capital allocation decisions but might still exert some influence over the outcomes (such as voting and engagement with investee companies, giving rise to engagement initiatives such as the CA100+) [72].

Cognition – *how* we think

In turning to how we think (our cognition), Kahneman (2011) provides an overarching framework that puts the rationality theory favoured by Plato, Aristotle, and the Enlightenment in a different light, by suggesting that humans are a product of our evolutionary environment and in many ways ill-equipped to deal with a rational, science-based, logical world. This means that we are all (investors included) at risk of repeating the same cognitive errors and biases, easily manipulated, and driven by sometimes irrational beliefs (different rationalities would social sciences tell us), and fears. These tendencies have been classified by Kahneman (2011) in terms of fast and slow thinking responses, where fast thinking (referred to as System 1 thinking) refers to our automatic responses and decisions that are made quickly and with little effort. Slow thinking (System 2 thinking) allocates attention to the effortful mental activities that demand it, including complex computations. **KAHNEMAN ARGUED THAT THE NOTION OF RATIONALITY WOULD HAVE US BELIEVE THAT SYSTEM 2 THINKING IS PROLIFIC AND DOMINANT, ALTHOUGH THE EVIDENCE SUGGESTS THAT AUTOMATIC THINKING WITH LEAST EFFORT IS MOST COMMON, TAPPING INTO SYSTEMS 2 THINKING TO CONFIRM OUR AUTOMATIC RESPONSE OR JUDGEMENT**. Cultural norms, associated to the place of science, productivism and consumerism play a key role.

This is an important body of work in the context of the finance sector, as it goes to the heart of how capital can be misallocated at the global level. Some of the identified psychological effects that can lead to inefficient allocation of capital include heuristic simplification, self-deception, narrow framing [73] and lack of systems thinking [74]. Daniel et al (2002) highlighted how **HEURISTIC SIMPLIFICATION MIGHT HELP TO EXPLAIN MANY INVESTOR BIASES SUCH AS AVAILABILITY EFFECTS (HEAVY FOCUS ON INFORMATION THAT STANDS OUT), FRAMING EFFECTS (WHERE THE DESCRIPTION OF A SITUATION AFFECTS JUDGEMENT), MONEY ILLUSION (WHERE NOMINAL PRICES AFFECT PERCEPTIONS) AND STATUS QUO (WHERE RELIED UPON FRAMEWORKS ARE NOT CRITICALLY QUESTIONED)**. In addition, self-deception can explain overconfidence, biased self- attribution, confirmatory bias (interpret information in a way that is consistent with one's pre-existing beliefs) and anchoring to existing beliefs.

Two of the areas that warrant closer attention in relation to how we think and the ability of the financial sector to change its behaviour with respect to climate change action are systems thinking and long-term horizon. As we will see from the literature and evidence, **NARROW REDUCTIONIST THINKING TENDS TO DOMINATE HOW MANY INVESTORS MAKE DECISIONS, WHICH CAN REDUCE THEIR ABILITY TO SEE THE CONNECTIONS AND INTERRELATIONSHIPS AT THE SYSTEM WIDE LEVEL. REDUCTIONIST THINKING HAS EMERGED AS THE DOMINANT AND PREFERRED MINDSET FROM A BODY OF KNOWLEDGE AND LEARNING SINCE THE INDUSTRIAL REVOLUTION TO INCREASE EFFICIENCY, BUT AS WE WILL SEE, IT CAN BE UNLEARNED** with some focus and effort to see the world in terms of interconnecting systems.

The second area of literature we will explore is the prevalence of short-termism in the financial sector. This has been a well-documented and debated phenomena both in the academic and industry context, but to date there has been no real breakthrough or change to our myopic tendencies. We will explore why that is, if it can be overcome and some possible actions that could be taken.

Developing systems thinking

Aristotle observed that the whole is more important than the sum of its parts [75], which has been interpreted to mean that a system must be understood as a whole and cannot be comprehended by examining its individual parts in isolation from each other. That is the essence of what systems thinking means.

What we have seen over the past 400 years is an increasing tendency to segment, at society's level, our knowledge and understanding into smaller pieces and start to lose sight of the interconnections and relationships between these pieces. Ackoff [76] explained that we have mistakenly come to view analysis and thinking as being synonymous. Analysis is, however, only one method of understanding the world around us. Ackoff described what he coined synthetic thinking, where we try to explain the behaviour of the system and why the

73. Hirshleifer, D. (2001). Investor Psychology and Asset Pricing. The Journal of Finance, 56(4), 1533–1597. http://www.jstor.org/stable/2697808

74. Meadows, D.H. (2008). Thinking in Systems: A Primer. White River Junction: Chelsea Green Publishing.

75. Aristotle 980a Metaphysics, Translated by W. D. Ross. - 76. 2004:4

parts do what they do, compared to analytical thinking which tries to explain what the parts do and how they work: "Systemic thinking is holistic versus reductionistic thinking, synthetic versus analytic".

As Atwater et al explained in the context of learning how to cultivate systems thinking, analytical thinking involves breaking down a system into smaller parts and examining them in isolation. Once the parts are understood, the analyst attempts to explain the behaviour of the whole based on the behaviour of the parts. In contrast, synthetic thinking attempts to "understand the larger context that the system operates within" [77] to explain the behaviour of the system as a whole. In other words, "analytical thinking explains what the parts do and how they work while synthetic thinking explains why the parts do what they do" [78]. Additional insights are offered by Meadows who defines a system as:

> ***an interconnected set of elements that is coherently organized in a way that achieves something... A system must consist of three kinds of things: elements, interconnections and a function or purpose*** [79].

In the context of the finance sector, **THESE ELEMENTS MIGHT BE CHARACTERISED AS THE TRADITIONAL FINANCIAL METRICS THAT ARE UTILISED TO EVALUATE THE FUTURE VALUE OF A COMPANY OR ASSET, WHEREAS THE INTERCONNECTIONS ARE THE LINKAGES BETWEEN THE VALUE OF A COMPANY OR ASSET AND OTHER CONDITIONS THAT STRETCH BEYOND THESE METRICS (THE MACROECONOMIC, POLICY, POLITICAL, SOCIAL, AND ENVIRONMENTAL CONTEXT)**. The function or purpose as part of this framework links the systems thinking to how investors define their purpose, and the extent to which this is an enlarged sense of purpose that incorporates wider social and environmental responsibilities.

There is growing recognition from within some of the thought leaders of the financial sector on the benefits of systems thinking for the financial sector, although this is not yet the accepted wisdom of the mainstream investment community. As the Thinking Ahead Institute argued in its paper on system thinking and investment: "To better achieve their objectives in a complex adaptive system, participants need to utilise a multi-disciplinary approach to understanding, and managing, the system [80]."

We can see how important systems thinking is for the financial sector when we observe what happens at the system wide level when investors focus only on their individual part of the system and fail to see the whole or consider their wider responsibilities. The global financial crisis is an obvious example of such an event. At the system wide level, the continued financing of fossil fuel extraction activities in the face of catastrophic climate risks is another example, where the linkage between financing decisions and climate impacts is either not considered, not understood, not considered a priority, or not considered the best way to exert influence. It is such situations where we also see the liveliest debate within the finance sector, with some arguing that continued financing of fossil fuel activities while

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77. Atwater et al, 2008:12
78 Atwater et al, 2008:12
79. 2008:11 - 80. 2017:13

supporting net zero by 2050 goals is incompatible, whereas others justify this as a question of what lever to utilise and prefer to exercise their influence through engagement, whilst continuing to finance fossil fuel companies [81].

Another important consideration in terms of systems thinking is to consider **HOW COMFORTABLE AND WILLING THE FINANCIAL SECTOR IS TO THINK BEYOND THE DATA. THE USE OF JUDGEMENT IN MAKING INVESTMENT DECISIONS UNDER UNCERTAINTY IS A NECESSARY AND INHERENT PART OF THE PROCESS, ALTHOUGH JUDGEMENT IS OFTEN DENIED OR VERLOOKED BY INVESTORS, AS THE ASSUMPTIONS HAVE BECOME SO DEEPLY INGRAINED THAT THEY ARE NO LONGER CALLED INTO QUESTION, THEY ARE PART OF THE INDUSTRY'S ACCEPTED WISDOM** [82]. When it comes to utilising new tools, information, frameworks or models that require thinking outside of these accepted norms, then the level of discomfort and resistance increases.

A pilot study on systems thinking amongst asset managers noted that "incorporating a systems approach to assessing sustainability impacts introduces a high level of complexity into methodologies and raises requirements for extensive data collection at the company level" [83]. The study considered some different approaches that investors use to manage this complexity. These include:

1) narrowing the focus to companies that are considered most important for achieving global sustainability impacts;

2) using complex automation techniques and;

3) adopting more qualitative approaches to assess system-wide sustainability impacts, such as semi-structured interviews, observational studies, participatory action research techniques, to name a few.

The authors noted that they did not find very good examples of the latter, revealing a very important dichotomy in the context of the financial sector. The industry recognises there are gaps in the data, that it alone cannot and does not explain the complexity of the system that investment decisions are made, yet it resists moving into territory that goes beyond overreliance on historical data. It is as though qualitative analysis is not considered worthy, or is not sufficiently robust, despite a long history of strong research and utilisation of qualitative research techniques in many disciplines of academic research and industry. As Reinecke et al (2016) noted, qualitative methods are well poised to understand and explain complex and messy phenomena in sustainability research. The tools and approaches can be helpful to examine novel or emergent questions, where no or little extant theory or data exists from which to deduce testable research hypotheses.

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81. Leaton, J. (2014). Gone fishing: divestment and engagement. An article published by Carbon tracker, UK.
82. Guyatt, D. (2006). Identifying and Overcoming Behavioural Impediments to Long Term Responsible Investment: A Focus on UK Institutional Investors. Available at SSRN: https://ssrn.com/abstract=1911821 or http://dx.doi.org/10.2139/ssrn.1911821.
83. Järnberg et al, 2023:4.

An additional topic of relevance to systems thinking is the growing realisation of the planetary limits to economic growth that challenges the pursuit of GDP growth that has dominated the discourse of policy makers, corporations, and investors for the past 40+ years. It is common sense to see that exponential economic growth in a world of rising population and finite resources is not sustainable. Moreover, rising inequality, biodiversity loss and climate change are some of the outcomes of this pursuit of growth. Yet these connections are not often made or understood within the finance sector, as almost everyone has been trained and educated to believe that GDP growth is a valid pursuit, and that the goal of maximising short-term returns on investment will induce exponential growth in the aggregate stock of financial capital.

The same planetary boundaries that dictate limits to growth also imply limits to investment, since investment fuels growth....

...The drive for exponential returns on financial capital pushed finance to shorter-term and more speculative activity at the same time as physical resource limits to growth began to impose constraints [84]***.***

The drive for exponential returns on capital and infinite GDP growth therefore feed from each other, a pursuit that clearly cannot continue if we are genuine in our quest to pursue sustainable development and restore the health of the ecosystem. There is abundant literature from credible sources that proposes alternative goals that respect the planetary boundaries and align economic and financial outcomes with goals that also prioritise justice, fairness, equality, resilience, well-being and environmental sustainability.

Many financial institutions are aware of the need for a new economic approach and see the merit of systems thinking and regeneration economics [85], but this awareness is not always reflected in day-to-day decision-making processes. This is due to several possible reasons:

1) There is an assumption that enabling a paradigm shift is an issue for policy makers or academics, they see themselves as future takers rather than future maker [86] or

2) It is seen as a side or niche activity,

3) They are too busy getting on with their job of investing within the existing norms that prevail.

Systems thinking would instead, lead people to think beyond those boundaries and pro-actively find ways to contribute to financing activities that support a reduction in consumption, emissions, pollution and waste, and an increase in recycling and re-using of materials, as well as activities that support the regeneration of the ecosystem.

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84. Fullerton, 2014:3.
85. Thinking Ahead Institute. (2020). System thinking and investment: introducing the ecosystem perspective. A report published by Willis Towers Watson, UK.
86. Allen, J. (2014). Long-term thinking. An article published by Bain & Company.

Aligning short-term decisions with long-term vision

There is a body of literature that focuses on the relationship between investor behaviour and the short-term investment horizon [87], with evidence to suggest that myopic behaviour prevails in the financial market [88]. Indeed, **SHORT-TERMISM HAS BEEN IDENTIFIED BY THE FINANCIAL SECTOR ITSELF AS A KEY BARRIER TO ACTION ON SUSTAINABILITY AND CLIMATE CHANGE**, with Mark Carney's speech (2015) of the tragedy of the horizon being a widely cited and lauded intervention!

When we consider the remedies to short-termism that have been proposed and adopted through the TCFD and other investor initiatives, we see that these mostly focus on the external conditions rather than the internal processes that are driving the short-term investment horizon. This stands to reason since the problem is also defined as resting on external factors. Moreover, the discourse tends to shift away from investors needing to think with a long-term horizon and putting the onus back on to companies to do so in setting their strategy. The chicken and egg game continues, as companies complain that investors place short-term pressure on them for financial performance over quarterly time horizons, so long-term strategy is not rewarded or encouraged [89]. Meanwhile investors advocate the need for long-term thinking, but in effect do very little to change their own mental model.

The various groups, clubs and research efforts that have looked at promoting long-term investing over the years are all largely based on the assumption that we can combat our short-term tendencies through changing the external conditions. For example, solutions include increasing the volume and reliability of information, reducing the frequency of company reports, giving long-term shareholder voting preferences, including the 'long run' in fiduciary duty laws [90]. None of these deliberations consider the possibility that we could also look inwards to try to understand our behaviour and why we gravitate towards the short term. Cognitive neuroscience provides a valuable insight in this regard.

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87. Stein, J. (1989). Efficient capital markets, inefficient firms: A model of myopic corporate behaviour. Quarterly Journal of Economics, Vol.104(4):655-659.
Froot, K.A., Scharfstein, D.S. and Stein, J.C. (1992), Herd on the Street: Informational Inefficiencies in a Market with Short-Term Speculation. The Journal of Finance, 47: 1461-1484. https://doi.org/10.1111/j.1540-6261.1992.tb04665.
88. Black, A. & Fraser, P. (2002). Stock market short-termism - An international perspective. Journal of Multinational Financial Management. Vol.12(2):135-158.
Cuthbertson, K., Hayes, S., & Nitzsche, D. (1997). The Behaviour of UK Stock Prices and Returns: Is the Market Efficient? The Economic Journal, 107(443), 986–1008. http://www.jstor.org/stable/2957845.
Miles, D. (1993). Testing for Short Termism in the UK Stock Market. The Economic Journal, 103(421), 1379–1396. https://doi.org/10.2307/2234472.
Nickell, Stephen & Wadhwani, Sushil B. (1987). «Myopia, the 'Dividend Puzzle', and Share Prices,» CEPR Discussion Papers 155, C.E.P.R. Discussion Papers.
89. Fuller, J,. and Jensen, M. (2009). 8. Just Say No to Wall Street: Putting a Stop to the Earnings Game. In D. Chew & S. Gillan (Ed.), U.S. Corporate Governance (pp. 161-169). New York Chichester, West Sussex: Columbia University Press. https://doi.org/10.7312/chew14856-008.
90. WBCSD. (2020). Reinventing Capitalism: A Transformation Agenda. A report published by Volans and the World Business Council for Sustainable Development.

Sharot (2017) observed that it is difficult for people to think too far into the future about things that may or may not happen. The brain likes and is rewarded by immediate and certain outcomes. Researchers have identified two areas of the brain that appear to compete for control over behaviour when a person attempts to balance near-term rewards with long-term goals [91]; these are emotions and abstract reasoning. Decisions involving the possibility of immediate reward activates parts of the brain influenced heavily by neural systems associated with emotion. Impulsive choices or preferences for short-term rewards result from the emotion-related parts of the brain winning out over the abstract-reasoning parts.

REMEDIES TO COGNITIVE LIMITATIONS AND SHORT-TERM THINKING AMONGST INVESTORS THEREFORE NEED TO GO BEYOND EXTERNAL CONDITIONS SUCH AS INFORMATION FLOW AND THE PRECISE WORDING OF LEGAL TEXT. WE NEED TO ALSO CONTEMPLATE HOW INVESTOR'S APPETITE FOR SHORT-TERM REWARDS AND CERTAINTY (IN A WORLD OF COMPLEXITY AND HIGH UNCERTAINTY) CAN BE MANAGED THROUGH INTERNAL ENQUIRY AND CONTEMPLATION, BOTH AT THE COLLECTIVE (INDUSTRY WIDE) LEVEL AND FOR INDIVIDUALS.

This is why fostering a long-term mindset in finance is not only about changing the external conditions but is also about looking inside and discovering what motivates us, and what will allow each of our short-term day-to-day decisions to be consistent with the long-term vision and goals that inspire us. As psychologists Deci and Ryan observed, "To be motivated means to be moved to do something [92]." A person who feels energised and activated towards a certain goal is being guided by their intrinsic motivations, they are inspired to learn, to innovate and feel good about their decisions. In the context of climate change in finance, this means that if an individual's end goal or vision is to achieve a more sustainable and prosperous future for its stakeholders, then the day-to-day decisions will tend to be more aligned with that long-term vision.

Behaviours – *how* we behave.

We have already seen the growing body of literature that shows evidence of so-called 'irrational' (in reality, multi-rational) behaviour amongst investors (when compared to what traditional theory predicts in terms of behaviour). This body of knowledge has emerged from the behavioural finance, social psychology and economic psychology disciplines and is important for the study of the sustainability mindset principles, as it goes to the heart of acknowledging some of the limitations of existing theories and our mental models, so that we might move closer to achieving behaviour that is more aligned with the financial sector serving others and allocating capital to where it is most needed. This is related to the studies on over- and under-reaction [93] where it has been shown that investors tend to

91. Woolley, K., and Fishbach, A. (2017). Immediate Rewards Predict Adherence to Long-Term Goals. Personality and Social Psychology Bulletin, 43(2), 151–162. https://doi.org/10.1177/0146167216676480.
92. 2000:54
93. De Bondt, Werner F. M., and Thaler, R. (1985). Does the Stock Market Overreact? The Journal of Finance, 40(3), 793–805. https://doi.org/10.2307/2327804

overvalue the best stocks and undervalue the worst, which in turn, is usually driven by an extrapolation of recent performance [94].

Two behavioural tendencies of particular interest in the context of climate change and the financial sector are:

1) The tendency to conform to industry and organisational norms (which can give rise to resistance to change the status quo or a preference to anchor to what people know and understand).

2) The workplace culture of the financial sector can be fast-paced, competitive and stressful, giving rise to behaviours and outcomes that are tangential to achieving a more sustainable and purposeful financial system [95].

Encouraging innovation

An important consideration in the context of understanding investor behaviour is the extent to which investors conform to the dominant paradigm that prevails within the financial sector, which can lead to a type of groupthink that reinforces the status quo at the organisation, industry and market-wide level. This tendency towards conformist behaviour is underpinned by 'conventions', defined as the **MODUS OPERANDI THAT GUIDE BEHAVIOUR IN THE FACE OF UNCERTAINTY AND EXTERNAL SCRUTINY, BRINGING TOGETHER IMPLICIT AND EXPLICIT SHARED BELIEFS AND OVERT SIGNALS THAT FRAME EXPECTATIONS AND INTERACTIONS, BOTH WITHIN AN INSTITUTION AND ACROSS THE FINANCIAL MARKET**. This is relevant in the context of investors, as conventions produce a regularity in behaviour that is based on the expectations of others' behaviour and for which it is mutually beneficial to co-ordinate in different situational contexts (either consciously or unconsciously). It means that **A FORM OF GROUPTHINK ABOUT WHAT IS LEGITIMATE AND JUSTIFIABLE TO OTHERS CAN RESULT IN OVER RELIANCE ON NARROW INVESTMENT CRITERIA AND SOURCES OF INFORMATION, SOLIDIFYING THE STATUS QUO AND MAKING IT HARD TO INCORPORATE WIDER ISSUES RELATED TO SUSTAINABILITY AND CLIMATE CHANGE THAT SIT OUTSIDE THE BOUNDARIES OF DEEP ACCEPTANCE. THE ISSUE FOR TRANSITION IS THAT ANOTHER TYPE OF GROUPTHINK NEEDS TO EMERGE.**

There is some evidence of a change in industry conventions that are allowing climate change considerations to enter the mainstream discourse of finance, such as the inclusion of climate change in investment belief statements, setting goals and objectives that incorporate climate change outcomes, and increased focus on engaging with governments and investee companies to promote more sustainable behaviour. However, we have also seen the prevalence of greenwashing, the persistent gap between the financial sector's aspirations and its capital allocation decisions and a failure to internalise a broader definition of the purpose of finance.

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94. Shleifer, A. and Vishny, R.W. (1990). Equilibrium short horizons of investors and firms. The American Economic Review, 80(2), pp.148-153.
95. Guyatt, D. (2023). Cultivating a sustainable mindset in finance: Mobilising the capital needed to combat climate change. Ethics International Press, Cambridge, UK.

These are all indicative of an industry that is still anchoring to dominant conventions that have not yet shifted on the fundamentals of finance. As the industry embarks on the journey of learning and evolving its processes and thinking, the strength of beliefs and internalisation of a broader sense of purpose are crucial parts of building new industry conventions that will move the industry towards a more genuine climate change position.

Challenging and changing existing industry conventions also requires an element of courage and willingness to overlook the perceived risk of doing something different from the norm (Guyatt. 2006). What this means in practice, is that financial institutions would internalise a deeper sense of purpose that relates to its context and stakeholders, to bring a closer connection between legal duties, a broader sense of purpose and connection to individual and organisational beliefs. Financial innovation is prolific and there is certainly a lot of creativity inside the sector that has delivered positive social and environmental benefits [96], although this potential is not always harnessed in a way that reflects a broader sense of purpose that goes beyond making money in the short term, to one that is aligned with societal values and long-term interests. While not a silver bullet, a clearly defined broader sense of purpose at the industry, organisational and individual level would certainly help to form these connections and better guide the finance sector's day-to-day decisions.

At the organisational level, financial institutions can create a culture whereby investors are encouraged to seek new ways to think and alternative sources of information and perspectives, to challenge the status quo. **THERE ARE MANY WAYS TO APPROACH INNOVATION, FOR EXAMPLE ESTABLISHING AN INNOVATION CENTRE [97] OR SETTING A STRATEGIC GOAL TO PROMOTE INNOVATION AND ALIGNING THIS WITH THE BROADER SENSE OF PURPOSE AND SUSTAINABILITY GOALS [98]. BUT INNOVATION ALSO MEANS FAILURE BEFORE SUCCESS, WHICH REQUIRES A CULTURE OF THE RIGHT TO FAIL IN ORDER TO LEARN AND IMPROVE. RESEARCH ON MINDFULNESS HAS SHOWN THAT IT CAN BE EFFECTIVE IN ADDRESSING THESE INTERNAL, SUBJECTIVE ISSUES PLAYING A ROLE IN TRANSITION EFFORTS.**

Promoting mindfulness, health and well-being

Many people in the financial sector find themselves working in a high pressured, competitive, and stressful environment that prioritises quick decisions and short-term gains. This environment can encourage people to make decisions quickly, which can give rise to automatic decisions (Systems 1 thinking) and reinforce the tendency to conform to existing structures and knowledge. What this fast paced and competitive environment can also result in is increased stress and behaviour that leads to burnout – a state of physical and emotional exhaustion. While burnout is often discussed in different contexts to the pursuit of sustainability, it is a symptom of the same set of conditions.

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96. IMF. (2021). From financial innovation to inclusion. An article published by the IMF.
97. APG. (n.d.) Innovation Manual, Volume 9. An internal innovation manual published by the Dutch pension fund APG.
98. Nidumolu, R., Prahalad, C.K., and Rangaswami, M.R. (2009). Why Sustainability Is Now the Key Driver of Innovation. An article published by Harvard Business Review.

Indeed, research in the UK found that 58% of financial services professionals feel that their life is out of control, and that 46% admit there are times they have felt like running away, highlighting their fragile mental state [99]. A poor workplace culture has been found to increase moderate to severe burnout by 157%, this includes lack of organisational purpose, few opportunities to grow and develop, poor teamwork and a control and command leadership approach. The combination of a competitive and fast paced environment, along with a lack of belief in why people are doing what they are doing and lack of agency over what they are doing, can result in higher levels of stress and potential burnout. This is directly linked to how an industry behaves, the culture and norms that prevail, and the decisions that we make as we try to perform in that context.

We can clearly see a dilemma here in terms of how the culture in the finance sector potentially undermines the pursuit of sustainability. To create a kinder, more thoughtful world that does not pursue short term gain and create undue stress (on people and the planet), we need to embody this goal as part of our day-to-day interactions with each other, and the prevailing culture of the industry. It will be very difficult for the finance sector to create a sustainable financial system if it is coming from a place of unsustainability and disregard for the health and well-being of the people who work inside the industry. Put in another way: when people are healthy, feel a sense of purpose and agency, then they are more likely to be motivated to act with greater care and have the energy and vitality to make positive change [100].

The practice of mindfulness has been utilised to help create this cultural transformation in a broad array of contexts, with Boschert et al (2020) developing some resources and case studies to illustrate how this works in practice in the financial sector. They define mindfulness as ***"THE ABILITY TO REGULATE ATTENTION, EMOTIONS AND AWARENESS,*** [101] **" TO NOT ONLY ADDRESS STRESS AND REDUCE BURNOUT RISK, BUT TO ALSO STRENGTHEN CONSCIOUS DECISION-MAKING AND CHANGE ENTRENCHED HABITS**. The research noted that mindfulness training can be helpful for the financial sector, as cultivation of "attention regulation, emotional and body awareness, positive outlook and meta-awareness" [102] are core skills to improve wellbeing and to foster innovation and collaboration as we move towards a more just and sustainable financial system.

An additional element of mindfulness that is relevant for financial institutions and sustainability is to allow time and space to tap into our inner wisdom or intuition. The role of wisdom as part of systems thinking was discussed earlier, where we saw that wisdom embodies not only the accumulation of knowledge and understanding about the external world, but also how our inner conditions influence how we understand the interconnections and react to such stimuli. Inner wisdom is often likened to 'gut instinct',

99. Glasspool, J. (2022). Tackling burnout in financial services. An article published by IFA Magazine.
100. Guyatt, D. (2023). Cultivating a sustainable mindset in finance: Mobilising the capital needed to combat climate change. Ethics International Press, Cambridge, UK.
101. Boschert et al, 2020:4.
102. Idem, 2020:22.

'instinct' or intuition that feeling that we get when we are guided by something that is not completely explainable, but "it feels right". In the context of finance, our inner wisdom might be confused as being a behavioural bias, a Systems 1 automatic response aka the Kahneman model of behaviour. However, as Waddock (2010) argues, inner wisdom is much more powerful than our automatic reactions, it is those moments when we may have some evidence, facts, opinions, and past decision patterns – but something else is guiding us towards a certain outcome or behaviour, and that something is our broader systems perspective and sense of ethics and morality. This will vary from person to person and across different cultural contexts, what the inner wisdom is telling us specifically is less important than creating space to listen to it.

At the organisational level, the practical implications of the link between mindfulness, inner wisdom, well-being and conscious decision making that can support and enable a sustainable mindset shift are wide and varied. Boschert et al [103] provide some examples of actions that have been taken within the financial sector, including:

- prioritizing employee wellbeing and trust inside an organisation and through client and stakeholder relationships,

- undertaking training on mindfulness (both the management and team members),

- identifying the internal champions or people who are enthusiastic about mindfulness or already practicing it in their personal lives to be key agents for change internally, and

- daily meditation practice as a team and individually to begin to normalise the pursuit of sustainability and ecological transition into the organisation's culture.

Section 4 summary

This section explored some of the literature related to mindsets, sustainability mindsets principles and the emotional, cognitive, and behavioural influences on investor decision making. The review suggests that it will be harder (but not impossible) for people with a fixed mindset to want to adapt to an enlarged sense of purpose that embeds climate change at its core. **WHILE PEOPLE WITH A GROWTH MINDSET WILL BE MORE OPEN TO CHANGE AND WILLING TO ADAPT, THEY MAY NOT HAVE ALIGNED THEIR PERSONAL BELIEFS AND MOTIVATIONS WITH TRANSITION GOALS, OR THEY MAY BE UNSURE ABOUT WHAT IT MEANS IN PRACTICE AND STILL HAVE SOME WAY TO GO BEFORE THAT GOAL CAN BE REALISED**.

In terms of the emotional characteristics of a sustainability mindset, we explored some of the literature that highlights the limitations of the neoclassical notion of rational homo economicus and considered how emotions could be harnessed to support the integration of climate change issues into investment decisions in a more genuine way. Rather than

103. Boschert et al, 2020:22-23

ignoring our emotions, pretending they do not play a role in investment decisions, or indeed treating them as a behavioural bias that needs to be corrected, we could also look at how emotions could be part of the transformation process. There are many ways to approach this, and there is a raft of literature and examples of the practical application of building emotional intelligence that we can draw from. The review focused on two key areas specific to the investment context : embracing a broader sense of purpose of the finance sector, and the realisation and alignment with our beliefs.

In turning to how investors think (cognition), we explored some of the behavioural and psychological literature that further challenges the notion of rationality, as the evidence shows that investors are at risk of repeating cognitive errors and biases, are easily manipulated and driven by sometimes irrational beliefs and fears. This is an important body of work in the context of the finance sector, as it goes to the heart of how capital can be misallocated at the global level, and it also helps to explain why climate change issues can be overlooked, as it is still relatively new to investors and would therefore take more Systems 2 thinking effort. Two of the areas that warrant closer attention in relation to cognitive processes and the ability of the financial sector to support and enable the shift to a sustainable financial system are:

1) THE NEED TO DEVELOP SYSTEMS THINKING WITHIN THE FINANCE SECTOR TO COMBAT REDUCTIONIST AND NARROW FRAMING, AND

2) TO ALIGN SHORT-TERM INVESTMENT DECISIONS WITH LONG-TERM VISION, SUCH THAT OUR URGE FOR SHORT TERM REWARDS AND ACTIONS IS STEERED TOWARDS (AND IN ALIGNMENT WITH) THE LONG-TERM VISION OF THE SUSTAINABLE FUTURE WE SEE.

Finally, in terms of how investors behave, we have seen the growing body of literature that shows evidence of so-called 'irrational' behaviour amongst investors (when compared to what traditional theory predicts in terms of behaviour). This body of knowledge is important for the study of the sustainability mindset in finance, as it goes to the heart of acknowledging some of the limitations of existing theories and our mental models, so that we might move closer to achieving behaviour that is more aligned with the financial sector allocating capital to where it is most needed. Two of the behavioural tendencies of particular interest are:

1) The tendency to conform to industry and organisational norms (which can give rise to resistance to change the status quo or a preference to anchor to what people know and understand).

2) The workplace culture of the financial sector can be fast-paced, competitive and stressful, giving rise to behaviours and outcomes that are tangential to achieving a more sustainable and purposeful financial system.

5. Conclusion: potential application and implications

This chapter highlighted that most of the industry efforts, research and policy discussions have been largely focused on changing the external conditions to mobilise capital, such as inconsistent government policy, lack of information, definitions and standards, lack of expertise, liquidity barriers, market pricing and difficulty in accessing the opportunities. The question that emerged from the review is whether the industry and regulators are willing to acknowledge that there are also internal conditions that may undermine or support change, and that not all the solutions are related to the external conditions. This is where research on the inner dimensions come into play:

THE LACK OF CAPITAL ALLOCATION TO CLIMATE FINANCING IS AS MUCH ABOUT INVESTORS' MENTAL MODELS, WITH MIND-MADE OBSTACLES, SUCH AS NOT CONNECTING BELIEFS WITH A BROADER SENSE OF PURPOSE, FEELING UNCOMFORTABLE WITH COMPLEXITY, CONFORMING TO PEER GROUP NORMS, FAILURE TO REFLECT ON OUR PERSONAL AGENCY, FRAGMENTED ORGANISATIONAL CULTURE, TENSION BETWEEN SHORT- AND LONG-TERM GOALS AND A FEAR OF FAILURE.

Turning to the literature and frameworks on the role of mindsets in supporting change, it was suggested that if investors can envision the future and imagine the role they want to play in realising that future, then their short-term decisions will increasingly become more aligned with that long-term pursuit. When there is a sense of agency and intrinsic motivation to act, then a creative and innovative response is more likely to follow when challenges or problems arise. There will be a greater level of awareness and willingness to challenge dominant assumptions and paradigms that are inconsistent with this vision.

The insights from the literature reviewed have implications for institutional investor organisations in terms of how they evaluate and conduct their investment decision making processes, governance arrangements, the questioning of assumptions around existing beliefs and narratives, particularly with respect to how they are allocating capital to mitigation and adaptation activities. It also has implications for the way in which regulators, industry groups and associations communicate with investors, develop guidance material, conduct workshops, design surveys, and establish new frameworks to support investor action on climate change that prioritises and examines the mindset shift that will support change (in addition to the external conditions).

In terms of the gaps in existing research and literature, more cross-disciplinary research on the role of mindsets is needed to close the knowledge gap that will support and enable investors to contribute to sustainable development and climate mitigation, including research on the role of emotions, cognition and behaviour. **THE FINANCIAL SECTOR HAS RELIED HEAVILY ON THE NOTION OF RATIONALITY THAT IS EMBEDDED WITHIN MAINSTREAM ECONOMIC AND FINANCIAL THEORIES. THESE THEORIES, IN TURN, TEND TO BOTH OVEREMPHASISE AND GIVE CREDIT TO THE RELIANCE ON DATA AND QUANTITATIVE ANALYSIS TECHNIQUES TO THE DETRIMENT OF QUALITATIVE ANALYSIS AND CONSIDERING INVESTORS AS HUMANS, WITH EMOTIONS, VARYING COGNITIVE CAPACITY AND A WIDE RANGE OF BEHAVIOURAL TENDENCIES, NOT ALL OF WHICH FIT THE NARROW DEFINITION OF RATIONALITY**.

As we move closer towards holistically integrating sustainability and climate change objectives into investment decision making processes, multi-disciplinary research is essential to support the mindset shift that is needed to widen the entrenched and narrow framing that prevails.

At the industry level, further research and efforts to support a mindset shift is relevant for financial institutions who are in the process of developing a sustainability policy, or already have some form of sustainability objective, policy, goal, or program of work in place, and are interested in exploring alternative ways to achieve these goals and manage any challenges that might arise. It could be applied through a facilitated team setting or for individual contemplation, by simply thinking about the issues differently, and extending the enquiry further where needed, depending on what issues arise and where the greatest potential for development might be. Such an exploration might include incorporating mindfulness practices to become part of an organisation's board, committee and staff training and development programs.

Industry standard setting agencies and financial regulators could also incorporate the role of mindsets into their frameworks and standards, to encourage financial institutions to look at some of the internal barriers to achieving their goals and make efforts to address these. It could be embedded into the reporting and disclosure frameworks, for example, to acknowledge and encourage the important role that internal change and enquiry can play in creating a more sustainable, resilient, and prosperous financial system that serves the broader needs of everyone. This would include and reinforce the need to move beyond data and quantitative analysis to consider the human and behavioural dimensions and the role that these play in enabling a more sustainable future.

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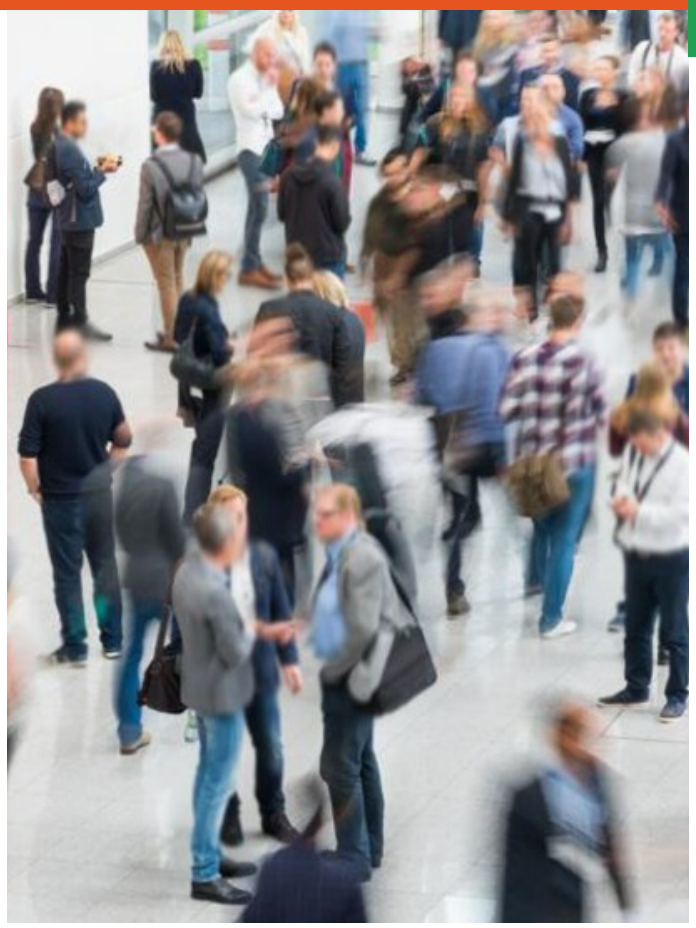
Homo economicus vs Entrepreneurial moderation practices: a reality with transformative potential

Ch. 7

Ansart, S., Ottaviani, F., Duymedjian, R., Poissonnier, H. et Steiler, D
UNESCO Chair towards a culture of economic peace

Grenoble Ecole de Management



Discipline:
Management sciences

Summary

This contribution focuses on the constraints of representation and analysis induced by a conceptual figure still dominant in non-specialized literature[1] concerning the apprehension and legitimization of logics of action of entrepreneurs not exclusively guided by an essentially economic and individual purpose. We are talking here about homo-economicus – The proposed approach is essentially conceptual, mobilizes in counterpoint philosophical currents specifying the role of values in human action, and illustrates through a few cases practices that are not necessarily guided by maximizing rationality.

Anyone who has dabbled with micro-economic theory knows that the entrepreneur is supposed to behave like a homo economicus who would maximize his utility (satisfaction, profit) under constraints (costs, budgets). However, it is enough to look at the behavior of entrepreneurs, such as Elon Musk (Tesla) or Thomas Huriez (1083), to observe the coexistence in the field of entrepreneurship of several non-fungible rationalities, such as intuition, in a calculative rationality. This chapter shows that there is not, for the entrepreneur, only one way to make rational decisions, but multiple ways to exercise rationality depending on circumstances and a person's values.

To distinguish these different forms of rationality, this chapter highlights two distinct figures of the entrepreneur: that of homo economicus inspired by economic utilitarianism based on maximization behavior under constraint, that of the moderate entrepreneur who, in the wake of virtue ethics, articulates a plurality of values such as moderation, prudence, the ability to take care, etc. This paper reveals how plural value criteria can coexist in entrepreneurship and underlines the potentially performative nature of discourses and training sessions about entrepreneurship. Thus, as economic peace promotes, to be able to put entrepreneurship at the service of the common good, it is essential both to recognize the capacity of people to transform the logic of action and to reflect on the institutional factors that condition the reproduction of behaviors of violence, domination, and exploitation.

We focus on the constraints of representation and analysis induced by homo economicus, relative to the understanding and legitimization of logics of action of entrepreneurs not exclusively guided by an essentially economic and individual purpose. The proposed approach is essentially conceptual, mobilizes in counterpoint philosophical currents specifying the role of values in human action, and illustrates through a few cases these practices not necessarily guided by a maximizing rationality.

Keywords:
entrepreneur; entrepreneurial practices; homo œconomicus; moderation; virtue ethics

1. Here, the notion of «non-specialist» literature refers to economic theory or not, and/or the consideration of the motives of human action. In fact, by non-specialist literature, we mean here non-economic scientific literature, economic or social science literature not dedicated to or not impacted by the representation of the economic actor, by professional literature which very often mobilizes this dominant representation of homo economicus to account for the individual entrepreneur.

Introduction

Given the socio-environmental issues at stake, there is a growing awareness of the need to question current trajectories and how societies function. Indeed, the environmental challenge is not confined to its own dimension but calls into question the production and consumption patterns of economies in many ways, such as:

- Because of potential resource shortages and negative environmental impacts, can we assume that all production must be carried out on the simple principle that it is expected to be profitable? In analyses and theories, is it not essential to better distinguish between the needs and desires of individuals?
- What do we mean when we talk about "resource scarcity"? Which resources are genuinely scarce? How does the term «resources» fuel conceptions and practices?
- What would wealth look like and be perceived as, in a world where the satisfaction of needs - not desires - is compromised? What modes of production should be favored, and what modes of sale? Would the market guarantee satisfactory access to these fundamental goods and services?
- What production logic should be implemented in a world faced with natural and human limits? Are product and/or process innovation indispensable and necessarily a source of progress?
- Finally, can the desire to reduce production and consumption ensure the standard of living and quality of life required by our citizens? Is it possible to undo current modes of operation, to modulate them or change them fundamentally?

The point here is not to adopt an overly pessimistic vision of the future but to raise issues regarding practices induced by fairly drastic restrictions (standards, development of public players, firm and top-down public policy, etc.), which would very likely be quickly denounced on the grounds of reduced freedom to act. Instead, these questions aim to encourage citizens, such as economic players and politicians, to modify their representations and actions at their level, modulate their ways of doing things, and act where they can, where it seems feasible and accessible...

In recent years, these behavioral adjustments have become increasingly prevalent, as moderation is asserted in consumption [2], and, in general, in messages such as «consume better,» «work better,» or «produce better», that aim at replacing the desire always to do or have more. These changes in behavior appear to be one of the essential ways of responding in parallel to many of the ills facing us today: the climate crisis, rising stress levels in the workplace, suicides, international crises, etc. Generally speaking, practices are evolving, and among them, those of business leaders. While today's tech entrepreneurs (such as Mark Zuckerberg and Elon Musk) are highly visible in the media, conveying an image of the entrepreneur whose criteria for success are measured in terms of the amount of power or money acquired, **THIS FIGURE OF THE STAR ENTREPRENEUR IS FAR FROM EXHAUSTING THE DIVERSITY OF WAYS IN WHICH BUSINESS LEADERS MAKE AND DECIDE. OTHER TYPES OF ENTREPRENEURS ARE POSSIBLE AND INDEED, EXIST**.

Indeed, we can observe two main categories of entrepreneurs: those who maximize profit and power in line with the theoretical figure of homo economicus, and other types whose objectives are less focused on this maximization of pecuniary utility, in other words profit. This chapter does not limit itself to a philosophical discussion regarding the notion of homo economicus: **IT ARGUES THAT THIS ABSTRACT CONCEPT HAS VERY REAL EFFECTS NOT ONLY ON ECONOMIC THEORIES, MODELS AND METHODS BUT ALSO IN THE REAL WORLD, ON ECONOMIC ACTORS' EXPECTATIONS IMPLICIT COGNITION AND ACTIONS**. For example, it has become commonplace to observe the choice of restricted business opening hours or deliberately limited and fully assumed working hours to preserve personal time (dedicated to family, leisure and other activities). Maximizing business profitability is therefore not the only leitmotiv. Optimizing the production tool is not considered fundamental. Some company heads also choose to organize their production process by focusing on proximity, networks and reconditioned resources (like Thomas Huriez of 1083), thus promoting a different logic of resource utilization. Here again, «doing more» is not systematic. This diversity of entrepreneurial practices sometimes aligns with the trend toward moderation and the search for meaning.

Faced with the challenges of ecological transition which depends on societal transitions, this contribution aims to question the representations of the economic actor as defined by economic theory and better define what moderation behaviors may encompass in practice. **THE WAY WE THINK ABOUT THE "IDEAL" CAPITALIST HOMO ECONOMICUS TENDS TO REINFORCE THEIR ACTUAL EXISTENCE, REWARDS**, etc. [3] In fact, entrepreneurial reality has been theorized through two major figures: by the neoclassical authors via the ideal type of homo economicus, centered on economic dynamics, by Schumpeter. Our objective is to explore how these representations, in theory and practice, phagocytize or support the development of moderation behaviors. We will show that the classic and emblematic homo economicus is not a construct in phase with this type of objective. The figure of the entrepreneur, for

2. Chaté, 2009

3. Albertson Fineman & Dougherty, 2005, p. xv; Miragaya-Casillas et al., 2023.

its part, offers more promising prospects in its ability to integrate moderation and has the advantage of being part of a logic of economic dynamics and factors of change (part 1). However, it turns out that both actual cases and the DIY practices widely observed among entrepreneurs (and cataloged by the entrepreneurship disciplinary field) underline the existence of these moderation practices, notably through an inversion of the subordination between means and ends (part 2). Finally, if we come back to the reason or rationality that can justify this type of behavior, it seems relevant to investigate virtue ethics as a possible basis for approaching behaviors turned towards moderation, notably as a counterpoint to the utilitarian vision proper to homo economicus (part 3). The idea here is to insist on the foundations of the action of homo economicus, which is based on utility, and not ethics. The object is not – in any case here – to go as far as the establishment of a "homo ethicus" but, rather to establish lines of investigation.

To explore these figures, we focus on the constraints of representation and analysis induced by homo-economicus, a conceptual figure still dominant in non-specialized literature [4] concerning the apprehension and legitimization of logics of action of entrepreneurs not exclusively guided by an essentially economic and individual purpose. The proposed approach is essentially conceptual, mobilizes in counterpoint philosophical currents specifying the role of values in human action, and illustrates through a few cases these practices not necessarily guided by a maximizing rationality. It questions the concept of homo-economicus with regard to philosophical contributions in order to identify non-economic explanations for the action of the entrepreneur: in the sense that it would not fall under a rationality focused on use optimized resources and the pursuit of an exclusively individual interest. This investigation is motivated by the existence of moderate practices (illustrative cases). Thus, **THE MAIN CONTRIBUTION LIES IN AN INITIAL CHARACTERIZATION OF THE MODERATE ENTREPRENEUR COMPARED TO HOMO ECONOMICUS THROUGH THREE DIMENSIONS: (1) THE CHARACTERISTICS OF THE ACTION, (2) THE CHARACTERISTICS OF THE ETHICAL FOUNDATIONS OF BEHAVIOR; (3) THE CHARACTERISTICS OF PRODUCTION LOGICS**.

This chapter is essentially conceptual and exploratory. It questions the concept of homo-economicus with regard to philosophical contributions in order to identify non-economic explanations for the action of the entrepreneur: in the sense that it would not fall under a rationality focused on use optimized resources and the pursuit of an exclusively individual interest.

4. Here, the notion of «non-specialist» literature refers to economic theory or not, and/or the consideration of the motives of human action. In fact, by non-specialist literature, we mean here non-economic scientific literature, economic or social science literature not dedicated to or not impacted by the representation of the economic actor, by professional literature which very often mobilizes this dominant representation of homo economicus to account for the individual entrepreneur;

1. Theoretical representations of Homo economicus as *the* entrepreneur: their contribution to practices of production and supply moderation

'One of the essential structures of economic theory and its modes of reasoning lies in the distinction between supply and demand. The neoclassical school [5] considers that the economic system is made up of a multitude of economic agents (households, companies) who exchange goods in order to satisfy their utility-maximizing objectives. Equilibrium is reached on a market when supply and demand are matched. Differences between the various schools of thought then emerged as to whether or not equilibrium could be achieved via this mechanism [6]. Despite the plurality of the neoclassical movement, three axioms are common to this approach [7]: 1) methodological individualism; 2) methodological instrumentalism and; 3) methodological equilibration. The question of satisfying individual needs in the face of resource scarcity always mobilizes this representation [8], which is then integrated into a variety of concerns, where its role is considered more or less fundamental. For example, some would say production responds to consumption while others, that production drives demand. In economic theory, to question the behavior of company directors or CEOs – as they are commonly known – is to look at the actors involved in production. However, in the economic field, these actors are considered in terms of two emblematic figures: homo economicus – which here takes the form of a producer on the supply side [9] – and the entrepreneur [10]. None of them is defined and constructed in its own right but relative to a model, to an economic question and to the economic function they fulfill to fit into, and respond to, specific questions/models. That model is the understanding of general equilibrium or the dynamics of the economy.

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5. Walras 1874, Marshall, 1890. - 6. Mantel, 1974. - 7. Arnsperger & Varoufakis, 2008.

8. This definition of economics as the science of scarcity imposes a certain way of approaching economic knowledge and is not neutral. Other definitions of economics are possible. For example: «From its very beginnings, economic science has struggled between the art of lucre (chrematistics) and the art of organizing the production and distribution of goods needed to supply the community and satisfy human needs. It is in this direction that economics should be radically reformulated, as a science of the reproduction or sustainability of the material conditions (biophysical and socio-institutional) that make personal, social and spiritual life possible. It's an economy oriented towards the reproduction of life" (Hinkelammert & Mora Jiménez, 2014).

9. In this article, we make deliberate use of the term «entrepreneur» in a broader sense than the Schumpeterian version presented in this section.

10. Schumpeter's entrepreneur fits into a dynamic vision, while homo economicus fits into a static vision. Moreover, Schumpeter associates homo economicus with the manager, the one who manages daily life. In reality, an entrepreneur carries out the two activities alternately: that oriented towards innovation fueling economic dynamics, and that oriented towards management and management of the daily activities and operations of the company.

We will begin by describing the characteristics of homo economicus, as defined by the literature in order to highlight the difficulties of consistency that this widely shared representation creates between the principles of maximization that govern it and those of moderation. We will thus be able to highlight the extent to which **THIS PRISM FOR READING THE WORLD CAN ACT AS A BRAKE TO DEPLOYING NEW PRACTICES FAVORABLE TO ECOLOGICAL AND SOCIETAL TRANSITIONS**. Secondly, we will look at another supply-side figure, the entrepreneur – opposed by Schumpeter to the manager – whose role in innovation and economic dynamics seems more conducive to introducing and legitimizing new behaviors.

The maximization principles of homo economicus: institutionalized calculative rationality incompatible with practices of moderation

Economic theory distinguishes in particular two branches: that of methodological individualism and the holistic approach [11]. The first apprehends economic phenomena – and includes the object of economic theory (considered as the production, distribution and consumption of resources, material goods, in a human group) through the utilitarian behavior postulated economic agent rational (choosing the best combination) who is fully informed. Homo economicus is the key actor in this branch of economic theory.
S/he is considered as the economic actor par excellence and is often extracted from his/her reference paradigm in everyday life [12]. Its construction hypotheses were revised with the introduction of limited rationality [13], and with Behavioral economics [14] – which denounce rationality as measured in simple situations reproduced in the laboratory. However, homo economicus allows the use of mathematic models and thus it persists as the emblematic representation of the economic actor [15]. It remains also commonly used in models of large international institutions aimed at "demonstrating" several results in sectors such as balance, efficiency or the search for optimum markets [16]. Let us here focus on homo economicus to highlight how it is an obstacle to the transition.

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11. Arnsperger & Varoufakis, 2008.
12. Urbina and Ruiz-Villaverde, 2023.
13. Simon (1957) underlines that the individual's decision-making capacity is impaired by a set of constraints such as lack of information, cognitive biases or even lack of time.
14. Gintis, 2000; Kahneman, 2003; Thaler, 2015.
15. Spash. 2020; Levine et al., 2015.
16. Arnsperger & Varoufakis, 2008.

Originally, it was presented as an ideal type [17], i.e., it was an intellectual construct obtained by deliberately accentuating certain features of the object under consideration [18], and under considering others, but it is nonetheless the expression of actual practices, which it helps to legitimize and institutionalize. It is described as a rational optimizing actor. The purpose of this optimization – maximizing utility under constraint – depends on the individual's role in society. Thus, "utility" is measured in terms of consumption for the consumer; remuneration for the worker (here we are moving away from traditional microeconomics to incorporate one of the significant principles of the Scientific Organization of Work developed by Taylor); the probability of election or re-election for the politician... and; profit for the producer.

In reality, however, certain practices of **MODERATION – AND THEREFORE OF NON-OPTIMIZATION OF THE PRODUCTION APPARATUS** – exist and disrupt this objective of maximizing profit within the constraints of production costs. Contrary to neoclassical theory's stance, which accepts transitory sub-optimal situations [19], these practices are not ephemeral and constitute fully-fledged, long-term choices intended to be permanent for these producers who are motivated by objectives they consider to be 'higher' (quality of life, altruistic behavior of helping and sharing, environmental concerns, etc.). In order to bring these practices within the realm of homo economicus, two explanatory approaches are offered, which preserve the calculative rationality that defines it.

The first is to maintain the affirmation that the optimization of his utility always drives homo economicus. However, this utility would no longer be the maximization of profit but a utility or satisfaction that would be more specific to individual actors [20]. For example, utility could be expressed in terms of self-limited production, by a certain level of resource mobilization, or by the desire for autonomy, or to preserve as much time as possible for oneself and relatives, or to favor a network of relationships... [21].

The second is to retain part of the definition but while considering that homo economicus focuses not on the objective but on the constraints: s/he would integrate other types of constraints – environmental as well as social – in order to maximize his/her satisfaction and profit, if we adhere to the neoclassical vision. The producer then attempts to reconcile objectives associated with specific values that are dear to him/her with the classic objective of profit (which, supposedly, enables him to ensure the sustainability of his activity). We find this approach in the perspective of sustainable development, a model that is necessarily profitable while also focused on social and environmental aspects in a search for balance. Other constraints may stem from the lack of resources that the producer/entrepreneur has to deal with. This brings us back to the need many have to deal with for doing things with little (for example, the frugal engineering developed by entrepreneurs in developing countries).

17. Morgan, 2006.
18. Weber, [1922] 1988, p. 191; 1965, p. 181.
19. Hayek, 1986, p. 135.
20. Dewatriont and Tirole, 2024.
21. Parada-Contzen & Parada-Daza, 2023.

Beyond these theoretical adjustments, there are many examples of behavior in which **NOT ONLY IS PROFIT MAXIMIZATION NOT THE ORDER OF THE DAY, BUT THE CONSTRAINTS THEMSELVES ARE NOT THE PREDOMINANT GUIDES TO HOW THINGS ARE DONE**. The choices, the way things are done, and more importantly, the motivations are quite different: to make a sufficient profit to ensure the sustainability of a project (which may, moreover, be to have an occupation or to give people jobs), or to mobilize ways of doing things, not determined by constraints, but rather by free choices between limited or clearly absent profitability objectives and other non-pecuniary objectives. Indeed, such non-profitable behavior is, to say the least, dissonant with the behavioral and decision-making principles of homo economicus: it, therefore, reduces the interest in mobilizing it. Moreover, this calls into question the potential hindrance that this ideal type could represent in developing and legitimizing new practices that are so necessary today.

To the previous criticisms often leveled at the ideal type of homo economicus, we would like to add a new one [22]. Even if the theoretical objective assigned to this ideal type was clear, it is essential to stress the extent to which **IT PROVES COERCIVE IN EMANCIPATING THE ANALYSIS AND THE THINKING NECESSARY TO MEET THE CHALLENGES OF FUTURE TRANSITIONS. IN THE FACE OF THESE TRANSITIONS**, this ideal type is no longer operative since it does not emerge from empirical reality [23], but from a poor theoretical construct over-simplifying reality, "purified of contingent variations" [24]. Yet, "the link with empirical reality remains an imperative, to the extent that Weber assigns the researcher the task of assessing in each case how close reality is to or how far it deviates from this ideal representation" [25].

It seems fundamentally incompatible to attempt to reconcile the homo economicus ideal with the moderation practices [26], in particular because the standard economic model considers its object to be the «how» and considers itself to be «neutral». In other words, **ETHICAL CONSIDERATIONS, WHILE THEY CAN BE INTEGRATED AS PARAMETERS, ARE NOT CENTRAL TO ECONOMIC THINKING** [27], [28]. Even an amended representation of homo economicus does not seem to offer any relevant opportunities for grasping behavior that is fundamentally at odds with this figure since neoclassical thinking remains focused on the means. From this point on, thinking about the ends such as altruistic objectives, and more generally, the search for satisfactions that are difficult to measure - such as happiness, a refusal to do more, the desire to adopt restrictive production and consumption practices, favoring the well-being of employees or reducing the environmental impact of the production process rather than increasing the company's profitability, etc.- remains an unthought of neoclassical theory [29]. In conclusion, three key points emerge from this critical analysis.

22. Favereau, 1989; Thévenot, 2001; Batifoulier, 2001; Boltanski & Thévenot, 1991.
23. Cayla, 2018; Imas et al., 2012.
24. Rocher, 1993, p. 629.
25. Coenen-Huther, 2003 p. 533.
26. Sen, 1998, p. 16.
27. For a recent example of this type of positioning, readers can consult the article by V. Chassagnon and J. T. published in Le Monde in June 2024: https://www.lemonde.fr/idees/article/2024/06/08/l-economie-est-une-science-du-comment-elle-etudie-comment-allouer-et-produire-des-ressources-rares-pour-atteindre-les-objectifs-societaux_6237984_3232.html
28. Packard & Bylund, 2021.
29. Funtowicz & Ravetz, 2003; Caillé, 2013.

First, **ECONOMIC STAKEHOLDERS' MOTIVATIONS THAT ARE TO BE CONSIDERED HAVE A VITAL COMPONENT OF PERSONAL (AND NOT INDIVIDUAL) MOTIVES, LINKED TO SELF-FULFILLMENT, THE SEARCH FOR SERENITY (INCLUDING IN AN ECOLOGICAL CONTEXT) AND A FEELING OF HAPPINESS**. However, happiness cannot be maximized because it cannot be controlled; instead, it is the consequence, the 'extra' that emerges from a set of conditions. As Comte-Sponville (2000) points out, happiness cannot be found if it is posited as the future object to be achieved by my search. In other words, to experience happiness in the present, we need to stop hoping for happiness in the future. From this perspective, where computational rationality seems challenging to defend, and over and above the contributions of bound rationality (Simon, 1983), the need emerges for economic theory to construct and integrate a characterized economic actor who is not driven by other motives and ends. However, in the illustrations given, we can see alternative logic or motives linked to balanced and fair action. Questions of responsibility and ethics emerge: are we not trying to do the right thing and is the action 'right' in absolute terms or in relation to a particular situation? The rightness of an action does not have to be seen as normative but simply as an adaptation to a context. This offers latitude for action and opportunities to take into account and create a wider range of possibilities. It also preserves a capacity to act, to work for others, for the environment and for the common good [30].

Second, besides purpose, we can identify adaptive, personal process practices. These represent a departure from the neoclassical vision of the design of resources and the technical combinations of production [31]. The rise of do-it-yourself practices and theories in academic fields illustrates this trend and once again challenges the ideal type of homo economicus.

Finally, it should be remembered that this homo economicus is closely linked to a representation of the functioning of the market and the construction of general equilibrium in neoclassical theory. However, postulated utilitarian hypotheses need to be abandoned. In this case, the discussion must also include the commoditization of society and the achievement of a general equilibrium by market forces, which are widely questioned with environmental issues. However, sociology, psychology, philosophy, anthropology, etc. [32] tell us other things about human behavior, its embeddedness in society, techniques and insist on the subjective meaning actors give to their actions [33]...

30. Tronto, 2010; Vallas, 2005; Sen, 2002.
31. Duymedjian & Rüling, 2010.
32. Demeulenaere (2015) underlines that although economics is one of the most rigorous social sciences, it has difficulty accounting for economic reality, and in particular the representation of the action. See also, Simondon, 1989.
33. An economist like Polanyi (1957) had underlined this without investing the subject of homo economicus because his approach did not relate to methodological individualism.

The figure of the entrepreneur in economic theory: an agent that transforms the economy and can help legitimize moderate behavior

Economic theory also identifies the entrepreneur as an actor in production [34]. Relatively marginal compared to other subjects in this disciplinary field [35], **THE ENTREPRENEUR IS THE TRANSFORMING AGENT OF THE ECONOMY, INITIATING THE ECONOMIC DYNAMIC**. Unlike homo economicus, which is the subject of microeconomic theory and analysis, the entrepreneur is mobilized at a macroeconomic level. His/her decision-making methods and new modes of calculative rationality are not defined, but rather, they are their characteristics and distinctive traits [36]. Clearly, s/he is not rational [37] and is driven instead by other psychological motivations [38]. S/he differs from the manager (homo economicus), who is seen as remaining in a routine, managing day-to-day production, or from the capitalist, who provides capital but does not innovate.

Whether it is Cantillon, Say, or Schumpeter, each emphasizes the entrepreneur's ability to take risks, position himself as a scout, to anticipate and identify potentially (and therefore not necessarily) profitable activities. It is fundamentally embedded in uncertainty. S/he carries out a complex and challenging job that requires many qualities and is often considered as "unusual". S/he is distinguished from other actors in production (the worker or the scientist for Say, the manager and the shareholder for Schumpeter – even if they consider that the same individual can fulfill these different functions at different times). **S/HE IS A TRANSFORMER OF THE ECONOMY AND CAPITALISM**, assuming uncertainty, promoting and generating "new combinations of production factors," in other words, innovations [39]. Thus, for the entrepreneur, profit maximization is by nature uncertain. In all cases, according to Boutiller and Uzinidis [40], it may even be secondary: «The entrepreneur is a type of player for whom the joy of creating takes precedence over the intrinsic quest for gain even if profit crowns the success of new combinations of production factors. It is the expression of the value of the entrepreneur's contribution to production, like the wage for the worker [41]."

34. Cantillon, 1755; Say, 1833; Schumpeter, 1911.
35. Boutillier & Tiran, 2016.
36. For a characterization of the Schumpeterian entrepreneur, refer in particular to Boutiller & Uzinidis (2013).
37. The entrepreneur is therefore not rational, in the sense of homo economicus: "the typical entrepreneur does not ask himself whether each effort to which he submits promises him a sufficient "surplus of enjoyment". [...] He creates without respite, because he can do nothing else [...]" (Shumpeter, 1911, 1935 edition, p. 134). Translated by the authors.
38. Boutiller & Uzinidis (2013) indeed underline that "The decisions taken by the entrepreneur do not arise from Walrasian rationality, but from a subjective rationality which is based on psychological factors, according to Menger's conception".
39. According to Schumpeter, there are five types of innovation: Product innovations, process or organizational innovations, marketing innovations, development of new sources of supply, new market structures.
40. 2013, p.100.
41. Translated by the authors.

So, what does this figure of the entrepreneur bring us compared to the moderation practices of business leaders, managers, and start-uppers?

THIS FIGURE

- **RECOGNIZES AND LEGITIMIZES PRACTICES OF NON-MAXIMIZATION OF PROFITS AND ALLOWS US TO CONSIDER THAT THIS PURPOSE MAY BE SECONDARY WITH REGARD TO OTHER REASONS TO UNDERTAKE CHANGE, PROVIDED THAT ITS ATTACHMENT TO THE CREATION OF NEW TECHNICAL PRODUCTION COMBINATIONS IS MAINTAINED, I.E., INNOVATION.**

- **UNDERLINES THE POSSIBILITY OF MOTIVATIONS, PURPOSES, AND NON-RATIONAL PROCESSES AS A DRIVING FORCE OF BEHAVIOR OR EVEN ORIGINALITIES IN THE SEARCH FOR JOY TO SATISFY SPECIFIC PSYCHOLOGICAL TRAITS.**

These moderation practices are inherent to managing uncertainty and the difficulties of committing and/or having resources committed and developing new technical production combinations. As an engine of transformation, the entrepreneur is the opposite of marginalist theories. Baumol (1990) thus underlines the extent to which the entrepreneur is consubstantial with the institutional context and thus considers him as embedded[42] in his/her economic, social, and political environment. Therefore, it is not an isolated actor that can be aggregated by accumulation. **HER/HIS ACTIONS AND IDENTITY ARE IMPACTED BY THIS EMBEDDEDNESS IN AN ENVIRONMENT AND INFLUENCED BY INTERACTIONS WITH OTHER AGENTS. THUS, SOCIETAL OR ECOLOGICAL TRANSITIONS CAN CONSTITUTE MANY REASONS TO UNDERTAKE AND EXPLAIN BEHAVIORS THAT DEVIATE FROM THOSE OF HOMO ECONOMICUS**. Finally, note that "moving closer to Weber, Schumpeter also considers that the entrepreneur is also characterized by a lifestyle, a moral system of ethics and values"[43]. This opens new doors to integrating moderation behaviors into the entrepreneur and offering an economic explanation.

What, then, are the motivations for undertaking action? The adventurous spirit (Weber [1971], the wise calculator in the entrepreneur) may coexist with many other motivations: the pleasure of innovating, of being a pioneer, of "hitting the jackpot", of building an organization to one's liking, of having one's own business, to see a project through to the end, to give oneself the means to secure an activity, to be helpful, to contribute to social life, to the common good...? The possible reasons for acting and guiding a company or an organization are, therefore, multiple and not necessarily restricted to profit optimization. Thus, homo economicus as an ideal type does not offer a construction adapted to the integration and legitimization of non-profit motivations and, by definition, tends to exclude transition issues.

42. Granovetter, 1985.
43. Boutiller & Uzinidis, 2013, p.100.

2. Practices of moderation and the questioning of means and ends

The figure of the entrepreneur in economic theory, therefore, offer better possibilities of articulation with the "moderate entrepreneur." However, the function assigned to him/her in models of capitalist dynamics has not supported the definition of alternative behaviors, making it possible to specify the levers and axes of possible moderation. The hypofirm theory [44], giving explanation of the choice to stay small, seems to be the only one to analyze a form of entrepreneurial moderation consisting of limiting a company's growth.

To try to outline these alternative behaviors, we propose to draw up an initial inventory of profiles of moderate entrepreneurs, relying on the one hand on an illustrative case and the other on the entrepreneur's theories. These theories attempt to take into account an original approach to the "means-ends" couple, moving away from a maximizing end and an optimization under constraint in the use of resources.

Entrepreneurial moderation in practice

There are many observable examples of entrepreneurial moderation that could find here the status of an inspiring illustration. We could cite the well-known cases of plumbers or dentists choosing not to work one day, or more, during the week to have more time for their passion or to take care of their children, refusing interventions or appointments for this reason. Beyond these individual entrepreneurs, for whom the terms of arbitration between professional and private life are generally well understood, entrepreneurs in charge of larger structures do not appear to be left out when prioritizing the quality of life over the number of orders processed. Here, we choose a single case to emphasize the density and complexity of the elements taken into consideration to define an objective and the means allocated or re-examine what the objective is. As a backdrop, these choice processes include anchoring in values, a personal trajectory, links, network, context, etc. This example allows us to better understand, beyond the methods taken, part of the motivations and effects of moderation that characterize entrepreneurs' daily actions. We describe real and observed practices with a certain level of detail based on a concrete case [45]. The value remains illustrative but allows us to identify essential lessons.

Outilacier is a company specializing in the distribution of equipment and tools for businesses. Pierre-Yves Lévy has, for a long period, been its director before its resale in 2018 to the Rubix group. He took over the company, initially created by his father in the late 1980s and developed it by profoundly modifying its business model. Driven by the ambition to preserve jobs, threatened in the event of the company being resold to potential buyers, Pierre-Yves Lévy agreed to take over the management of Outilacier by

44. Marchesnay, 2004; 2008.
45. Lévy, 2023; Poissonnier, 2023.

renouncing a life project that would have allowed him to practice his profession as an engineer, which he loved, and to live his passion for the mountains more intensely. As a high mountain guide, he also drew part of his conviction (which had fueled his choice to take over the family company) from the desire to contribute to preserving the environment by relocating at a time when the practice was far from being common, and thereby reducing the environmental footprint of products (exclusively distributor, Outilacier worked with manufacturers mainly located in Asia in the 1980s). Partnerships with manufacturers-suppliers developed in line with relationships maintained with customers, often lead large companies to whom it was important, according to Pierre-Yves Lévy, to provide "the right product, to meet the right need, at the right fair price": a first expression of moderation aimed at structuring commercial relations.

The primary motivations of Pierre-Yves Lévy were social (preserving jobs and contributing to the perennity of skills) and environmental (reducing the environmental footprint of products while showing that the solution is possible, setting an example and communicating on the practices deployed to inspire competitors and, with them, collectively generate more effects). **COMMERCIAL, ECONOMIC AND FINANCIAL PERFORMANCE WERE CERTAINLY UNDERSTOOD AS ESSENTIAL IN THE SENSE THAT THEY WERE SUPPOSED TO VALIDATE THE ECONOMIC MODEL AND ALLOW THE COMPANY TO BE SUSTAINABLE, BUT THEY WERE CONSIDERED AS MEANS RATHER THAN ENDS**. Profitability, as the majority of classic financial indicators (turnover, commercial margin, benefit) improves rapidly. This observation reinforces the idea according to which profitability should be seen as a means instead of a goal[46].

It is very inspiring in many ways and illustrates in particular, a multitude of virtuous practices concerning partnerships, the ability to co-innovate with suppliers, the construction of collective resilience, the role of pedagogy, and the impact of management based on the principles of economic peace[47], the Outilacier case undoubtedly finds an essential part of its success in the entrepreneurial moderation which characterizes the choices and actions of its manager. If we observe it carefully, this moderation was expressed in relations with all the stakeholders, taking specific forms with each of them. We mentioned commercial moderation which consists of responding to the "just need" of customers without the excessive quality that value analysis eliminated. This commercial moderation also took the form of a renunciation of a significant part of the unit margins associated with the products sold (margins were divided by two!), a condition that allowed the sale of products manufactured in France at prices that are not so high, but still higher than the prices of products manufactured in Asia. **IT IS THE INCREASE IN QUANTITIES SOLD, THANKS TO THE QUALITY OF RELATIONSHIPS AND THE PEDAGOGY DEPLOYED, WHICH ULTIMATELY CONTRIBUTED TO THE IMPROVEMENT IN FINANCIAL PERFORMANCE**.

46. Poissonnier, 2023.
47. Lévy, 2023; Poissonnier, 2023.

Moderation was also expressed in the use of power towards suppliers. While the economic model justified significant efforts in terms of cost control, the prices of products manufactured in France being higher than Asian products, Pierre-Yves Lévy always endeavored to consider the relationships in the long term and to consider cost management in a collaborative way, in particular through innovation with manufacturers, rather than through harsh negotiations. Moderation regarding the company's growth was voluntarily limited and was a real key to the sustainability and success of the company – while specific competitors disappeared after having grown too quickly.

This case study demonstrates the existence, but also the merits, of entrepreneurial moderation. This merit must be assessed considering the performances generated, whether social, environmental (the primary objectives of Pierre-Yves Lévy) or economic and financial (perceived as means – and emerging as consequences of an act well done, not as the sole purpose of an enterprise). This led the leaders of the Rubix group to entrust Pierre-Yves Lévy, as a final mission, to disseminate the Outilacier model to all of the group's companies. Moderation practices that were deployed in a natural way and without being completely conscious (Pierre-Yves Lévy does not use the word himself) were then considered as relevant and deserving replication. This was made possible thanks to the entrepreneur's embeddedness [48] in her/his economic, social and environmental environment and of his adaptation to it which leads her/him to trace, as a scout would, new paths that others can then take up. This embeddedness also leads **THE ENTREPRENEUR, IN RELATION TO THE SOCIAL, ECONOMIC, AND ENVIRONMENTAL OPPORTUNITIES AVAILABLE, TO GENERATE NEW COMBINATIONS OF PRODUCTION, WHICH, ALTHOUGH IMPLYING A NEW LABOR/CAPITAL ARBITRATION AND FORMS OF SOCIAL AND TECHNICAL INNOVATIONS, IS ALSO BASED ON ANOTHER RELATIONSHIP BETWEEN MEANS AND ENDS**.

A moderation based on means and/or ends, using iteration loops

The Outilacier case provides a rich illustration of moderation, given the complexity and originality of Pierre-Yves Levy's entrepreneurial practice. It also offers a fascinating angle of analysis with regard to this moderation, namely the relationship the entrepreneur builds between means and ends.

Entrepreneurial commitment is frequently described as obsessed with the limitless acquisition of market share and the pursuit of maximum profit [49]. Entrepreneurship is about «faster, higher, stronger,» to quote the motto of the Olympic Games, but alone rather than together, which contrasts with the second part of the motto, valuing the collective dimension, to the point where some advocate the idea that every entrepreneur's dream must be to establish a monopoly [50]. When ends are set in such terms, when they become

48. Baumol, 1990.
49. Mazzei, 2018.
50. Thiel, 2015.

hegemonic in the collective imagination (the implicit cognitive truth being that the sole purpose of a company is to make profits), they impose their influence on decision-making to the point where they «justify the means» to be deployed to achieve them. The result is a coupling between ends that push ever further the desire for market domination and profit maximization, on the one hand, and means that are continuously extracted and exploited according to a logic of reification of the world which has dehumanized the social (the expression «human resources» being an extreme expression of this) and a constant optimization of their use, down to the last drop...

However, Pierre-Yves Levy's choices indicate a different stance: moving away from the domination of ends over means, creating a dynamic balance between what is to be created and the means at hand instead of trying to find the ideal means to execute the ideal plan and reach the ideal goal. Costs indeed have to be controlled, but never to the detriment of stakeholders such as suppliers or employees, whom the company takes care of on a long-term basis in order to build and maintain long-term relationships. First, Outilacier's original and concrete practices reflect the idea that the end does not quite justify the means and that the means (maintaining fruitful relations with suppliers, for example) are worth so much as to imply a renouncement of part of the end (economic and financial performance, in particular). However, the case described shows that the practices implemented improve economic and financial performance. On closer examination, it becomes clear that Pierre-Yves Lévy has been inverting the subordination of means and ends, as traditionally envisaged since he took over the company. This inversion corresponds to deeply held values and convictions, validated by the company's initial and subsequent successes. It has also inspired competitors and locally changed the rules of the game towards more respectful, less destructive interactions between stakeholders and with the environment. However, there is one human practice that breaks away from the hegemony of ends dominating without limits the means designed to achieve them : bricolage. This term finds its place in the social sciences through the eminently metaphorical use made of it by Claude Lévi-Strauss in his landmark work, The Savage Mind. He describes a bricoleur, the one who engages in bricolage, who:

UNLIKE THE ENGINEER, DOES NOT SUBORDINATE [HIS DIVERSE TASKS] TO THE AVAILABILITY OF RAW MATERIALS AND TOOLS CONCEIVED AND PROCURED FOR THE PROJECT. HIS UNIVERSE OF INSTRUMENTS IS CLOSED, AND THE RULES OF HIS GAME ARE ALWAYS TO MAKE DO WITH 'WHATEVER IS AT HAND [51].

These means at hand, whether from the situation itself or the repertoire the bricoleur carries around, constitute a rich material s/he will compose through dialogue, assembly and diverting. Above all, these elements are used with care since once they have been put to good use, they will be reintegrated into the bricoleur's repertoire in the familiar movement of «nothing is lost, nothing is created.»

51. 1966, p.17.

This bricoleur might never have left this book of anthropology, leaving the world of management in the hands of Taylor, an engineer obsessed with optimization and maximization, who has influenced managerial practices and organizational forms to this day [52]. And yet, bricolage has taken its place in the palette of managerial concepts since the mid-90s, irrigating organization, innovation and information systems theories [53]. But it is in entrepreneurial theory that bricolage has been most intensively embraced, developing a robust theory that is original in its opposition to classical approaches to the entrepreneurial process, yet simultaneously articulates it with standard concerns such as the quest for performance and innovation. The term «entrepreneurial bricolage» was coined by Ted Baker and Reed E. Nelson, who received the Foundational Paper Award from the Entrepreneurship Division of the Academy of Management in 2020 for their contributions to the field of entrepreneurship. The title of their paper, «Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage» (2005), is evocative of a kind of frugality without actually claiming it.

Entrepreneurial bricolage turns the hegemonic order of ends and means on its head. Rather than starting from a precisely constructed (or identified) opportunity that provides the template for obtaining the means ideally required to meet it - what Jullien refers to as a hylomorphic schema [54] - entrepreneurial bricolage loosens the ends according to the means available, without however «falling» into pure improvisation - a temporally constrained process whose production is only framed by a few very open principles. Instead, **IT IS A MATTER OF ACCEPTING THE UNCERTAIN, EVEN INDETERMINATE, NATURE OF BOTH THE CONTEXT AND THE DESIRES OF THE ACTORS INVOLVED IN THIS PROCESS AND, IN THIS FLOATING STATE, REPLACING EXTREMIST POSTURES UNDERPINNED BY OPTIMIZATION OR MAXIMIZATION LOGICS WITH A PRACTICAL INTELLIGENCE ADAPTED TO (AND ADAPTING TO) MEANS AND ENDS**. Two figures, social entrepreneurship and craft entrepreneurship, will illustrate this moderation of means and by means.

Of all entrepreneurial figures, the social entrepreneur is the one who most readily mobilizes the practice of bricolage. The first reason is that social entrepreneurship, which aims for social impact much more than financial performance, often finds itself in a scarcity of resources, forcing it to do with what is at hand [55]. But beyond compensating for a shortage of resources, Bacq et al. [56] **SHOW THAT ENTREPRENEURIAL BRICOLAGE IS POSITIVELY ASSOCIATED WITH MORE SIGNIFICANT SOCIAL IMPACT, PROVIDING EVIDENCE OF AN OFTEN-OVERLOOKED EFFICIENCY OF BRICOLAGE. INDEED, BRICOLAGE IN SOCIAL ENTREPRENEURSHIP DEVELOPS THE ABILITY TO INVENT NEW INSTITUTIONAL FORMS, BRICOLAGE THUS BECOMING A MECHANISM FOR LEGITIMIZING INSTITUTIONAL CHANGE** [57]. Once again, social transformations brought about by entrepreneurial practice do not tolerate pre-determined ends making their way abruptly into a social space yet to be reinvented. They require great vigilance of the environment and constant prudence, which belong to the practical intelligence [58]. More broadly, introducing innovation in markets requires phronesis to master the way it spreads throughout society and transforms it [59] to the point of deciding to exnovate a technology when consequences become unbearable [60].

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52. Linhart, 2018. - 53. Duymedjian & Rüling, 2010, Senyard et al., 2014; Reypens et al., 202..
54. Jullien, 1996. 55. Desa & Basu, 2013. - 56. 2015. - 57. Desa, 2012. - 58. Johannisson, 2014.
59. Kuzior & Zozuľak, 2019; Bardone & Lind, 2016. - 60. Arne Heyen et al., 2017; David, 2018.

The craft entrepreneur differs from the classic entrepreneur in that he pursues objectives that go far beyond the purely financial goals of profit maximization. **S/HE SEEKS TO DEVELOP TECHNICAL SKILLS THROUGH THE BEAUTY OF A GESTURE, WHICH IS TESTED AGAINST A MATTER VALUED FOR ITS POTENTIAL TO BE EXPLORED. HIS/HER PRACTICE INTIMATELY CONNECTS RESPECT FOR TRADITION, COMMUNITY BELONGING AND EXPLORATION OF THE NEW** [61]. However, the creative manipulation of available means, which contain unexpected possibilities accessible through technical gestures, attenuates the desire to aim for a precise form at all costs. As Henri said of the artist, a statement that also resonates with the practice of the entrepreneur-craftsman, «The real artist's work is a surprise to himself» [62]. Craft practice must, therefore, maintain an open interplay between means and ends, a balance that requires choosing the prudence of the fitting gesture rather than the risk of immoderation.

Through their practice of entrepreneurial bricolage, both social and craft entrepreneurs illustrate that a moderate, respectful use of the means at work is perfectly possible, but on several conditions:

- We must acknowledge the fundamentally contingent nature of the environment to be transformed, whether human or material;
- that the elements of which it is composed are not inert matter that can be bent to one's will by the sheer force of a supposedly perfect idea, but rather
- are complex, rich in unsuspected possibilities and reactions that deserve respect and to be taken into account;
- as a consequence, it is important both to take care of this environment and to be attentive to the potentialities it contains, which go well beyond the simple market value of what makes it up; to the point where...
- The means often possess a power far greater than the ends they are supposed to serve. This focus on the means-ends relationship reveals another form of rationality, which we now need to illuminate by taking virtue ethics as a possible basis for approaching behaviors geared towards moderation.

61. Dacin & Dacin, 2019.
62 Henri, 2007, p.262.

3. Characteristics of entrepreneurial moderation through virtue ethics

The examples above show that there is no single way of making rational decisions but multiple ways of exercising rationality depending on the individual's circumstances and values [63]. A vast literature in psychology and management, for example, emphasizes the central role of intuition in decision-making [64]. The case of Outilacier highlights that the entrepreneur is not confronted with an environment that is simply external to him but is immersed in a world in which s/he has found his place and participates [65]. In an anthropological sense, the common good, as Flahault (2011) puts it, is posited from the outset. The constitution of the individual as a singular person involves exchange with others and is based to a large extent on disinterested practices [66]: "The reasons for acting are to be found in the aim, the consideration of the consequences and the adjustment to the situation" [67]. **IN CONTRAST TO THE CONCEPT OF THE RATIONALITY OF HOMO ECONOMICUS, THE RATIONALITY OF THE MODERATE ENTREPRENEUR IS NO LONGER SEEN AS A RESOURCE BUT AS A PRODUCT OF ACTION. IT IS BASED ON THE INTERPRETATION OF SITUATIONS BY THE STAKEHOLDERS AND THE COMMITMENTS THEY MAKE, WITH THE LATTER NEVER BEING SURE BEFOREHAND OF THE SUCCESS OF THE COORDINATION**.

Thus, beyond utilitarianism, the literature on economics, business ethics and management have sought other ways of explaining behavior that might account for the restraint shown by some managers [68]. The utilitarian question of maximizing income, well-being, etc., has consequently been replaced by, or at least added to, the critical question of virtue ethics: Who should I be? What am I doing with my life? All moral theories enter the moral question via a particular conception [69]. For example, whereas utilitarians focus primarily on non-moral goods such as pleasure, satisfaction, happiness, or income; virtue ethics emphasizes moral goods that refer to virtues. It reintroduces feelings considered virtues into the field of ethics, such as care, attention, solicitude, kindness, generosity, friendliness, and so on.

63. Eymard-Duvernay, 2006, p. 14.
64. Adam & Dempsey, 2020; Klein, 2015; Simon, 1987.
65. Dewey, 1927.
66. Caillé, 2009.
67. Chatel & Rivaud-Danset, 2006, p. 3.
68. Fontrodona et al., 2013; Dyck & Keysen, 2001; Solomon, 1999.
69. Frey & Stutzer, 2002; Goffi, 2009.

Out of the plurality of views on virtue ethics in the field of economics and management (Confucian [70], Aristotelian [71], Buddhist [72], Humean [73], Capabilitist [74], Christian [75], Islamic [76], etc.), we selected only four salient features of this ethic that enable us to understand entrepreneurial moderation [77].

- Multi-rationality ;
- Mobilizing plural principles and recognizing the fundamental interdependence between one's activity and the course of the world;
- the ability to live serenely with oneself
- A relational ontology in the sense that the 'self' is always understood and engaged in relation to others.

We develop each in the following sections, qualifying them as attitudes.

Four ethical attitudes

Firstly, we can describe rationality in the classical conception of homo economicus, as instrumental. The individual is here a system oriented towards an already established end (maximization of profit, production, etc.). In this case, there is no reflection on the purpose of the action, but only on its effectiveness about a given goal. Here, **'RATIONAL' IS THUS CONFUSED WITH 'EFFECTIVE'** [78]. Yet, this goal is not questioned, even though it is precisely the pursuit of the best end, for example eudemonia in Aristotle or the path of the Tao in Confucian approaches, that guides action in virtue ethics. It also leads to a re-articulation of ends and means in an ethical approach to the economy [79]. Sen points to a dual origin of economics. In the first - the ethical approach to economics -, goals are at the heart of economic thinking and ethical motivations cannot be without consequences for actual human behavior.

In the second - the engineering approach to economics, dominant in the contemporary period - "the ends are taken as fairly straightforwardly given, and the object of the exercise is to find the appropriate means to serve them" [80]. The re-articulation of these two approaches seems essential to account for the choices made by entrepreneurs. The search for human life and fulfillment [81] can lead the entrepreneur to value not only external goods such as wealth, reputation, power and quality but also, above all, the meaning of lived experiences [82]. Consequently, there is no single specific imperative for entrepreneurs to fulfill their potential, apart from pursuing their own virtue and aspirations, which each individual can define according to context and chance [83]. For example, the social entrepreneur can commit to improving the lives of others, or the artisan entrepreneur can pursue the quest for the perfect gesture within a community of shared skills.

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70. Koehn, 2020; Yuan et al., 2023. - 71. Morrell & Dahlmann, 2022. - 72. Ng, 2020.
73. Solomon, 1999. - 74. Sen, 2002; Nussbaum, 1993. - 75. Kotva,1996. - 76. Alpyagil, 2014.
77. We will not detail here the profound differences that may exist between each of these expressions of virtue ethics.
78. Bazzoli and Dutraive, 2013, p. 145. - 79. Sen, 1987. - 80. Sen, 1987: 4. - 81. Hartman, 2011; Nussbaum, 1993

Secondly, **MODERATION IS BASED ON MOBILIZING PLURAL PRINCIPLES AND RECOGNIZING THE FUNDAMENTAL INTERDEPENDENCE BETWEEN ONE'S ACTIVITY AND THE COURSE OF THE WORLD**. As Goffi [84] sums up, agents 'are their collection' of rules and principles, forged through their experiences (of injustice in particular [85]), their confrontation with the world and the search for harmony between their goals and their character [86]. With regards to individuals' environmental concerns, several authors [87] argue that their worries may reflect a moral malaise/moral outrage rather than simple reasoning under constraint (in terms of integrating externalities, for example). In other words, a virtue, socio-environmental humility, is to be cultivated in human beings [88]. This virtue is opposed to the vice of socio-environmental arrogance and can be associated with a moral anger [89]. The latter stems from the entrepreneur's inability to recognize her/his own limitations and those of the world [90], and to attribute value to things beyond utility. For some entrepreneurs, this arrogance can be seen in the fact that they attach little importance to felling a forest, while for others, socio-environmental humility will lead them to voluntarily limit the extension of their buildings in order to preserve the site and its human and non-human inhabitants.
This posture, therefore, questions the individual's ability to perceive and identify their relationship to things and beings [91]. An anecdote from the writings of Hess (2013) helps us to understand what lies behind this environmental humility:

The American environmental philosopher J. Baird Callicott relates a particularly suggestive anecdote. He recounts how a biologist named Edwin P. Pister, a California Fish, Game, and Sport Federation member, devoted much of his life to protecting certain fish species, including the Cyprinodon diabolis. Individuals of this species are tiny fish that live in puddles, totally uninteresting to fishing federations and fishmongers. The biologist's moral commitment led him to defend the cause of this species before the Supreme Court of the United States. Asked by his colleagues at the federation what good the Cyprinodon diabolis could be, to the point of justifying such a major legal battle, Pister finally replied: "And you, what good are you?"

82. Kraut, 2018.
83. Despujol, 2022, p. 74.
84. 2009.
85. Nussbaum, 1993.
86. Deslandes, 2010.
87. Sadler-Smith & Akstinaite, 2022; Jasanoff, 2022; Hill, 1983.
88. Snow, 2021.
89. Panno et al., 2021.
90. Ng, 2020.
91. Kammavāda in Buddhist doctrine.
91. Caillé, 2009, p. 18.
91. Cf. Les Echos : https://start.lesechos.fr/innovations-startups/portraits-innovateurs/avec-loom-julia-faure-tricote-son-militantisme-dans-la-mode-1901618
91. Arendt, 2003, pp. 145-146.

The position of humility is, therefore, opposed to hubris, in other words, to the excess that characterizes our socio-economic system (particularly with the idea of infinite growth in a finite world). It sheds light on the difference between 'interest for' and 'interest in' [92]. Edwin P. Pister aimed at the preservation of the Cyprinodon diabolis without having an interest in preserving it. Similar approaches are also found in the corporate world. For example, the Carthusian monks have decided to break with the 'race to infinite growth' and continue to work for the local economy. They prioritize supplying their product to their long-standing customers and, therefore, giving up on growing their business. Such a decision aligns with the vocation of a Carthusian monk, which is not to produce but to pray for humanity. The example of Loom, a locally produced French clothing company (co-founded by Julia Faure and Guillaume Declair), also testifies to this opposition to hubris: "The two co-founders don't want growth at any price. They prefer to stay true to their motto: 'Less but better'» [93].

Thirdly, **MODERATION REFERS TO THE ABILITY TO LIVE SERENELY WITH ONESELF**. As Arendt puts it: *Morality concerns the individual in his or her singularity. The criterion of what is just and unjust, the answer to what I should do, depends, in the final analysis, neither on the habits and customs I share with those around me nor on any commandment of divine or human origin but on what I decide by considering myself. In other words, 'if I cannot do certain things, it is because, if I did them, I would no longer be able to live with myself* [94].

The case of Outilacier is also instructive, showing that Pierre-Yves Levy made the moral choice to take over the company. In his case, his cognitive interest (as an engineer and mountain guide) is insufficient to account for such a choice, rather the 'subjective criterion' is key here, as it relates to the kind of person the entrepreneur wishes to be and with whom he wishes to work and live [95]. **MODERATION, THEREFORE, APPEARS AS AN EMBODIED PROCESS** [96]**, ETHICS IN A SITUATION THAT CAN BE TRANSLATED THROUGH ACTS OF SELF-CONTROL** [97]**, COURAGE** [98]**, OPENNESS, THE PURSUIT OF JUSTICE** [99] **AND THE RECOGNITION OF THE ABILITY TO PROMOTE AND IMPLEMENT MORALLY SOUND ACTS – SELF-EFFICACY** [100]. This does not mean that the 'altruistic personality' highlighted by Samuel and Pearl Oliner in their work on the Second World War is forged through disengagement and disinterested concern, but rather as an autonomous self that can resist authority and social mimicry and align its actions with its convictions and feelings (of empathy and compassion) [101]. In economics, this fidelity to the self finds expression in a priori atypical practices: rescuing one's competitor, equalizing pay conditions within the organization, completely redesigning one's business model, and so on. Mindfulness [102] can be a lever for this awareness of oneself and others, which reduces the frequency of unethical decisions [103] and is a first step on the road to economic peace [104].

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95. Arendt, 2003, p. 160. - 96. Billeter, 2002. - 97. Grant et al., 2018.
98. Naughton & Cornwall, 2006. - 99. Dyck & Kleysen, 2001.
100. Kiriyavāda and Viriyavāda : We can make a link here with the vast literature on self-efficacy, which emphasizes that belief in one's abilities enables one to perform a task better (Gist & Terence, 1992).
101. Terestchenko, 2005, p. 15. - 102. Kabat-Zinn, 1990. - 103. Ruedy & Schweitzer, 2010.
104. Steiler, 2017; Ottaviani & Steiler, 2020; Ottaviani & Steiler, 2022.

Fourthly, **MODERATION PRESUPPOSES A RELATIONAL ONTOLOGY - INSOFAR AS THE 'SELF' IS ALWAYS UNDERSTOOD AND ENGAGED IN RELATION TO OTHERS, WHICH CALLS FOR PRACTICE (PRAXIS) AND DELIBERATION (PHRÓNÊSIS)**[105]. It is in relational and emotional contexts that moral meaning comes to be validated. In any case, there can be no freedom without community and, consequently, no freedom without others[106]. The literature illustrates this through the study of socio-emotional wealth. This refers to the pursuit of non-financial needs that meet the family's emotional needs and control over the family's future[107]. Based on a study of 3,816 European companies, Graadfland (2020) shows that the small size of the family business and the plurality of its governance members (from within and outside the family) play a positive role in the company's ability to achieve "clean" products.

SOCIO-EMOTIONAL WEALTH APPEARS TO BE A KEY TO UNDERSTANDING THESE MODERATION BEHAVIORS, EVEN IF THE ANALYSIS OF THESE BEHAVIORS MUST CONSIDER THE PLURALITY OF THE ORGANIZATION'S STAKEHOLDERS. From the point of the choice of production level, the economist Chayanov (1966) provides a telling example. Studying the Russian peasant economy, he showed that the production level within farming households was defined not according to a logic of maximizing profit and production but according to an annual production plan whose criterion was the balance between the expenditure of labor and the satisfaction of needs thus provided. The peasant economy described by Chayanov is, therefore, an economy of moderation based on deliberation (Phrónêsis) within the productive entity (the family), linked to empirical knowledge of the environment, which influences agricultural production (Praxis). Here, productivity is not indexed to any quantitative factor (capital increase) but to a qualitative criterion of balance between drudgery and the satisfaction of needs embedded in broader cultural and natural dimensions. Today, these balancing approaches are found in other forms in committed companies, for example, through a balance that is also intended to be socio-environmental and appeals to the consumer's awareness of these issues. This search for balance, which is more about the 'art of composition'[108] than optimization, also echoes the entrepreneurial postures that have emerged from indigenous traditions[109].

105. Bredillet et al., 2015.
106. Arendt, 1958.
107. Zellweger et al., 2011.
108. Thévenot, 2001.
109. Coral Guerrero, 2018; Okecha et al., 2020.

Thus, these different features of moderation lead us to see it not as the opposite of maximizing behavior but as another way of making an economy work, i.e., for actors to invent the most satisfactory ways of meeting the needs of others as well as their aspirations. This is embodied in:

- **1. A BROADENED CONCEPT OF "VALUE"**, which leads to the re-articulation of exchange value with the use of value of goods as with Marx and to consider the importance of the non-market (free time, community involvement, etc.) as a basis for the fulfillment of individuals and organizations;
- **2. A RE-INTEGRATION OF THE COMPANY INTO SOCIETY** [110], leading us to consider that the global economic system is not simply the sum of individual entities but is the result of complex synergies developed at different levels;
- **3. THE ABANDONMENT OF THE NORMATIVE IDEAL OF GENERAL EQUILIBRIUM** as the bearer of social harmony and which favors a vision that recognizes the power relationships between players and their construction of 'dynamic harmonies in transit' [111].

The moderate entrepreneur does more than respond to uncertainty or develop new technical combinations of production and innovation - moderation can be a powerful source of innovation in hypofirm theory [112], for example, by enabling these companies to focus on their know-how and the development of new varieties in the French rose industry. Beyond the fact of integrating 'ethical motives for action into the theory of rationality' [113], in order to revise our conception of the articulation between the macro, meso, and micro, we need to take into account the structuring role of institutions on the rationality of actors [114]. For example, there is currently a "vice premium" in the clothing sector, since the absence of regulation encourages social and environmental dumping. On the other hand, the law on the artificialization of land is a national regulation that will be applied at the local level, encouraging sobriety in land use, and thus encouraging company directors to think about the appropriate use of their buildings.

110. Polanyi, 1957.
111. Liu, 2006, p. 220.
112. Marchesnay, 2004; 2008.
113. Eymard-Duvernay, 2002, p. 133.
114. Chanteau, 2003.

As the actor is 'immersed' from birth in a world 'which constitutes throughout his existence the horizon of meaning for his actions' [115]; the 'naturalization' and the institutionalization of utilitarian logic can make it difficult to apprehend other paths, as has been shown in these pages. However, stakeholders have a critical capacity in relation to these institutions. In this respect, 'economists are not innocent in helping, through their discourse, to shape the imaginations and behavior of actors' [116]: with its theory of homo economicus, economics has promoted a form of theoretical performativity, in which the aim is to 'construct the world in the image of the theory' [117]. In other words, it does not matter if entrepreneurs follow other than calculative logics to pursue their actions, since theory tells us that to reach an optimum situation, they have to behave "as if" [118] they were homo economicus. From the point of view of such theoretical performativity, it is 'reality' that has to adjust to economic science and not vice versa! Yet, Muniesa and Callon (ibid.) have identified a competing posture: experimental performativity, which aims to build theoretical propositions 'in itinere from problems and problematic situations' and field observations to resolve them. For example, for agricultural entrepreneurs, the idea is to start from the observation that the price of milk does not allow producers to be properly remunerated. Faced with this situation, theory is called upon to understand and rethink the concrete reasons behind such a situation, as well as the producer-consumer relationship [119]. The figure of the moderate entrepreneur seems to us to reveal such a posture constructed from the dissonant cases of leaders who have chosen to go off the beaten track of mainstream economics. Without attempting to establish a new ideal type, the following table (see Table 1) presents the characteristics of the moderate entrepreneur, going beyond homo economicus, showing that entrepreneurial behavior that not only shows that such an economic stakeholder can exist, but the they do indeed practice such ethics and that they are successful.

115. Perret, 2003, pp. 10-11.

116. Ottaviani & Steiler, 2020, p. 106.

117. Bateman et al. (2008, p. 139) propose that these individuals need to gain repetitive experience of the "operating rules of the contingent market" through a "learning design contingent valuation" to elicit theoretically consistent values. Among practitioners expressing such positions there is a belief that people should behave more in accord with economic theory, that is, as homo economicus" (Lo & Spash, 2012, p.3). See also: Muniesa & Callon, 2008, p. 5; Lo & Sachs, 2008.

118. Friedman, 1953, p. 13.

119. As illustrated by the emblematic example of the French case "C'est qui le patron" company, "Who's the boss?", that guarantees fair prices to milk producer and communicates directly on milk packs.

TABLE 1 – CHARACTERISTICS OF THE MODERATE ENTREPRENEUR

	DIMENSIONS	HOMO ECONOMICUS	MODERATE ENTREPRENEUR
CHARACTERIZATION OF ACTION	**Rationality**	Instrumental: a resource	Pragmatics – Product of action: the search for the best end
	Environment	External	Interdependence and immersion
	Individual	Maximiser agent	Moral subject constituted through interactions
	Coordination	Supply-demand equilibrium	Uninsured – Adjustments in situations
	Rational framework	Maximization under constraint: money, power, etc.	Plurality of modes of deploying rationality
CHARACTERIZATION OF THE ETHICAL FOUNDATIONS OF BEHAVIOURS	**Philosophical foundation**	Utilitarianism	Virtue ethics
	Key ethical criteria	Non-moral goods	Pluralism: moral goods, virtues, ...
	View of economy	Technical approach	Ethic approach
	Entrepreneurial posture	Hubris	Humility
	Ontology	Atomism	Relational
CHARACTERIZATION OF PRODUCTION LOGIC	**Social Harmony**	General equilibrium	Dynamic transit harmonies
	Goods values	Exchange values	Exchange values articulated with use values
	Society entities	Sum of individual based on synergies	Complex systems
	Productivity	Capital increase	Qualitative adjustments

Conclusion

A profound reflection on the modes of production and consumption and the principle of economic rationality underscores the urgent need for renewed ethical foundations associated with a new paradigm in response to the current environmental, climatic, social, and international crises. This paradigm must break with the existing norms to avoid perpetuating the status quo in the economic-political realm – merely doing a little more or a little less of the same thing. The urgency of the situation dictates that we can no longer afford to do so.

The critical analysis of Homo economicus and the examination of moderate entrepreneurial practices not only reveal the limitations of traditional entrepreneurial ethics based on the principle of maximization but also highlight the potential of alternative ethics based on moderation, humility, self-awareness, awareness of others, and a re-articulation of the relationship between ends and means. The existence of moderate practices prompts us to consider value beyond the economic, acknowledging the richness of non-market goods, the necessity for the social reintegration of the economy, and the abandonment of a frantic pursuit of profitability and accumulation of possessions and power in favor of a dynamic and contextually harmonious approach. In other words, we must think and act to shift away from a perspective – with its associated practices – that views the world as an object of exploitation (people, resources, animals, etc.) towards a world that is mutually interdependent between humans and non-humans and inanimate milieu . Relationships are paramount, for a simple yet overlooked reason in economic thinking: the world is interconnected, and it is these relationships that we must nurture.

The moderate entrepreneur, exemplified by Outilacier and others, embodies a promising path to innovation and change. Through a commitment to moderation, this entrepreneur demonstrates that balancing environmental preservation, social well-being, and economic viability is not only feasible but also desirable. This approach necessitates a profound reconsideration of prevailing economic assumptions (and a specific reductionist view of human beings, the homo economicus) and an emphasis on ethical behavior that is mindful of economic activities' social and environmental impacts.

Ultimately, the transition to moderate practices and the acknowledgment of the possibility of exercising virtues in the economic sphere offer a fruitful approach to addressing contemporary challenges. They call for a global contemplation of the role of the economy in society and how economic actors, from individual entrepreneurs to large corporations, can contribute to a more equitable, sustainable, and fulfilling future for all. Far from being a constraint, moderation proves to be an opportunity to redefine economic objectives, where the pursuit of meaning and responsibility towards the community and the environment becomes central. Moreover, it allows us to shift from the profit-maximizing objective of business to the greater goal of community participation, strengthening social cohesion, and contributing to the common good - what we refer to as economic peace.

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Ecological citizenship for a diversity of necessary behavioral changes

Ch.8

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Introduction

The growing importance of ecological questions requires necessary human behavioral changes. Often presented as the necessity to develop an ecological behavior to respect ecological limits, integrating ecological knowledge, formalized with the notion of 'planetary boundaries [1], we will here explore these necessary changes through the rich notion of ecological citizenship.

ECOLOGICAL CITIZENSHIP EXTENDS THE GENERAL CONCEPT OF CITIZENSHIP TO ENCOMPASS THE RESPONSIBILITY TOWARDS ECOLOGICAL AND ENVIRONMENTAL ISSUES

While the terms (ecological) 'humanship', or 'civility' could have been used, the advantage of the notion of 'citizenship' is to give space to numerous cultural and social dimensions of human behavior associated with citizenship conceptions and their associated rules. Citizenship concerns human rights and duties, ways to act, as moral autonomous beings. This concerns ways to intervene and decide in the economic and political spheres.

While the national level is most important to determine economic and political behaviors, hence the definition of proper behavior with regards to citizenship, citizenship concerns also international behavior, through organizations and institutions, from global supply chains to United Nations' conventions – on climate and biodiversity, international trade. The notion also concerns the subnational level, ways to interact, decide and interact in the context of local territories.

The notion of eco-citizenship requires exploring criteria to identify individual and regulated behaviors, through adequate 'ecological culture and institutions' – concerning laws, rules and norms, taxes and subsidies, political decision-making and so on. In other words, we will explore two dimensions of behavior from an ecocitizenship point of view: the cultural and institutional ones, these two being related as argued by Dewey [2] and others [3].

1. Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., ... & Rockström, J. (2023). Earth beyond six of nineplanetary boundaries. Science Advances, 9(37), eadh2458.
2. Dewey, J., & Rogers, M. L. (2012). The public and its problems: An essay in political inquiry. Penn State Press.
3. Oran R. Y, 2002. The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale. The MIT Press. DOI: https://doi.org/10.7551/mitpress/3807.001.0001

ECOLOGICAL CITIZENSHIP IS BASED ON THE PRINCIPLE THAT HUMANS ARE PART OF NATURE, BIODIVERSITY AND ECOSYSTEMS, SHARING THEIR TERRITORIES WITH NON-HUMANS. As a result, state and dynamics of non-humans, from living ones (animals, plants and microorganisms) to non-living ones (the physico-chemical environment of the ecosystems) is a fundamental human concern. Their state frames the quality of human life, human territories, the functioning dynamics and propensities of human systems. In other words, humans have to "think like a mountain" [4], which implies the necessity to consider every entity in the mountain, their interactions, to make possible a livable future. This concerns especially what we call 'anthropo-ecosystems', that is ecosystems where human density or activities are high, in cities and villages, farmland, nature-based tourism destinations, and fishing and hunting grounds.

The aim of the present review chapter is to examine three ways the literature has formalized ecological citizenship as necessary human behavioral change, to 'think like a mountain', for humans to become compatible with nature. We will not consider here the much more complex issue of giving citizenship to non-humans. A first branch of literature is to formalize 'ecological citizenship' as an ecological question. That is, how should humans interact ecologically and evolutionarily with non-humans based on this concept? Another branch can be called 'territorial', examining how the previous ecological considerations apply to different territories, depending on the relative importance of humans and non-humans, their types of interactions being different in cities, farmland and natural areas. The third branch of the literature is social, translating the previous considerations in economic, technical and political contexts, considering how these contexts can give some importance to ecological interactions with non-humans. The point is to show what systemic thinking might look like from an ecological citizenship point of view. In this regard, we will add that if such changes are deemed necessary for humans to adapt and thrive in the environment they are modifying rapidly and intensely.

ECO-CITIZENSHIP IS NOT CONSIDERED HERE EITHER AS A MORAL OBLIGATION, NOR AS A UTOPIA, BUT RATHER AS A POTENTIAL CHANGE IN CITIZENSHIP.

4. Leopold, A. (1970). A sand county Almanac. 1949. New York: Ballantine.

1. Defining ecological citizenship: making 'ecological nature' visible

'Thinking like a mountain' involves a diversity of behavioral interactions, depending on the types of non-humans they interact with. Four categories can be identified:

I) necessary for human life in material terms, the 'natural resources', from fertile soils to pollinators on;

II) having adverse effects humans' ecosystems, from pathogens to pests to new ones as climate change;

III) at the opposite being favorable, helping human ecosystems to adapt to global change, like fungi-trees mutually reinforcing interactions (mutualism);

IV) finally, as ecologically and evolutionarily close to humans, and therefore exposed to the same risks as humans, their decline being a warning that human regression will follow.

Ecological citizenship faces a major difficulty: humans interact and depend on nature in two major, most often dissonant ways. On the one hand, nature is the source of fundamental supplies, qualified as 'natural resources' (food, drinkable water, wood, fibers, hunted and fished animals, harvested plants, domesticated micro-organisms present in cheeses and wines...) whose exploration has always been a major human concern. On the other hand, humans depend on what we will call 'ecological nature', the quality and stability of ecosystems humans inhabit and deeply affect. The state of 'ecological nature' determines the quality of human habitats – from cities to countryside –, human health, global and local climates, human vulnerability to environmental hazards and disturbances.

As a result, ecological citizenship is complex, because there are tensions and contradictions around these interactions, in this 'mountain'. Exploiting 'natural resources' impacts negatively 'ecological nature' (see below 'socio-economic framing of ecological citizenship'). The poor state of the present 'ecological nature', the not so well-identified nature, at the opposite of the flourishing state of 'natural resources' [5], exemplifies this tension, the evidence that human behavior towards nature ought to change, ecologically.

5. Díaz, S., Settele, J., Brondízio, E. S., Ngo, H. T., Agard, J., Arneth, A., & Zayas, C. N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. Science, 366(6471), eaax3100.

Ecological issues are therefore manifold. Reducing non-human and human vulnerabilities to human impacts, from land-use change to various pollutions, which have been shown to deeply impact vertebrates [6], favoring ecosystems where humans can live, correspond to the human ecological niche – in particular, maintaining a climate compatible with more than eight billion human individuals' activities.

Besides the diversity of ecological interactions between humans and non-humans, another reason that makes ecological citizenship difficult to define is the ambiguous relationship we have with some of them, which can be perceived as trivial, everyday species that we take for granted, that is ordinary. This relates to the status, we humans, give to non-human beings. Some have been called 'liminal species', that cannot be described accurately in terms of 'wild' or 'domesticated' [7]. These live close to humans (garden birds), benefit from their presence (from prairie butterflies to rats), benefit to humans (like dung beetles), are considered as ornamentals (certain flowering plants such as poppies), or are considered too ordinary to instill human concerns (many common insects such as earwigs). Having evolved as a result of their interactions with humans [8], these species have also been called 'transformed' or 'secondary nature', which go beyond species and relate to ecosystems, such as agricultural landscapes or planted forests. These different terms – liminal, ordinary, transformed, secondary - suggest a lesser value compared to what is called 'pristine' or 'original nature [9, 10]. Pristine nature being the natural milieu that favored human emergence, and which in return has been influenced by humans [11].

AN ASSOCIATED DIFFICULTY IN PROMOTING THE RELEVANCE OF ECOLOGICAL CITIZENSHIP IS THAT THE DECLINE OF FALSELY 'TRIVIAL' (AS PERCEIVED BY INDUSTRIALIZED SOCIETIES) NATURE OF THE NOTION AND ITS REAL-LIFE CONSEQUENCES MIGHT GO UNNOTICED.

This shifting-baseline syndrome [12], which is an urbanite, industrialized perception, both western and eastern [13], is due to the very progressive, although general, decline of 'ordinary biodiversity' [14].

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6. Rigal, S., Dakos, V., Alonso, H., Auniņš, A., Benkő, Z., Brotons, L., ... & Devictor, V. (2023). Farmland practices are driving bird population decline across Europe. Proceedings of the National Academy of Sciences, 120 (21), e2216573120.
7. Donaldson, S., & Kymlicka, W. (2011). Zoopolis: A political theory of animal rights. Oxford University Press, USA.
8. Sullivan, A. P., Bird, D. W., & Perry, G. H. (2017). Human behaviour as a long-term ecological driver of non-human evolution. Nature Ecology & Evolution, 1(3), 0065
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10. Turner, R. K., Paavola, J., Cooper, P., Farber, S., Jessamy, V., & Georgiou, S. (2003). Valuing nature: lessons learned and future research directions. Ecological economics, 46(3), 493-510.
11. Sullivan, A. P., Bird, D. W., & Perry, G. H. (2017). Human behaviour as a long-term ecological driver of non-human evolution. Nature Ecology & Evolution, 1(3), 0065
12. Soga, M., & Gaston, K. J. (2018). Shifting baseline syndrome: causes, consequences, and implications. Frontiers in Ecology and the Environment, 16(4), 222-230.
13. Krenak, A. (2019). Ideas to Postpone the end of the world. Companhia das Letras
14. Couvet, D., & Prevot, A. C. (2015). Citizen-science programs: Towards transformative biodiversity governance. Environmental Development, 13, 39-45. Díaz, S., Settele, J., Brondízio, E. S., Ngo, H. T., Agard, J., Arneth, A., ... & Zayas, C. N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. Science, 366(6471), eaax3100.

Finally, our human common life with parasites, microbes, bacteria and so on, creates a feeling of unease for most people leading them to underestimate the importance of non-human life in their own daily life. Part of the objective for this paper is also to raise awareness of these interactions, as part of the reality behind the notion of ecological citizenship.

Confronted with these concerns, ecology and evolutionary sciences propose diverse concepts and tools, to make 'ecological nature' (see thesaurus) visible to and understood by stakeholders, economic actors, political parties, decision-makers and individual actors. These can be summarized through three complementary scientific approaches developed in ecology that we should be accustomed to, and even be integrated into our human culture. These three approaches were synthesized from our literature review, but also processed by our own analyses. These will each be presented in one of the following sections: 1) Non-humans are organized as ecosystems and ecological networks; 2) Ecological functions are an essential property of ecosystems, of non-humans organizations; and 3) Evolutionary dynamics of non-humans determines the fate of future ecosystems. All three are impacted by the human system and combining these approaches is necessary for the emergence of ecological citizenship. This chapter also attempts to offer as best as possible a thinking mode that is relational and dynamic, by offering many examples from how the living network operates.

Non-humans and humans are organized as ecosystems and ecological networks

All living-beings, including humans, interact and are organized in ecological networks, made from micro-organisms, flora and fauna, interacting with one another. Through these networks, non-humans are subject to the functional processes of circulation of matter and energy, to natural selection and to its multi-level distribution. We offer here a few examples of how different species of different orders cohabit in complex mutual interactions: mutualism, competition, predation and parasitism, commensalism and amensalism [15] (please consult the thesaurus for definitions of these terms).

Microbial communities, with biofilms, are also organized in such networks; moreover, they deploy mutualistic relationships with their hosts and in particular with humans, exhibiting important effects on human physiology, neurology and even psychology. Our microbiota affects regulation of hunger and food-cravings, nutrient processing, ion balance and humor [16]. In higher termites, a set of bacteria, such as Spirochaetes, Fibrobacteres, Bacteroidetes and TG3 bacteria inhabit the hindgut, while flagellate protists occur along with these bacteria in lower termites, which we will delve deeper. In the fore and middle gut, while the mandibles and gizzard of the termite mechanically grind the wood matter, salivary enzymes such as endoglucanases chemically tear the cellulose fibers down.

15. Ricklefs, E. R. (2010). The economy of nature sixth edition.
16. Collen, A. (2015). 10% human: How your body's microbes hold the key to health and happiness. Harper..

Meanwhile, in the foregut, it is the enzymes of flagellates that decompose cellulose and lignin enough to nourish the termite with carbohydrates. But how about nitrogen-rich proteins? Those are produced inside the hind gut by the symbiotic bacteria, either inhabiting the flagellate surface or interior [17]. In other words, without the bacteria community living inside it, the termite would not be able to live.

Toxoplasma gondii is a parasitic microorganism that has the cat as final host, but can use a suit of intermediary hosts, from rats to humans. Chronic infections with T. gondii were considered asymptomatic until behavioral changes were perceived. Rats would walk longer distances and become bolder, including towards cats. Similar results were recorded for hyenas and foxes. With humans, infected men with this parasite became more jealous, suspecting and disregarded more rules, while infected women became more outgoing, trusting, self-assured and resourceful. People with toxoplasma are 2.6 times more prone to cause car accidents than uninfected people [18]!

Information – visual, sound, odor – participates in these ecological networks, regulating interactions through corresponding behavioral signals, leading to diverse and complex behavioral organization, from animal cultures [19] – which includes self-domestication of elephants, musical 'tubes' in whales, delayed reward tolerance in rats and birds [20], complex modalities of eusociality, i.e.: the highest degree of sociality that involves superposition of generations (adult offspring cohabit in the nest with their parents), reproductive dominance by the queen, cooperative building of a nest and labor division in morphologically different castes [21] in insects, and even micro-organism sociality [22] and in plants [23].

An important property of ecological networks is their architecture. This architecture can be characterized by averages such as the number of species and their interconnections, as well as the intensity of these connections: how much a species affects the one it interacts with? Birds have more intense interactions with cats than with foxes for example. A recently understood important property is their geometry [24]: the way these interactions are organized, composed of modules – a set of species with denser interactions (for example plant-pollinator modules) and nodes (species which present more interactions with other species, a tree for example).

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17. Brune, A. (2014). Symbiotic digestion of lignocellulose in termite guts. Nature Reviews Microbiology, 12(3), 168-180.
18. Adekunle, R., & Lateef, A. (2022). Understanding the Effects of Toxoplasmosis on Host Behavior, Personality, and Cognition. In Towards New Perspectives on Toxoplasma gondii. IntechOpen.
19. Whiten, A. (2021). The burgeoning reach of animal culture. Science, 372(6537), eabe6514.
20. Green, L., Myerson, J., Holt, D. D., Slevin, J. R., & Estle, S. J. (2004). Discounting of delayed food rewards in pigeons and rats: is there a magnitude effect?. Journal of the experimental analysis of behavior, 81(1), 39-50.
21. Wilson, E. O. (2000). Sociobiology: The new synthesis. Harvard University Press.
22. Brown, S. P., West, S. A., Diggle, S. P., & Griffin, A. S. (2009). Social evolution in micro-organisms and a Trojan horse approach to medical intervention strategies. Philosophical Transactions of the Royal Society B: Biological Sciences,
23. Baluška, F., & Mancuso, S. (2021). Individuality, self and sociality of vascular plants. Philosophical Transactions of the Royal Society B, 376(1821), 20190760.
24. Bascompte, J. (2010). Structure and dynamics of ecological networks. Science, 329(5993), 765-766.

A trophic network in an arctic region will include much less nodes (species) with much stronger connections than a similar network in the tropics, with many more species interacting in a weaker manner with one another. Similarly, a gluten-free vegan could interact more strongly with fewer food items than an omnivorous hunter-gatherer Yanomami in the Amazon. Geometry determines strongly but not entirely, their resilience. Plant-herbivore networks are organized as modules, while plant-pollinator ones are nested, and these differences have been shown to be adaptative. By adaptative we mean that they are respectively the best ones to enhance the networks' resilience, because a species' disturbances have different effects on interacting species. Their respective geometry, although different, contributes to the mitigation of these disturbances [25].

Understanding how nature is organized in ecosystems and networks is fundamental for ecocitizenship to flourish. But this complexity is one of the factors playing a role in the difficulty humans have in taking biodiversity into account. The comprehension of such complex co-dependency webs between living beings and with the physical environment surrounding them is key for us to foresee how minor punctual interferences spread throughout the whole environment. And imagine how powerful a global force such as climate change is for the global living network. Furthermore, **PERCEIVING OUR PRESENCE WITHIN THESE NETWORKS CLARIFIES OUR OWN INTERDEPENDENCE OF THE ENVIRONMENT SURROUNDING US AND THE LIFE FORMS THAT SHARE IT WITH US, PUSHING PEOPLE TOWARDS ECOCITIZENSHIP**.

Ecological functions are an essential property of ecosystems, of non-human organizations

An emerging property of these networks are ecological functions such as soil fertility, biomass production, pollination, functions associated with birds and common insects (seed dispersal, biological control of invertebrates, insects, etc.). The concept of functional group (the species pool which performs this function by sharing "comparable ecology" defines the organisms performing these functions). Functional groups in an ecosystem are numerous and diverse: vegetation and herbivores, pollinators, small, meso, and large carnivores... The 'biodiversity and ecosystem function' relationship exemplifies the fact that genetic and species diversity of a functional group favors the proper functioning of a functional group, its productivity resilience, hence of the ecosystem it belongs to. Humans have a specific function in terms of both biodiversity and climate crises: that of potential ultimate disruptor.

To illustrate these ideas, for instance, many bats belong to the pollinator functional group. The diversity of snout morphology and foraging schedule is proportional to the adequate pollination of flowers of different shapes and availability of nectar sources [26]. In other words, bats feed more when there is more to eat. Many mechanisms are involved in this synergy between biological diversity and ecosystem functioning.

25. Thébault, E., & Fontaine, C. (2010). Stability of ecological communities and the architecture of mutualistic and trophic networks. Science, 329(5993), 853-856.
26. Diniz, U. M., & Aguiar, L. M. D. S. (2023). The interplay between spatiotemporal overlap and morphology as determinants of microstructure suggests no 'perfect fit'in a bat-flower network. Scientific Reports, 13(1), 2737.

These can be summarized as niche differences between individuals and species, with diverse abilities to use different resources, perform different functions and react differently to environmental variations. In this regard, biological diversity must be considered through the lens of diversity of functional traits (body mass, rate of metabolism...), and of life history traits (longevity, dissemination distance), life-history traits determining the rhythms and modalities of adaptation of species and ecosystems to climate change. Starting from the concept of the river continuum, which predicts a chain of events from river spring to river mouth including organic matter accumulation, rivers tend to be richer in energy the closer to the mouth you get. One way to bring energy back from the lower sections of a river to its headwaters is through large migratory fish such as salmons. In general, only part of these fish populations migrates, depending on their navigation capacity, fat storage and reproductive proneness [27]. These factors are strongly influenced by genetics and vary in a population. The high mortality of these migratory fish after reproduction brings such a high amount of organic matter to the river, that they influence soil fertility in their margin after the flood has passed [28]. Note that some human cultures engage in this: some Japanese traditional fishermen plant "fishery forests" above fishing areas to increase nutrient influx to the water, increasing fish productivity down in the sea [29].

THE NOTION OF 'NATURE'S CONTRIBUTION TO PEOPLE', CALLED 'ECOSYSTEM SERVICE', DEFINES THE ECOLOGICAL FUNCTIONS OF CRITICAL IMPORTANCE TO HUMANS – AND THUS, IS DEFINED FROM A HUMAN PERSPECTIVE, HISTORICALLY POLITICALLY AND CULTURALLY DEPENDENT. It is thus more anthropocentric than it is based on an ecological citizenship standpoint. These contributions correspond to four types of human rationalities:

I) material–natural resources;
II) cultural (esthetic, psychological, educational and inspirational);
III) regulatory or ecological (concerns with regards to health, security, climate, water) [30];
IV) support services such as soil formation, nutrient cycling and primary productivity.

Major ecosystems performing immaterial and regulatory 'nature's contribution to people' include forests and wetlands, mangroves and coral reefs, while for material contributions, there are different ecosystems such as farmland, crops and pastures. As a result, there are tensions among these categories of "nature's contribution to people" with what is sometimes called "progress", defined as an increase of the material *nature's contribution to people*, associated to deforestation urbanization, develops at the expense of the two other types of contributions. An increasing tension with an ever-growing exploitation of natural resources from human demands, which is a major reason for the research on the development and management of an ecological citizenship.

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27. Duponchelle, F., Pouilly, M., Pécheyran, C., Hauser, M., Renno, J. F., Panfili, J., ... & Baras, E. (2016). Trans-Amazonian natal homing in giant catfish. Journal of Applied Ecology, 53(5), 1511-1520.
28. Glaser, B., & Birk, J. J. (2012). State of the scientific knowledge on properties and genesis of Anthropogenic Dark Earths in Central Amazonia (terra preta de Índio). Geochimica et Cosmochimica acta, 82, 39-51.
29. Matsushita, K., Hori, M., Yamane, F., & Asano, K. (2023). Incorporating traditional ecological knowledge into holistic watershed management: Fishery forests in Japan. Ecological Economics, 204, 107654.
30. Díaz, S., Settele, J., Brondízio, E. S., Ngo, H. T., Agard, J., Arneth, A., ... & Zayas, C. N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. Science, 366(6471), eaax3100

Evolutionary dynamics of non-humans determines the fate of future ecosystems

Ecological citizenship would integrate a third important property of ecological nature: its capacity to evolve, to change, to adapt to global change, including climate change. These depend on evolutionary processes, including cultural evolution, and on ecological processes, such as succession. Like humans, non-humans react and adapt to human pressures, pathogenicity evolves, pests become resistant to pesticides, species become invaders and these changes are impacted by global human activity induced changes...

AN ECOLOGICAL AMBITION IS TO MAXIMIZE ADAPTIVE MUTUALISM BETWEEN HUMANS AND NON-HUMANS, AVOIDING THE RISE OF ADVERSE EFFECTS COMING FROM NON-HUMANS. OPPOSINGLY, A POTENTIAL RISING HOSTILITY OF BIODIVERSITY SEEMS INEVITABLE, BECAUSE BIODIVERSITY IS NOT AT THE SERVICE OF HUMANS.

Homo sapiens, like any species, has indeed enemies, which can behave as competitors, predators, parasites or pathogens whose eradication is sometimes welcomed, like the smallpox virus. The Bible, in describing the ten plagues of Egypt and their causes, testifies to the antiquity of this human concern. The emergence of epidemics caused by the disturbance of tropical forests [31] and their fauna underlines the possible lethal liability of ecological networks.

BIOLOGICAL DIVERSITY IS A KEY FACTOR IN AVOIDING RISING HOSTILITY LIKE EPIDEMICS AND PESTS' INVASIONS, FAVORING THE POSSIBILITY TO INCREASE MUTUALISTIC INTERACTIONS BETWEEN HUMANS AND PLANTS AND ANIMALS [32]

As an example, the brown stinkbug, Euschistus heros, is a voracious pest in soybean cultures in Brazil. Pesticides expenses totaled almost 40 billion dollars in 2007 around the world, but tolerance and resistance have evolved in many insect populations. A group of ecologists in Brazil have recently discovered that a natural enemy of stinkbugs, the wild marsupial Gracilinanus agilis, may be a strong agent of biological control for this agricultural pest, saving tens of millions of dollars per year in lost farmlands and pesticide economy [33]. So long as their natural habitat is not destroyed.

31. Faburay, B. (2015). The case for a 'one health'approach to combating vector-borne diseases. Infection ecology & epidemiology, 5(1), 28132.
32. Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., ... & Naeem, S. (2012). Biodiversity loss and its impact on humanity. Nature, 486(7401), 59-67
33. de Camargo, N. F., dos Reis, G. G., Mendonça, A. F., Laumann, R. A., Nardoto, G. B., de Camargo, A. J., & Vieira, E. M. (2022). Native marsupial acts as an in situ biological control agent of the main soybean pest (Euschistus heros) in the Neotropics. European Journal of Wildlife Research, 68(5), 62.
34. Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., ... & Naeem, S. (2012). Biodiversity loss and its impact on humanity. Nature, 486(7401), 59-67
35. Bridgewater, P., Kim, R. E., & Bosselmann, K. (2014). Ecological integrity: a relevant concept for international environmental law in the Anthropocene? Yearbook of international environmental law, 25(1), 61-78.

Another associated major evolutionary concern is the dynamics of ecological functions, i.e., the direct and indirect consequences of the decline of 'ecological nature' as defined above, of the global ecosystem collapse and thus, toward a possible shrinking of the human species' niche [34].

Ecosystem integrity: representing ecological nature

The notion of ecological integrity, appearing repeatedly for the last fifty years in international conventions [35] synthesizes the three previous considerations. Integrity can be defined in three dimensions, three sets of variables that classically characterize an ecosystem: its composition, its structure and its functions [36]. For these three sets of variables, in addition to the range of values characterizing a forest, grassland, pond, etc., diversity is considered to be the core integrity criteria. In other words, ecosystem integrity means compositional diversity (genetic and species diversity of the ecosystem, among micro-organisms, plants and animals, soil fauna and flora, pollinators and diversity of vegetation physiognomy for terrestrial ecosystems) as well as strata diversity, from herbaceous plants to large trees- and diversity of ecological functions.

DIVERSITY IS SYNERGISTIC: THE DIVERSITY OF COMPOSITION CONTRIBUTES TO THE DIVERSITY OF FUNCTIONS, AND VICE VERSA.

The heterogeneity of the structure favors the maintenance of the two previous ones. Within the framework of the 'theory of adaptive cycles', enunciating conditions for ecosystems to avoid collapse, the diversity of compositions, structures and functions of ecosystems is supposed to favor ecosystems reorganization and transformation, avoiding post-crisis stagnation [37]. The notion of the red list of ecosystems, which focuses on the tipping conditions of an ecosystem, underlies the concept of integrity in danger [38].

The notion of ecosystem completeness refers to the presence of all the elements that should constitute it: a high mountain area is not 'complete' in the same way a desert or the Antarctic or a tropical forest is. Completeness is thus relative and a variation of this criterion, explicitly taking into account the diversity of threatened groups of species, like large herbivores or carnivores. An example illustrating the positive importance of such completeness is the reintroduction of wolves into Yellowstone Park, in order to restore biological control of herbivores, which were overgrazing vegetation, degrading the habitats of many species, including beavers [39].

36. Barros, C., Thuiller, W., Georges, D., Boulangeat, I., & Münkemüller, T. (2016). N-dimensional hypervolumes to study stability of complex ecosystems. Ecology letters, 19(7), 729-742.
37. Sometimes called the poverty trap. Holling, C. S., & Gunderson, L. H. (2002). Panarchy: understanding transformations in human and natural systems. Washington, DC: Island Press.
38. Keith, D. A., Rodríguez, J. P., Brooks, T. M., Burgman, M. A., Barrow, E. G., Bland, L., ... & Spalding, M. D. (2015). The IUCN red list of ecosystems: Motivations, challenges, and applications. Conservation Letters, 8(3), 214-226.
39. Beschta, R. L., & Ripple, W. J. (2016). Riparian vegetation recovery in Yellowstone: the first two decades after wolf reintroduction. Biological Conservation, 198, 93-103.

These considerations led to proposals for indicators of good ecosystem status or integrity [40]. Thus, rewilding has been emerging as a strategy to restore integrity, by reintroducing ecological functions, especially those associated with large fauna, which have disappeared. For example, bisons would be better stimulants of prairie plant diversity, relative to their domestic counterparts, cows [41]. Note that rewilding has sometimes been associated to fierce, dangerous, species, like large carnivores, and as such has been criticized as a patriarchal bias [42].

Rewilding may be a way out of an anthropocentric approach, but which species should be reintroduced is a delicate topic that frequently answers more to the demands of large human stakeholders with more political pressure than to ecological necessities or to local minorities' interests which will interact more closely with this reintroduced fauna. The point is that ecological citizenship ought to be inclusive to be legitimate and intuitive to any party, which raises very social science issues! Overall, one might wonder which relationships can be built between biodiversity sciences and behavioral ones. They can frame what could be called **A NEW CULTURAL LANDSCAPE, WHERE NON-HUMANS MATTER, BUT NOT AS A RESOURCE OR A RISK, BUT RATHER AS AN OFTEN IMPLICIT AND ORGANIZED PARTNER. SUCH LANDSCAPE IS AT THE SAME TIME METAPHYSICAL, PHILOSOPHICAL ESTHETICAL AND ETHICAL**.

40. Hansen, A. J., Noble, B. P., Veneros, J., East, A., Goetz, S. J., Supples, C., ... & Virnig, A. L. (2021). Toward monitoring forest ecosystem integrity within the post-2020 Global Biodiversity Framework. Conservation Letters, 14(4), e12822.
41. Ratajczak, Z., Collins, S. L., Blair, J. M., Koerner, S. E., Louthan, A. M., Smith, M. D., ... & Nippert, J. B. (2022). Reintroducing bison results in long-running and resilient increases in grassland diversity. Proceedings of the National Academy of Sciences, 119(36), e2210433119.
42. Ward, K. (2019). For wilderness or wildness? Decolonising rewilding. Rewilding, 34-54.

2. Framing ecological citizenship in 'natural' territories: a social science issue

Ecological citizenship is already deeply explored in 'natural' areas or ecosystems, where human disturbance and pressures are low. At the same time, from a human factor point of view, it is easier to grasp what sustainable practices mean in a pristine rainforest or amid coral reefs than inside an office in a large city. As a result, one might wonder what contribution our considerations on ecological citizenship might bring to the understanding of the human factor in transition efforts, in their territories. They might provide additional objectives, rationality, hence bring further legitimacy to policies in these areas, by explicitly considering expected global changes and their impacts. This responds to an important and interesting caveat for natural – and modified – areas policies, departing from the hypothesis that, no matter how much we interfere with nature, it will find its equilibrium where few species will be lost, a hypothesis which is losing credibility with climate change and the biodiversity crisis.

Protection policies have indeed focused on facilitating the definition of maintenance and restoration of original 'natural' ecosystems. These were slightly modified by humans, characterized by their weak presence in the present and in the past, by the historical pre-industrial state of the natural ecosystem, which is assumed to be in a state of equilibrium. The canopy of Caribbean islands illustrates the relevance of this approach. Autochthonous trees, having a high capacity to resist disturbances, cyclones and fires, have been replaced since the arrival of humans about a millennium ago, and thus also by species that are more adapted to immediate human needs [43]

THE NOTION OF ECOLOGICAL CITIZENSHIP PROPOSES ADOPTING A MORE DYNAMIC BEHAVIOR, GOING FROM PASSIVE NATURE PROTECTION TO ACTIVE NATURE RESTORATION. Such citizenship implies becoming concerned with the modalities and speed of response to global changes of nature, such as the rate of mangrove retreat. The point is to distinguish desirable modifications from adaptation syndromes and maintenance of ecological integrity. For example, one could think of mutant tuskless elephants in areas where poaching control is unviable [44] or heat-resistant corals to face global warming [45].

43. Fall, P. L., van Hengstum, P. J., Lavold-Foote, L., Donnelly, J. P., Albury, N. A., & Tamalavage, A. E. (2021). Human arrival and landscape dynamics in the northern Bahamas. Proceedings of the National Academy of Sciences, 118(10), e2015764118.
44. Campbell-Staton, S. C., Arnold, B. J., Gonçalves, D., Granli, P., Poole, J., Long, R. A., & Pringle, R. M. (2021). Ivory poaching and the rapid evolution of tusklessness in African elephants. Science, 374(6566), 483-487.
45. Bay, R. A., & Palumbi, S. R. (2014). Multilocus adaptation associated with heat resistance in reef-building corals. Current Biology, 24(24), 2952-2956.

Non-native species can be adapted to new local conditions and more importantly, provide essential ecological functions of ecosystems, complementing this integrity [46]. This includes 'neo-native' species, present in ecosystems that are geographically and environmentally close [47] and which, with climate change is occurring 'naturally'. Others may be less ecologically desirable for the species present in the ecological network, including the appearance of exotic invasive species. Overall, maintaining and restoring integrity provides richer objectives and benchmarks for human behaviors.

THE IDEA HERE IS NOT THAT HUMANS TRY TO REPRODUCE COMPLEXITY – WE ARE UNABLE TO –, BUT RATHER THAT HUMANS CREATE CONTEXTS AND CONDITIONS FAVORABLE FOR NATURE'S COMPLEXITY TO THRIVE AND PROSPER.

The criteria underlined above correspond to such context.

Adaptation through rewilding and nature-based solutions is indeed a critical question for local ecosystems likely to collapse in the near future, like Mediterranean forests [48]. The 'bioclimatic ecosystem resilience index' [49], assessing the suitability of an ecosystem's habitats to host these neo-native species could complement other criteria, assessing the ecosystem's capacity to be resilient to global changes. An associated and compatible objective should be to maintain the original character of these ecosystems, assessed in terms of threatened species and communities, because they have disappeared from other areas, contributing to the maintenance of biological diversity on a global scale. Adding ecosystem integrity as an objective is to provide these original ecosystems with better capacities to adapt to global change which will impact several conditions underlying integrity and diversity.

46. Lundgren, E. J., Bergman, J., Trepel, J., le Roux, E., Monsarrat, S., Kristensen, J. A., ... & Svenning, J. C. (2024). Functional traits—not nativeness—shape the effects of large mammalian herbivores on plant communities. Science, 383(6682), 531-537.
47. Essl, F., Dullinger, S., Genovesi, P., Hulme, P. E., Jeschke, J. M., Katsanevakis, S., & Bacher, S. (2019). A conceptual framework for range-expanding species that track human-induced environmental change. BioScience, 69(11), 908-919.
48. Aplet, G. H., & Mckinley, P. S. (2017). A portfolio approach to managing ecological risks of global change. Ecosystem Health and Sustainability, 3(2), e01261.
49. Ferrier, S., Harwood, T. D., Ware, C., & Hoskins, A. J. (2020). A globally applicable indicator of the capacity of terrestrial ecosystems to retain biological diversity under climate change: The bioclimatic ecosystem resilience index. Ecological Indicators, 117, 106554.

3. Framing ecological citizenship in transformed, humanized territories

As underlined above, a major concern for ecological citizenship is its tension with anthropocentric, resource-oriented citizenship, which considers biodiversity, and nature more generally, essentially as a resource. In order to percolate through our culture and everyday decisions and behaviors, ecological citizenship must demonstrate its socio-economic relevance. In other words, giving more importance to an 'ecological nature rationality', relatively to the resource rationality, can lead to new, attractive, socio-economic options, which has been suggested by many reports, analyses, and meta-analyses [50].

To estimate the socio-economic and positive importance of 'ecological nature' for humans, including health and immaterial dimensions, for example esthetic ones, scenarios varying in the relative priority of 'natural resources' versus 'ecological nature', have been compared. Their results overwhelmingly suggest the relevance for local communities, decision-makers, a majority of stakeholders to give greater importance to ecological nature, at the expense of natural resources rationale [51]. Wetlands are an emblematic case, for which scenario comparisons show they bring higher benefits to the whole human community, than the same agricultural area that produces 'natural resources', as long as there is enough food to feed humans. Such results reverse the economic status of wetlands, from being antagonistic for humans (pestilential habitat, unsuitable for agriculture) to being strongly mutualist, through their climatic (carbon sequestration) and environmental (fertilizer and pesticide trapping, regulation of water flows and flood mitigation...) beneficial effects [52]. This is the reason why making 'ecological nature' visible and understood by stakeholders is so important. Individuals and species would benefit from these effects, from climate mitigation, fertilizer and pesticide trapping to regulation of water flows, flood mitigation and adaptation capacity to crises. These examples emphasize the importance of an ecological culture for stakeholders, including economic parties who ought to be aware of the economic advantages of preserving biodiversity and to act politically in favor of this.

Behavioral challenges depending on social classes

Given these socio-economic arguments in favor of a greater social importance for 'ecological' nature, the next step is to examine how behavioral changes could accomplish these potential benefits. For this matter, the distribution of the costs and benefits of such a change, depending on social groups, should be examined. This determines in part the kind of behavioral changes required, which might depend on the sector concerned (food production and consumption, vacation...) but a particular attention must be paid to the most vulnerable people.

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50. As suggested forcefully, in Costanza, R., et al. "The value of the world's ecosystem services and natural capital" nature 387.6630 (1997): 253-260. And more recently, with a different frame, Dasgupta, Partha. The economics of biodiversity: the Dasgupta review. Hm Treasury, 2021.
51. Daily, G. C. (1997). Valuing and safeguarding Earth's life support systems. Natures Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, DC, 365-374.
52. Costanza, R., De Groot, R., Sutton, P., Van der Ploeg, S., Anderson, S. J., Kubiszewski, I., Turner, R. K. (2014). Changes in the global value of ecosystem services. Global environmental change, 26, 152-158.

The creation of markets in favor of these 'regulatory contributions' is not necessarily the obvious behavioral answer, because of the probable perverse social effects through the appropriation of and access to 'ecological nature' by dominant stakeholders [53] and the perception that, once again, the most vulnerable will bear most of the efforts. An alternative is to consider functions and entities associated with ecological nature as a common good, and thus, to strongly regulate access to nature swiftly especially when new access to nature appears, as a result of scientific and technological progress, like for example with genetic technologies (GMOs- genetically modified organisms). Another way to consider the social question is to examine the benefits of ecological nature through risk avoidance, and then include investment considerations, highlighting the biodiversity option value, considering ecosystem and biodiversity credits [54]. Such cautious behavior would be a wide change from a promethean ethos, that technology solutions will solve all problems (a 'cornucopian worldview' [55]), which has been the dominant type of citizenship in the last century in the industrialized world. Again, past, present and future behaviors of different social classes, their rationalities and niche, should be considered, especially their possible differences in terms of impacts, depending on time horizons, and their perceived and real capacity to act.

Numerous studies [56] suggest that vulnerable populations would benefit from better protection from 'regulatory contributions' due to their (over)exposure to environmental hazards (see the Katrina episode and yearly landslides in the Brazilian Serra do Mar during the rainy season). On the other hand, a shorter time horizon for vulnerable populations when they compare probable, short-term outcomes, could lead them to give a higher preference to natural resources exploitation. These social considerations lead to a broader question associated with ecological citizenship's systemic consequences: its relation to human behavioral preferences for economic growth, an often-given condition to reduce poverty. Indeed, Sustainable Development Goals prioritize such growth [57]. Thus, promoting ecological citizenship might affect poverty reduction policies and might require making these less dependent, or even independent from economic growth. This might also mean that citizenship as a general concept should give more importance to global, intergenerational and justice questions.

ECOLOGICAL CITIZENSHIP IS THUS AN ASPECT OF THE GLOBAL CITIZENSHIP CONCEPT, TRANSCENDING NATIONAL OR STATE EMPHASIS TO A WORLD-WIDE VIEWPOINT. BESIDES A DEEP ENVIRONMENTAL CONCERN, SOCIAL JUSTICE AND GOVERNMENTAL RESPONSIBILITY IN DIFFERENT SCALES ARE ALSO PRESENT IN ECOLOGICAL CITIZENSHIP.

53. Peluso, N. L. (2012). What's nature got to do with it? A situated historical perspective on socio-natural commodities. Development and change, 43(1), 79-104.
54. Souza, B. A., Rosa, J. C. S., Campos, P. B. R., & Sánchez, L. E. (2023). Evaluating the potential of biodiversity offsets to achieve net gain. Conservation Biology, 37(4), e14094.
55. Jonsson, F. A. (2014). The origins of Cornucopianism: A preliminary genealogy. Critical Historical Studies, 1(1), 151-168.
56. E.g. Schröter, D. (2012). Our vulnerability to changes in ecosystem services. In Assessing Vulnerability to Global Environmental Change (pp. 97-114). Routledge. Palta, M., Du Bray, M. V., Stotts, R., Wolf, A., & Wutich, A. (2016). Ecosystem services and disservices for a vulnerable population: Findings from urban waterways and wetlands in an American desert city. Human ecology, 44, 463-478.
57. Eisenmenger, N., Pichler, M., Krenmayr, N., Noll, D., Plank, B., Schalmann, E., ... & Gingrich, S. (2020). The Sustainable Development Goals prioritize economic growth over sustainable resource use: a critical reflection on the SDGs from a socio-ecological perspective. Sustainability Science, 15, 1101-1110.

4. Nature-based solutions: ecological citizenship in socio-technical contexts

Having defined necessary socio-economic behavioral changes associated with ecological citizenship, a further step is to examine changes of the socio-technical dimensions of an eco-citizenship behavior. This dimension explores the challenge to feed, and respond to, the material demands of more than eight billion humans, and at the same time integrating the place and the role of non-humans in socio-ecosystems, restoring their integrity and protecting 'ecological nature' by becoming aware that we humans are an integral part of that whole.

The concept of 'socio-technical imaginaries', or *"collectively held, institutionally stabilized and publicly performed visions of desirable futures (or of resistance against the undesirable), animated by shared understandings of forms of social life and social order, and supportive of advances in science and technology"* [58], coins the role of socio-technical contexts to make decisions, frame a collective future and adjust behaviors in a collective manner. For example, **AGROECOLOGY IS ONE OF THE BEST KNOWN EXAMPLE OF AN ECOLOGICAL SOCIO-TECHNICAL IMAGINARY. THESE IMAGINARIES ARE INTEGRATIVE WAYS TO IMAGINE A FUTURE ECOCITIZENSHIP IN A SOCIO-TECHNICAL CONTEXT, COMBINING REPRESENTATIONS, INSTITUTIONS AND MATERIAL ENTITIES, WHICH FRAME HUMAN BEHAVIORS.**

In this context, 'nature-based solutions', a concept originally proposed by the 'International Union for the Conservation of Nature', are socio-technical imaginaries where 'ecological nature' has a fundamental importance. Nature-based solutions are defined as 'actions that rely on ecosystems to meet the challenges posed by global changes to our societies, such as the fight against climate change, the management of natural risks, health, water supply and food security' [59]. Their socioeconomic ambition is to allow humans to be nurtured by nature while protecting it, finding in nature inspirations for nature-compatible solutions to decrease, avoid and solve crises.

58. Jasanoff, S., & Kim, S. H. (2015). Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power. University of Chicago Press.
59. https://uicn.fr/wp-content/uploads/2019/07/uicn-g20-light.pdf

This definition emphasizes the interdependency between human and non-humans needs. Three classic examples illustrate this notion; 1) white roofs in order to reduce climatic extremes; 2) wetlands, in order to regulate water flows, in addition, replacement of dikes, which are expensive to build and maintain and are of limited capacity; 3) agroecology in order to reduce the use of fertilizers and pesticides in agriculture and stop the decline of agricultural biodiversity at a global level; it should involve ecosystem restoration at the local level, with the help of hedgerows and associated ecological networks, including wild plants, pollinators, birds and bats. **NATURE-BASED SOLUTIONS SUCH AS THESE GIVE US A PERSPECTIVE OF WHAT ECOLOGICAL CITIZENSHIP MEANS IN ECOLOGICAL TERMS AND MAY GUIDE SOCIAL AND POLITICAL ACTIONS AND BE A SOURCE OF LEARNING RELATIVE TO NATURE'S DIVERSITY AND COMPLEXITY**.

Associated to ecological nature's complexity, in social terms, nature-based solutions have to be inclusive of different systems of knowledge, including scientific, experiential, vernacular and indigenous knowledge, which have the advantages to carry empirical knowledge of the local complex ecological context, as local complexity might still be difficult to access for classical scientific knowledge. Zai, for example, is a traditional method of reforestation in arid environments in the Sahel through the creation of favorable micro-pedoclimatic conditions, letting nature choose the shrub and tree species that germinate and develop. Zai is very efficient in terms of costs and results, compared with classical scientific agronomic engineering where humans determine and maintain the species planted [60], in a classic example of the ecological citizenship approach. These alternative systems of knowledge are a fundamental asset in the face of the difficulties of scientific experimentation at large spatial scales, like ecosystems, landscapes or continents, at which scale nature-based solutions should be implemented. This leads to a privileged link with participatory research, a new way for modern science to thrive, including and evaluating these traditional forms, their efficiency, their integrity and understanding how these can be replicated in similar milieus. In particular, modern science could evaluate traditional knowledge empirically, replicating and adapting it to similar milieus, according to specific local 'natural' and human conditions.

60. Carey, J. (2020). The best strategy for using trees to improve climate and ecosystems? Go natural. Proceedings of the National Academy of Sciences, 117(9), 4434-4438.

5. Conclusion: the implication of ecological citizenship for political behavior and our imagined place in nature

Implementing nature-based solutions to favor ecological nature, in the context of a future ecological citizenship, requires additional changes in of our imagined place in nature and political behavior. In this regard, as recommended by the 'Global Biodiversity Framework', and because "nature-based solutions" involve **A DIVERSITY OF SYSTEMS OF KNOWLEDGE, AND THUS MUST BE INCLUSIVE, THESE SOLUTIONS REQUIRE NOTICING OUR INTRICATE CONNECTION TO THE NON-HUMAN NATURAL WORLD, AS WELL AS INCLUSIVE AND PARTICIPATORY GOVERNANCE**.

This will clash with the logics of many present agricultural, economic and financial dispositive, which have neglected these political and ecological issues, neglecting the diversity of systems of knowledge and non-human values.

Governance can contribute to ecological citizenship

Citizenship can coevolve with governance styles, i.e., a series of coercive, incentive and cohesive rules put in place and which regulate collective life. In other words, eco-citizenship issues cannot ignore the ways environmental questions are governed. In this regard, Fletcher [61] distinguishes six types of reasons to legitimize ecological policies and ecological citizenship. The obvious one is 'scientific evidence' presented by environmental sciences, such as the IPBES' expertise. This 'environmentality' [62] would improve the necessary scientific arguments by integrating social, economic, political issues. Nevertheless, the other five reasons distinguish discipline, norms, sovereignty, – in particular food sovereignty, including many forms of anarcho-socialism –, values and incentives. The shape and character of ecological citizenship will be highly dependent on the governance choices made by different societies.

This means that **ECOLOGICAL CITIZENSHIP HAS A CULTURAL COMPONENT AND THUS WILL HAVE WIDELY DIFFERENT MEANINGS AND TRAITS, AMONG COUNTRIES, AND MIGHT REQUIRE AND LEAD TO QUITE DIFFERENT BEHAVIORAL CHANGES**.

61. Fletcher, R., & Cortes-Vazquez, J. A. (2020). Beyond the green panopticon: New directions in research exploring environmental governmentality. Environment and Planning E: Nature and Space, 3(2), 289-299.
62 Agrawal, A. (2005). Environmentality: Community, intimate government, and the making of environmental subjects in Kumaon, India. Current anthropology, 46(2), 161-190.

The notion of *'Common But Differentiated Responsibilities'* [63] exemplifies such variability, at the international level, its difficulties but also its promises. One of the obstacles for this is orchestrating these different necessary actions globally in synergy, instead of antagonistically. Another is making sure all actions are effective and based on sound evidence. For instance, carbon sequestration has been shown to be much less effective than reductions in carbon emissions in controlling climate change [64]. So, the latter option should be prioritized over the former. With climate justice, cultural specificities and regional potentialities play different political roles in the climate crisis, but the crucial point is that every government and society must take political action.

Humans are part of nature

Humans are not detached from ecological networks and their interdependence, ecosystem services even imply that we are meshed in a net of ecological interactions on which our health and culture, and even our very survival, depend. Our needs and chains of values are deeply dependent on material, immaterial and regulatory nature's contributions. As living beings, we depend on material and regulatory contributions. Our livelihoods and culture depend on immaterial contributions, while, as an intelligent species, we are also ethically and biologically compromised along with other living beings on this planet. The concept of ecosystem services encapsulates the diverse ways in which humans rely on nature's function. Understanding and preserving both natural and human-engineered ecosystems is vital not for wildlife conservation or for future generations: it is the only option for human survival in the present [65,66,67].

Nature-based solutions concern every territory, from natural to transformed ones, with the additional goal of restoring the quality of transformed ecosystems. At the forefront of the challenges are production ecosystems, associated with agriculture, forestry, fisheries and aquaculture. Besides exerting strong pressures on neighboring humans, ecosystems, through pollution in particular, these ecosystems usually exhibit low integrity, questioning their sustainability. Implementing nature-based solutions for them should lead to increases in complexity in ecosystems management, requiring additional social, technological, citizen, economic and political changes, asking for further social considerations that will help to specify what is meant with eco-citizenship.

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63. Stone, C. D. (2004). Common but differentiated responsibilities in international law. American Journal of International Law, 98(2), 27.
64. Fissore, C., Espeleta, J., Nater, E. A., Hobbie, S. E., & Reich, P. B. (2010). Limited potential for terrestrial carbon sequestration to offset fossil-fuel emissions in the upper midwestern US. Frontiers in Ecology and the Environment, 8(8), 409-413.
65. Daily, G. C., Söderqvist, T., Aniyar, S., Arrow, K., Dasgupta, P., Ehrlich, P. R., ... & Walker, B. (2000). The value of nature and the nature of value. Science, 289(5478), 395-396.
66. Chan, K. M., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., ... & Turner, N. (2016). Why protect nature? Rethinking values and the environment. Proceedings of the national academy of sciences, 113(6), 1462-1465.
67. Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., ... & Yagi, N. (2017). Valuing nature's contributions to people: the IPBES approach. Current opinion in environmental sustainability, 26, 7-16.

6. Research tracks and controversies

Scientific criteria around ecosystem integrity remain at this time complex, based on cutting-edge science. The challenge is to make them socially legitimate, understandable to stakeholders. This concerns especially parties whose practices will be the most directly impacted if ecosystem integrity becomes a major social concern, for which major behavioral changes are necessary, and whose actions will have the greatest potential to affect nature. These are the parties directly involved with production systems where 'natural' biodiversity is the major resource: farmers, fishers and hunters. Nevertheless, every economic actor is concerned, as biodiversity is present all along the global chain values, including services such as food or housing. On the opposite, previous focuses on protection of threatened species had the advantage to be focused, geographically and economically – like in the case of impacts of palm oil extraction on orangutans. This allowed for easier implementable solutions. Nevertheless, the relationship of these protection policies with human societies' sustainability was not obvious – their purpose being to be performative –, questioning their legitimacy, such as wolf protection in Poland [68]. In other words, what is needed is a common, civic, understanding of non-humans, their place and importance. Ecosystem integrity is a good basis for this.

Ethical questions

The issue of ethics, and especially biocentric ethics, underlies this entire discussion. The recognition of ethical responsibilities towards non-humans finds its foundation in various ethical theories, each offering distinct perspectives on the relationship between humanity and nature. Environmental ethics is the exploration of ethical inquiries arising from human interactions with the non-human environment. They address questions about what actions we should undertake, and the ethical assertions they encompass are prescriptive, guiding us on how we must behave [69]. Within this framework, **BIOCENTRISM STANDS AS A SIGNIFICANT ETHICAL PERSPECTIVE, AFFIRMING THAT ALL LIVING BEINGS POSSESS INTRINSIC VALUE BEYOND THEIR UTILITY TO HUMANS** [70]. Moreover, ecocentrism takes a broader look, urging moral consideration for entire ecosystems and the ecological community. It emphasizes the interdependence of species and ecosystems, underscoring the significance of preserving their integrity for their own intrinsic value even more than for the services they offer to human life [71].

68. Niedzialkowski, K., Konopka, A., & Putkowska-Smoter, R. (2021). To hunt or to protect? discourse-coalitions in the Polish wolf management. Conservation and Society, 19(2), 91-100.
69. Palmer, C., McShane, K., & Sandler, R. (2014). Environmental ethics. Annual Review of Environment and Resources, 39, 419-442.
70. Vilkka, L. (1997). Biocentrism. In The Intrinsic Value of Nature (pp. 53–70). BRILL.
71. Steverson, B. K. (1994). Ecocentrism and Ecological Modeling. Environmental Ethics, 16(1), 71–88.

This ecocentric approach is widely regarded as a fundamental pathway to effective conservation efforts [72]. More recently, **DEEP GREEN ETHICS NOT ONLY RECOGNIZE THE ETHICAL VALUE OF NON-HUMAN INTERESTS, BUT ALSO CONSIDER THAT SOME PURELY HUMAN INTERESTS SHOULD BE RENOUNCED WHEN NON-HUMAN INTERESTS ARE IMPORTANT** [73]. Environmental ethics frameworks collectively emphasize the imperative of acknowledging our ethical responsibilities to the web of life that constitutes our planet, highlighting that our moral obligations extend not only to humans but also to the non-human species and the environment.

Being complex and fuzzy, the concept of ecosystem integrity which integrates ecosystems trajectories and dynamics, tends to lead to a lack of clear rules and references and is more amenable to greenwashing [74]. On the other hand, pushing the subject of adaptation of every landscape at the forefront of protection policies might add to the political legitimacy of these policies, helping to resist to diverse growing human pressures. Nevertheless, considering the necessary adaptation of non-humans in any areas to global change, which might lead to deep ecosystem and civilizational changes, is a mental rupture, which might take time to diffuse. Furthermore, will there be enough time for adaptation to these global changes to evolve or are they too rapid for human and non-human's evolutionary pace? Evidence points in both ways, most changes are too fast and that is why we have huge extinction rates, but sometimes interesting evolutionary novelties come up and help save populations. On the other hand, putting the subject of adaptation of natural populations at the forefront of protection policies might add to their legitimacy, helping to resist to diverse growing human pressures on these areas. Nevertheless, adapting to rapid human-induced change may not occur fast enough to safeguard natural populations. Moreover, adaptation of natural populations to global change is counterintuitive, taking time to settle for well-intended ecological citizens who may consider that no change is acceptable.

Post-colonial questions

A specific ethical concern regarding ecocitizenship is the relation between developed countries, having transformed and/or devastated ecosystems, and developing southern nations, whose natural areas are still somewhat preserved but under attack by the same civilization. Developing countries have most of the forest cover in the world, but their economies are much less industrialized, and they have contributed to far fewer carbon emissions than developed nations. The necessary change in the production system towards a carbon-neutral economy is urgent. But that would further hinder the economies of developing countries, dependent on importing new, greener technologies.

72. Taylor, B., Chapron, G., Kopnina, H., Orlikowska, E., Gray, J., & Piccolo, J. J. (2020). The need for ecocentrism in biodiversity conservation. Conservation Biology, 34(5), 1089–1096.
73. Curry, P. (2011). Dark green or deep (ecocentric) ethics. In Ecological ethics: An introduction (pp. 92–126).
74. Rohwer, Y., & Marris, E. (2021). Ecosystem integrity is neither real nor valuable. Conservation Science and Practice, 3(4), e411.

Previous socio-economic arguments in favor of 'ecological nature' have been highly controversial [75]. These have been accused of reinforcing the legitimacy of the present economic systems, a kind of systemic greenwashing, leading to perverse, rebound, spillover effects [76]. Deepening the negative environmental and social impacts of migrating to a more sustainable future. Similarly, deforestation bans hit harder poorer populations who live in marginal small towns in areas with sparser human density than on inhabitants of denser and richer large cities, in which deforestation has already taken place. The plausibility of these perverse effects might depend on socio-technical and political contexts, associated with the socioeconomic ones, two themes explored in section IV above.

A widely explored, controversial, case concerns agriculture, with an opposition between 'agroecology' as a 'nature-based solution', contrasting with 'sustainable intensification', the alternative option in the 'Global Biodiversity Framework', target 10 in particular, of the 'Convention for Biological Diversity' [77]. These two options somehow diverge in how they consider agriculture should interact optimally with non-humans. 'Sustainable intensification' favors yield maximization, supposed to reduce the spatial extension of agriculture, at the expense of a low level of farmland biodiversity, the so-called 'land-sparing' option [78]. Alternatively, agroecology, as a nature-based solution, with the 'land-sharing' option, favors farmland biodiversity. This option considers that possible adverse effects on yield, hence on possible agricultural spatial extensification matter less than biodiversity, based on several arguments [79]. Being aware of such debate and the scientific outcomes it brings about which system is more interesting in terms of ecological restoration, an ecocitizen can make better informed choices.

The possible effects on human and machines productivity per agricultural unit produced, on human practices' sustainability need to be considered further to compare these two options, and in general to consider the relevance of any 'nature-based solution'. This means that eco-citizenship is also concerned: it has a critical regard on humans' labor productivity and social acceleration. Another difference between these two options is that agroecology digs often deeper in regard to the social, behavioral, dimensions of agriculture, the fate of familial agriculture for example, which concerns almost one billion people at the planetary level [80] (and see below, dimensionality of socio-technical imaginaries). In other words, choices in favor of nature-based solutions involve a diversity of interests, human values – which can diverge among stake-holders, and the values of non-humans, once again bringing the deep green debate.

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75. E.g. Lele, S., Springate-Baginski, O., Lakerveld, R., Deb, D., & Dash, P. (2013). Ecosystem services: origins, contributions, pitfalls, and alternatives. Conservation and Society, 11(4), 343-358.
76. Lele, S., Springate-Baginski, O., Lakerveld, R., Deb, D., & Dash, P. (2013). Ecosystem services: origins, contributions, pitfalls, and alternatives. Conservation and Society, 11(4), 343-358.
77. https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf
78. Green, R. E., Cornell, S. J., Scharlemann, J. P., & Balmford, A. (2005). Farming and the fate of wild nature. Science, 307(5709), 550-555.
79. Desquilbet, M., Dorin, B., & Couvet, D. (2017). Land sharing vs land sparing to conserve biodiversity: How agricultural markets make the difference. Environmental Modeling & Assessment, 22, 185-200.
80. Loconto, A., Desquilbet, M., Moreau, T., Couvet, D., & Dorin, B. (2020). The land sparing–land sharing controversy: Tracing the politics of knowledge. Land use policy, 96, 103610.

OVERALL, BOTH THE INDIVIDUAL AND INSTITUTIONAL WILLINGNESS AND CAPACITY TO DEAL WITH FURTHER SOCIAL AND ECOLOGICAL COMPLEXITY IS A MAJOR DRIVER OF CHANGE AND NON-CHANGE TOWARDS A FUTURE ECO-CITIZENSHIP.

Wider political questions

There might be varied ways for politics to interact with ecocitizenship, and opposingly. How do humans feel as political subjects – and objects – relative ecology and non-humans? What are their collective priorities, how do they interact with non-humans? What are the most appropriate discourses? In other words, the way we think about and practice governance should be deeply affected, and they are, through Biodiversity and Climate COPs. The relative capacity of different governance modes–based on top-down expertise as well as local initiatives... to impulse behavioral change has to be scrutinized. That might depend on these styles' effects on the different stakeholders, according to their proximity to power, to production systems.... and their possible perverse social and environmental effects. Perverse effects have already been explored with the notions of green colonialism, of NIMBY 'Not In My Backyard', which has to be replaced with NIABY, 'Not In Anybody's Backyard'[81].
To choose and assess the relevance of these diverse, possible, governmentalities, the notion of structured agency might be useful, defining the agent's capacity to impulse changes in socio-ecological networks, depending on their place, role, in these networks[82]. Structured agency must be related to the notion of prefigurations, or social movements, spaces, trying to impulse behavioral changes, defined as 'the attempted construction of alternative or utopian social relations in the present, either in parallel with, or in the course of, adversarial social movement protest'[83], the notion of democracy being also most important. These prefigurations are very diverse, from alter globalism to green finance. Associated with this prefiguration diversity, major empirical questions arise, related to their agencies and systemic consequences. For example, how transformative are global economic and financial initiatives to respect planetary boundaries, to promote and generalize ecological citizenship in a diversity of contexts, compared to their more local, social alternatives, like alter-globalism? How complementary are those, their respective 'efficiency' at contributing to a new kind of citizenship[84]? For all these issues, what matters is to integrate their ecological, social and technological expected consequences and their scenarios.
A most important point being their dimensions, i.e., defined as 'the complexities and ambiguities in assemblages of attributes and associated meanings that are understood to constitute states and processes implicated in what societies regard as transformation'. Especially, among these dimensions, one ought to consider behaviors, involved through socio-technical imaginaries[85,86].

81. Robbins, P. (2019). Political ecology: A critical introduction. John Wiley & Sons.
82. Stirling, A. (2019). How deep is incumbency? A 'configuring fields' approach to redistributing and reorienting power in socio-material change. Energy Research & Social Science, 58, 101239
83. Yates, L. (2015). Rethinking prefiguration: Alternatives, micropolitics and goals in social movements. Social Movement Studies, 14(1), 1-21.
84. Kaul, S., Akbulut, B., Demaria, F., & Gerber, J. F. (2022). Alternatives to sustainable development: what can we learn from the pluriverse in practice?. Sustainability Science, 17(4), 1149-1158.

In other words, ecological citizenship will be associated to a diversity of behavioral changes, local and global, involving every stakeholder, in ways that ought to consider environmental and social contexts. Eco-citizenship must go with an ecological culture, one familiar with what biodiversity is, in ecological, functional and evolutionary terms. Furthermore, in a more active sense, it might insist, and give shapes to figures, that vary according to contexts. In cities, it might concern lifestyles or rates of animal proteins consumption. In farmland, the place of biological diversity among agricultural practices might be the critical theme, how it relates to soils fauna and flora, natural enemies, as well as "weeds" and "pests". In natural areas, where many biodiversity themes are already explored, politically implemented, avenues to deepen eco-citizenship should be the major question.

Summarizing what is meant by ecocitizenship

Overall, the present paper has offered some content to the discipline of ecosemiotics, which would be made of ecological citizenship, ecological nature, nature-based solutions, sociotechnical imaginaries and social prefigurations. Critical analyses of proposals about these different notions, and furthermore their assemblages, being a critical issue.

We might want to summarize what is meant by ecocitizenship: it is a way to always take into account and anticipate the fate and reactions of non-humans we interact with. It is not to be naive: all living organisms are programed to put the spread of their genes first, even if this is not of humankind's best interest. Nevertheless, the reality of ecological networks leads to the inescapable conclusion that benefits obtained at the expense of other partners, natural entities, will not benefit anyone. The reason being that the biosphere has created conditions with are favorable to the present living organisms, in terms of temperature, hygrometry, atmospheric composition, and its disturbance should most probably lead to less favorable conditions. Thus, avoiding unnecessary harm to the biosphere partners seems a reasonable conclusion.

Ecocitizenship involves a profound reconceptualization of us humans in nature, and then also in the way we interact with it. Overall, developing ecocitizenship will require transdisciplinary efforts, at least to relate biodiversity and behavioral sciences. It means to over-haul the cultural contexts, to re-examine the territorial declinations and institutional contexts, including technical economic and political questions.

85. Stirling, A. (2019). How deep is incumbency? A 'configuring fields' approach to redistributing and reorienting power in socio-material change. Energy Research & Social Science, 58, 101239.
86. Beck, S., Jasanoff, S., Stirling, A., & Polzin, C. (2021). The governance of sociotechnical transformations to sustainability. Current Opinion in Environmental Sustainability, 49, 143-152.

In a frame, what are the most important issues that need to be explored so as to:

1. BETTER UNDERSTAND

- 'Ecological nature' as a concept to describe intricate connections and retroactions between humans and the non-human natural world, why its state should matter for humans.
- How behavioral changes concerned with ecological citizenship involves and varies among diverse social political and economic spheres, involving consumptive, productive activities, quality of life and leisure, risk avoidance concerns.
- Nature-based solutions as socio-technical options negotiating with non-humans agentivities, involving diverse systems of knowledge beyond scientific ones, situated in local territories, requiring their governance to be inclusive and participatory.
- Relationship between eco-citizenship and governance style.
- Diversity of conceptions of eco-citizenship within a society.

2. BE MORE EFFICIENT IN CONTRIBUTING TO BEHAVIORAL CHANGE?

Frame in understandable terms to different stake-holders options to negotiate with non-human forces through 'nature-based solutions', and related concepts which are 'socio-technical imaginaries', 'structured agency' and 'social prefigurations', 'ecological citizenship', 'degrowth', and 'ecological civilization'.

3. WHAT ARE THE EMERGING SIGNALS OR THEORIES AND NEEDS (WHICH OTHER DISCIPLINE DO YOU THINK SHOULD BE CALLED UPON TO HELP ANSWER QUESTIONS)?

- Environmental humanities, including environmental psychology, anthropology, sociology of the environment, ecological economics, environmental ethics.
- Ontological approaches in every discipline to redefine their concepts according to the present ecological context.
- Transdisciplinary approaches and methods.

Thesaurus

ECOLOGICAL NETWORK
A depiction of the different biotic dyadic ecological interactions between organisms in an ecosystem.

MUTUALISM
Kind of ecological interaction in which both species involved are benefited. Passionfruit plants benefit from bumblebees as pollinators to transport their pollen to neighboring plants, while the bumblebees benefit by feeding on the nectar from those flowers. Cockroaches benefit from our garbage, and we benefit from their role in fragmenting our garbage for recycling its nutrients.

COMMENSALISM
Ecological interaction in which one organism benefits from another, without affecting it. (that is the definition, but I don't quite believe commensalism).
Bromelias sit on top of large trees in rainforests, being exposed to more sunlight, but without shading the host tree.

PARASITISM
Trophic interaction in which an organism, the parasite, consumes part of another organism, the host, usually without killing the host.

AMENSALISM
Ecological interaction in which one organism harms another, without benefiting from it. Elephants trample on grasses and smaller animals while they walk.

EUSOCIALITY
Highest degree of sociality that involves superposition of generations (adult offspring coinhabit the nest with their parents), reproductive dominance by the queen, cooperative building of a nest and labor division in morphologically different castes.

DISCOUNTING
The «time value of an asset» indicating there is a difference between the «future value» of this asset and the «present value» of the same asset.

ECOLOGICAL NATURE
The part of nature that sustains human existence, the ecosystems humans inhabit and transform.

SUCCESSION
Process by which the ecological community, the set of species, and the habitat change over time in a given area. Ecological succession continues by gradually replacing communities from a pioneer stage to a climax stage unless a disturbance occurs.

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Afterword
Food for transversal thoughts

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This report's introduction started with a story. A story of the emergence of new Scientists in transition issues. It told of a few Great Ones who helped to re-write part of our mental narrative, the story we tell ourselves about Nature, Gaia and our place in it. This conclusion continues this Story of how our imagination and the stories we tell ourselves have changed are and are still changing. How are this breed of scientists, behavioralists, contributing to writing a new, emerging, Myth of a Humans' place in Nature and of Nature in Human imagination?

This volume's chapters insist on the fact that our industrial activities but also our consumption patterns operate from a very human base, with all our idiosyncrasies, our complexity, desires, emotions among which fear which thus requires courage for change to occur.

Writing a transversal and interdisciplinary conclusion that would give justice to this volume's chapters is no easy task, yet attempting to address some of the common points between these contributions is key to understanding the human factor in transition. Of course, this first volume is inevitably incomplete in part because no book nor model on human behaviors could ever tell the whole story. In part also because this is the first IpBc report and we needed to be humble about our objectives. There are several drivers of change and non-change that are missing or were dealt with too lightly in this first volume (such as culture in the anthropological sense) or were treated as secondary issues in different chapters (such as values). This being said, several trends emerge as well as common conclusions. This, in itself, is revealing.

First, chapters make the main argument presented in the introduction even more powerful: the ecological crisis is not environment-based, it is a consequence of our activities and as such, it is a ***human*** crisis. Qualifying it as an "ecological crisis" and the solution as "ecological transition" tends to confuse cause and effect, means and objectives. Bees are not going to be saved by adding hives but by reducing the root (and very human) cause of their disappearance. Developing and taking into account different human sciences is only the first step in transition efforts. We then need to get behavioral disciplines to work together in interdisciplinary research and methods and eventually with practitioners (and thus, in transdisciplinary mode). This is one of our main objectives: attempt to identify common conclusions between different disciplines, each with its own 'angle' on drivers of behavioral change and non-change. While so much more can be explored, we can say that we have

made some progress in this direction as volume 1 of this First report brings several answers to the following question: if "humans are not rational animals but rationalizing ones" to paraphrase Heinlein[1], then, what are we? Formulated from the IpBc's point of view, what are the other drivers (apart from rationality) behind our behaviors?

Every chapter of volume 1 explicitly demonstrates that emotions, values and implicit cognition are more powerful drivers than rationality and conscious cognition. Of course, this does not imply that there are no debates nor holes in our understanding of what makes humans tick, especially relative to which drivers are more important than others in which condition and for which actor. But what is most interesting is that these common conclusions go beyond mere parallels without common ground. In this chapter, we explore this through three questions:

- Which drivers emerge as more (or less) important in behavioral change and non change?
- Are there common conclusions to all the disciplines – or most of them?
- What is the added value of our disciplines relative to natural sciences in understanding the transition challenges?

Regarding this last question, one of the fundamental differences between human and natural sciences is that not only molecules do not think, but also, they do not know they do not think. Not only are drivers of behavioral change and non-change far more numerous than climate drivers are, but the interactions between factors playing a role in human life are far more complex. And to make it even more complex: humans both think and know that they do (even though they may not know why they do so!). And this is affected by their social and natural milieus. Behavioral transdisciplinary research is thus the best avenue to understand that multiscalar complexity.

Biodiversity comes closer than climate to the complexity of human drivers of change and non-change. Indeed, behavioral sciences could gain in adopting (and adapting) some of the notions used in ecological sciences, such as equilibrium, retroactions, tipping points, runaway effects, and so on, in a multiscalar perspective - a local level integrated in a large-scale system, with inanimate matter (rocks, mountains, water, soil) and living species, all in interactions with each other. In return, recent work in ecosemiotics also show that behavioral sciences can provide real insights that are useful to natural sciences as well (see our chapter on zoo-ecosemiotics in the up-coming next volume of this first report). To paraphrase F. Herbert in Dune, 'once we will have learnt to speak biodiversity, we will have taken great steps toward systemic relational thinking'. But behavioral sciences also bring their own unique contributions.

What else do the chapters all agree on? First, that the figure of the rational actor is just that, a figure, an analytical over-simplification with countless real-world implications – examples to follow. Beyond the rational economic actor, humans are at least multi-rational beings: investing in household retrofitting is economically rational in the long term, but it is also rational for an elderly person or a young couple wanting to move due to the arrival of a new baby not to want to invest in the same retrofitting. Even if it is economically and

1. Heinlein, R. A. (1953). Assignment in Eternity. Fantasy Press, Reading, Pa.

ecologically wise in the long run. We also know that much of our conscious cognition is largely driven by implicit cognition, the mental equivalent of automatic physical reactions. But beyond being multi-rational, we are even more fundamentally ***subjective***, a point driven home by all chapters. Indeed, all insist on the fact that humans live in a world in which symbols and subjectivity (which humans produce individually and collectively) have very real and concrete effects on the physical world and in the way we organize ourselves. Behavioral sciences are best equipped to understand this relationship between the objective and the subjective worlds, through their tools, methods and theoretical frameworks, which the chapters demonstrate very well.

Subjectivity is therefore the answer to the three questions raised above.

As a reminder, this first volume covered a wide range of subjects and disciplines.

IpBc's First Main Report, Vol.1 Chapters

M. Bonaiuto and V. Vitale **(Social-psychological interventions promoting behavioral change for the ecological transition)** offer an analytical portrait of categories of measures aimed at changing behaviours as identified by the international literature from sociology and psychology, identifying underlying drivers of change and non change.

C. Trujillo **(The intersection of poverty and behavioral change for sustainable lifestyles)** goes beyond the usual discussions on ecological and social inequalities by including the way we define "poverty alleviation" and the unconscious postulates that inhabit it.

J. Saint-Charles, S. Yates, C. Alloing and A-S. Gousse-Lessard **(Communication and behavioural change in a time of ecological transition)** address the contribution and limits of (human) communication sciences in understanding behavioural changes for socio-ecological transition.

H. Jalin, C. Mouguiama-Daouda and A. Sapin **(Emotions in transition: can eco-anxiety save our civilization?)** explore the role of emotions, focusing on the emergence of eco-anxiety as a case.

S. Blanco, D. Gotteland and O. Trendel address **"The role of implicit cognition in the development of a pro-environmental organizational culture"** in private firms, as a major driver of change and non-change in trying to reach transition goals.

D. Guyatt **(Beyond data: The role of mindsets in closing the climate financing gap)** also explores it but as applied to a specific sector: climate financing and investment.

S. Ansart, F. Ottaviani, R. Duymedjian, H. Poissonnier and D. Steiler **(Homo economicus vs Entrepreneurial moderation practices: a reality with transformative potential)** go further with this argument by exploring the effect of a theoretical and methodological notion: homo economicus, at the heart of economic and management classical theory.

E. Bessa and D. Couvet **(Ecological citizenship: a diversity of necessary behavioral changes)** also explore the unconscious universe of our decision making system, by addressing the issue of humans' place in nature through the exploration of a notion: ecological citizenship.

Our subjectivity is composed of many categories of drivers that include emotions, values, social representations and imaginaries, all of which have effects on our individual behaviors but also on the way we organize ourselves as societies, the way we produce (as much and as cheaply as possible), consume (the almost irresistible smell of a BBQ in the spring), travel (ah those two weeks on a beach far from home; the boat cruise to see the Antarctic before it disappears), rest, comfort and work... The implications for both behavioral understanding and the efficiency of transition (or transformation?) strategies are deep. While it is "easier to think about the end of the world than the end of capitalism", [2] chapters do question in many different ways our productivist-consumerist system not by engaging in 'objective' analyses of its impacts and operations but by bringing explanations as to how our subjectivity interacts with it. Attributed to F. Jameson [3] and to S. Žižek [4], this phrase denounces a weakness in our human imaginative capacity, to substitute capitalism for another system compatible with planetary limits. Imagination (or lack thereof) as a human limit to respecting planetary ones. IpBc's authors take this several steps further.

First, by showing that the notion that we are mostly (if not only) cognitive beings does not match reality. They also show that this 'figure' influences how we, behavioral scientists, analyze behaviors and their drivers and also how stakeholders attempt to modify behaviors for transition. From concept to practice and through behavioral sciences, the rational-focus figure is simply too limited to be useful.

Worse, it is counterproductive.

So, to have a better picture (4D) of what makes humans tick, of our complexity – which is not infinite, thankfully-, we need to go beyond the rational view. Starting with the idea that there are several types of rationalities and cognitions.

COGNITION OR COGNITIONS?

Several chapters make reference to how we use two distinct but interactive processing systems : an immediate automatic one (thoughts and emotions) and an analytical system based on higher order reasoning [5]. When an individual encounters alarming information about the ecological crisis, it is mainly the immediate system that is activated, triggering emotional regulation mechanisms. Guyatt even writes that cognition would have us believe that System 2 thinking is prolific and dominant, although research suggests that automatic thinking, which requires less effort, is more frequently used. Indeed, system 1 would even tend to use System 2 to confirm its automatic response or judgement.

In other words: what if cognition was a tool of other drivers rather than a driver as such?

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2. Damasio, A. R. (1994). Descartes' Error: Emotion Reason, and the Human Brain. New York: Avon Books.
3. Jameson, F. (1996). The Seeds of Time. Columbia University Press. p. xi.
4. S. Zizek. (1993). L'Intraitable. Psychanalyse, politique et culture de masse, trad. E. Doisneau, Anthropos.
5. Kahneman, D. (2011). Fast and slow thinking. Allen Lane and Penguin Books, New York.

Yet, the prevailing view outside behavioral sciences is that the lack of effective responses to climate change is due to a lack of rational decisions and actions based on scientific data. In their chapter on communication, Saint-Charles, Yates, Alloing and Gousse-Lessard also show how disconnected from reality this view is with a direct and obvious conclusion: communication efforts aimed only at system 2 is really inefficient in leading to behavioral change. Yet, international, national, local and stakeholders' awareness raising campaigns aimed at changing living styles are based on scientific data projecting a future catastrophe if we do not change. If scientific data and rational arguments were all it took to generate behavioral and systemic change, it would already have convinced the most recalcitrant stakeholders to change [6]. And this IpBc Report would be useless and so would behavioral sciences in transition efforts.

All authors in this volume criticize:

i) the knowledge-deficit assumption (i.e., that if stakeholders do not change, it is only because they do not know) at the base of communication and awareness campaigns for transition and;

ii) the belief that

- inversely, behavioral change cannot occur without scientific data;
- correct knowledge will translate into changes in attitudes, which in turn
- should automatically influence behavior.

As Saint-Charles, Yates, Alloing and Gousse-Lessard write, information is neither concrete nor objective, it is constructed through subjective interactions taking place in a subjective and objective world. Information also varies in its level of concreteness, with the following general guideline: the more concrete an information for daily life, the more likely it is to have an effect on behaviors. Thus, data only showing an increase in greenhouse gases can remain an entirely uninteresting piece of information, except for atmospheric scientists. But this increase in molecule density translates into increases in average temperature, which in turn translates into increased intensity and number of storms, floods and droughts. These in turn have effects on the living conditions of the global biosphere and human lives, and it is at this point and only then, that the first bit of information takes on ***meaning***. Action may then come, or not, depending on other factors. In the case of biodiversity, the fact that the number of non-human species (and individuals) is decreasing is of interest to ecological sciences and biology. The concept of biodiversity, its importance and its meaning are in and of themselves, obstacles to change: highly complex, notions of mutualism, commensalism, inter-relationships, tipping points, dynamic equilibrium are widely used but little understood outside experts of the field. Nevertheless, the basic causes are well known: human activities. But why should the decrease of insects on my windshield mean anything important to me, except for the fact that I do not need to clean it anymore? Contextualising in social and human reality scientific data, gives it meaning and thus, it is more likely to be taken into account and translated into action.

6. Instead, it might even be linked to the increase in climate skepticism in the last few years, in a back-lash effect.

The path between knowledge and understanding, realization and impacts on behaviors is a very long and fluctuating one, with every step being a potential last step.

Most importantly is that science-based communication strategies only mobilise one, minor, part of our decision-making and interest system; cognition, and one specific emotion; fear. But there are other drivers. Hence the need for a diversified communication strategy that does not limit itself to data and scientific language and which mobilizes other forms of communication about both the ecological crises and its solutions, such as art, theater, movies, serious games, fiction and scenarios which all contribute to the creation of new myths. "Once upon a time, hell rained down on earth" or "once upon a time, we created a new civilisation"? Behavioral sciences show that by not calling upon other drivers of change and non-change, such as implicit cognition, we decrease the efficiency sought in communication and can even create negative reactions, indifference, rejection or back-lash effect.

IMPLICIT COGNITION

Implicit cognition occurs outside conscious awareness or control and is an expression of deeply-rooted, unconscious values and beliefs at the individual level. Some ideas thus appear as obviously true, beyond doubt, but we do not know why.
Guyatt shows the role of implicit cognition in investors' decisions and identities, arguing that some unconscious principles and objectives are so ingrained, they are no longer called into question. They are simply, 'obvious'. Thus, making profit is the sole objective of industry's accepted wisdom as well as economic theory. Yet, even in sectors deemed to be purely 'rational' such as investments, there is clear evidence that other factors are at play, such as:

i) connection between investment beliefs and a sense of purpose,
ii) level of comfort in managing complexity,
iii) large scale social and peer group conformity pressures,
iv) prevailing organisational and industry culture,
v) perception of risk (specifically in relation to fear of failure),
vi) career risk,
vii) prevailing "rules of the game".

At issue here is one of this volume's strong emerging transversal topic, one that was not part of our call for publication: the *homo economicus* figure at the heart of dominant economic theory (Ansart, Ottaviani, Duymedjian, Poissonnier, Steiler). This is a theoretical model, and a figure of the mind, which posits that humans are rational, that they have perfect information and that they always act in their own personal interest and maximise profit. Emotions, transcendence or ethics are literally not part of the equation: economic theories and analyses based on this figure consider other drivers of change and non-change as being "ceteris paribus" (other things being equal) and thus, not worthy of analysis as potential drivers or explanatory factors.

Guyatt shows that this figure's dominance in financial theories and analyses has impacts on research methods and results, leading to an overemphasis on data and quantitative analysis techniques to the detriment of qualitative analysis and non rational factors, mentioning beliefs, sense of purpose, comfort with complexity, personal agency, fragmented organisational culture, tension between short- and long-term goals and fear of failure... But these are important drivers since they influence actors' expectations and goals relative to performance, a firm's identity and objectives, its mission, actions (suppliers' choice, source market targeted, KPIs, evaluation...) as well as stakeholders' judgement and their evaluation of their own actions and others'. Yet, *homo economicus* remains at the heart of investors' decisions and sources of information and their analysis. It acts as a shared (and subjective) truth and "a form of groupthink about what is legitimate and justifiable to others (...)" but with a very narrow view of human beings and their drivers and for our purpose that tend to exclude ecological and inequality issues. Thus, it is widely believed that the sole purpose of a company is to make profits rather than be a contributive actor to society or a territory. Indeed, practices associated with *homo economicus* legitimize and institutionalize desires and definition of what the good life is and should be through rewards, positive and negative reinforcements and institutional culture. It also leads to a neglect of alternatives to investment (Guyatt) but also in conventions, rules and culture (Blanco, Gotteland and Trendel) and to the reification of economy as a discipline. From an ecological standpoint and at the organizational level, it limits firms' abilities to face environmental challenges, or any other that is not directly and visibly linked to finance.

Questioning homo œconomicus, its status and effects allows a diversification of alternatives. In order to cultivate a shared sense of environmental values and beliefs among employees (i.e., a pro-environmental organizational culture), it is crucial to modify the existing organisational culture and its underlying implicit cognition and figures (Blanco, Gotteland and Trendel). ***This work on organisations' management and governance applies to both private firms and public authorities*** [7]***, which suggests that it may be present in all human organizations***.

This overemphasis on an economic, rational and maximising actor is linked to a larger-scale phenomenon, a widespread attitude that other drivers, such as subjectivity, is not legitimate. It also partly explains why behavioral sciences have a harder time making themselves legitimate on transition issues than natural sciences, except for economics. This even shows in our daily language: 'rational' is now equated to 'efficient' while the phrase "that is subjective!" is an argument to undermine the other's position, as if being subjective was devoid of meaning or importance. Trujillo also addresses this issue in his own way, reporting how an increasing number of studies, "outside conventional economics", show

7. Hesmert, L. (2021). A Socio-cognitive Approach to Public Leadership: Content, Operation, and Effects of Implicit Public Leadership Theories (Doctoral dissertation, Staats-und Universitätsbibliothek Hamburg Carl von Ossietzky); Nosek, B. A., & Riskind, R. G. (2012). Policy implications of implicit social cognition. Social issues and policy review, 6(1), 113-147; La Branche, S. (2017). «Transition énergétique et collectivités territoriales : une délicate prise en main». In Artis, A. Coopération, gouvernance, territoires et transition énergétique.

that perception of one's well-being is not correlated to one's consumption nor to the usual economic criteria. Social relations are more important! Yet, as he argues, our consumerist society holds that high consumption is the path to well-being and fulfillment, including among the poor classes: +stuff = +well-being = +success = +KPI.

Obviously, socio-economic hardship affects consumer behaviors, beyond purchasing capacity. Less well understood is that it does so by impeding cognitive functions and the way information is processed and used. In turn, how this information is translated or not into action depends partly on one's perception of one's capacity to act (self-efficacy). The way between receiving information and acting is indeed full of obstacles: individuals with strong perceived consumer effectiveness and self-confidence tend to believe more strongly that their actions as consumers have meaningful environmental outcomes, which is more common among middle classes than in lower classes. Even more importantly: poverty tends to negatively impact one's sense of hope and one's coping mechanisms, decreasing self-efficacy and even, desire, to be an actor of change.

Avoidance strategies (such as spatial, temporal, social and hypothetical distances; cognitive biases; herding and group think) emerge in all classes of course, but their nature, depth and underlying factors may vary across them. The point is that ***these strategies emerge because of the emotions underlying them***, as Jalin, Mouguiama-Daouda and Sapin showed, even if the relationship between emotions and in/action it is not a clear cut one: one might have denial, increasing anthropocentrism (Trujillo), hedonism but also actions. On the other hand, Trujillo suggests that positive emotions, such as pride of a capable person, or a sense of wonder for living beings may have a positive impact on long-term pro-environmental behavior. Here, the report would have gained in having a chapter specifically on the role of values and norms and how they interact with emotions and social representations (also almost absent in this report). Nevertheless, we can only conclude that, emotions come first, then cognition (implicit and explicit), which comes to no surprise to humanities scholars.

Another fundamental transversal conclusion emerges from all chapters, taking our understanding of non-change to another level. The reader may have noticed the following term: "drivers of non-change". Simply put:

Not changing is not passive; it is very dynamic!

NOT CHANGING AS INHERENTLY DYNAMIC

Neither nature nor us, humans, are passive. The "Gaia hypothesis" formulated in the 1970s by J. Lovelock and L. Margulis, describes the Earth as a systemic whole capable of self-regulation while B. Latour explains that all elements, human and non-human, on Earth are in interaction with each other. Akin to Couvet and Bessa's argument, Latour holds that "humans' capacity to rearrange everything around them is a general property of living things. On this Earth, no one is passive: the consequences select, so to speak, the causes that will act on them" [8].

8. Ramond, C. (2015, September). Bruno Latour–La Terre, nouvelle utopie?. In Université Paris 8, Semaine de rentrée du Département de philosophie, Thème:» L'Utopie».

The transversal conclusion from all chapters is unequivocal: resistance to change is not a passive state. ***Drivers of non-change are very powerful even though they may be conservative***. One only has to think about how powerful our consumerist society is relative to transition efforts: desire to accumulate more, short-lived equipment, throw away bags, immediate award for the brain, fast food... The depth of the implicit values and cognition associated to this system are more powerful than the explicit emerging ecological values. This idea that not changing is a dynamic state of affair brings an altogether different conception of analyses and solutions to be imagined. This idea is common in system thinking and in many natural sciences (Weaver [9] spoke "of forces of stability") and while there are some important differences with human sciences, there are lessons to be taken, applied and tested for understanding the human factor at all levels.

Lewin proposed a dynamic view in which seemingly stationary states are the result of contradictory dynamic forces [10]. Three basic options exist:

i) contradictory forces cancelling one another (such as two waters streams meeting each other);
ii) inertia (water flowing around a rock) and;
iii) a lack of alternative to the status quo or the dominant figure (a leaf going with the flow does not resist).

From a behavioral stance, one sees resistance to change arising from indifference, contradictory and conflicting values (from which cognitive dissonance emerges) and the dominance of a specific view of human nature (homo economicus, for example) and of nature as such (natura economicus). Limiting our analyses to the idea that "not changing" is simple passivity can only lead to failure. **Behavioral sciences can shed light on how to initiate forces that oppose change (attractive prices on low impact goods); consolidate those that go in the direction of what we want (secure bike lanes); and create alternatives (efficient public transport and good vegetarian meals)**. To do this correctly, we need to consider how drivers of change and non-change at different scales interact with one other. Bonaiuto and Vitale explain well how individual level forms of denial or cognitive avoidance are influenced by culture and the policies. Knowledge, beliefs, values, attitudes and emotions are never entirely coherent with each other or with one's objectives and they interact with formal regulations, social norms and cultural influences. Behavioral sciences thus do not look at single causes but rather at correlations between drivers and they aim at identifying which are more important than others in X condition, for Y actor.

By doing so, it then becomes possible to conceptualize, analyze, identify and imagine other figures than homo economicus, other drivers than cognition and rationality, and then evaluate their respective importance. For example, ethics and the recognition of the interdependence between one's activity and biodiversity have been identified as important

9. Weaver, R.G., (1993). A dynamic model of systems change: The interaction between forces for change and forces for stability. The Fielding Institute ProQuest Dissertations & Theses.
10. Also see, among many other examples: Gallavotti, G., Cohen, E.G.D. Dynamical ensembles in stationary states. J Stat Phys 80, 931–970 (1995). https://doi.org/10.1007/BF02179860

drivers by research on entrepreneurship that does not limit itself to homo economicus (Ansart et ali.). Beyond knowledge and data, the capacity to engage in change requires emotional qualities (identified in the literature but not covered in this volume) such as self-control, courage, openness and the recognition of the ability to promote and implement morally sound acts. The satisfaction of being 'aligned' with one's decisions and actions is a strong indicator of well-being [11]. Thus, even implicit cognition is still one driver among others, emotions playing a potentially even more significant, but still ambiguous, role.

EMOTIONS [12]

The chapters do not deny the reality of cognition. Rather, they criticize the lack of consideration in analyses and behavioral change strategies for subjectivity and the over-emphasis on cognition. This is the most fundamental added value of our disciplines: we, humans, are only partly rational.

Limiting our analyses to cognition as a driver of change and non-change leads to under-estimating and badly understanding what makes us change our behavior or not, which can only lead to failures in transition efforts.

In the worst case, trying to change human behaviors on methods based on false assumptions leads to resistance, denial and anxiety, which in turn has consequences in terms of social, political and economic counter-reactions. It also leads to proposals for public policies and firm's managerial and governance rules that do not adequately answer issues because they do not correctly recognize the issues at stake. Thus, identifying which emotions emerge for which issue and their specific roles and consequences is a must. For example, Jalin, Mouguiama-Daouda and Sapin explain that when denial of emotions persists, anxiety, fear or anger emerge and can lead to depression, emotional exhaustion and psychosomatic symptoms. Change under constraints, then?

This gets even more complex as the literature also distinguishes between immediate and anticipated emotions. Anticipated emotions are those that an individual consciously predicts s/he will experience in relation to possible outcomes of a decision, based on past experience. For example, an ecologically minded person feels an anticipated regret at imagining inviting friends for a meat-based BBQ, decreasing the likelihood of engaging in this behavior. Immediate emotions account for 32% of variance in intentions to limit air conditioning use [13]. Immediate emotions are those an individual actually experiences during decision-making, such as: disgust for earthworms; fear of bees; wonderment for a flower.

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11. Chalofsky, N. (2007). The humane workplace: Aligning value-based organizational culture, meaningful work, and life balance. In Presentation delivered at the Organization Development Network Conference, Baltimore.
12. Part of the arguments made in this section on emotions also come from: Ho, V. C., Berman, A. H., Andrade, J. Kavanagh, D. J., La Branche, S., May, J., Philson, C. S., Blumstein, D. T. (2024.). "Adding immediate emotions to the Theory of Planned Behavior: A proposal for augmenting pro-environmental behavioral prediction". Frontiers in Climate, Vol. 6, 2024 | doi: 10.3389/fclim.2024.1344899

They are visceral and automatic emotions one feels during decision-making [14]. Clearly, in a biodiversity fund raising campaign, pandas do not elicit the same emotional reaction as worms or insects. Disgust emerges as the strongest predictor for insect consumption, outweighing the participants' awareness of the environmental benefits associated with entomophagy [15], while fear of wolves (strongly supported by children's stories) plays a stronger role than the desire to save it [16]. The context in which a decision is made, typically comprises a combination of these categories of emotions in interaction: if I have a fond memory of having been in contact with nature during my childhood, this will feed my immediate positive emotions to being in the forest now which will also reinforce my decisions and my behaviors by making me return to it regularly. Emotions may also conflict with each other: the immediate context for a difficult decision includes a combination of ambient (stress) and anticipatory emotions (fear of future failure vs pride for future success) [17].

We know that emotions play a significant role in guiding our responses to pro-environmental messages [18] and policies [19]. Overlooking the emotional impacts and the weight of emotions in initiatives may result in suboptimal or even counterproductive outcomes [20]. As Jalin, Mouguiama-Daouda and Sapin argue:

rather than ignoring emotions and treating them as a behavioural bias that needs to be corrected, emotions need to be considered as drivers of behavioral change and non-change playing a crucial role in the transition process.

This begs the question: which emotion for which effect? And are there differences between different types of crises such as climate, water or biodiversity? If emotions are more important than cognition, does this mean that cognition is driven, partly at least, by emotions? This is fundamental as it would have profound impacts on the way we create, organize, communicate on and support change. So far, the main emotion called upon in ecological awareness-raising has been the use of one specific emotion: **fear**, of catastrophes, violence, misery, extinction...

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13. Lam, T. W. L., Tsui, Y. C. J., Fok, L., Cheung, L. T. O., Tsang, E. P. K., and Lee, J. C.-K. (2022). "The influences of emotional factors on householders' decarbonizing cooling behaviour in a subtropical metropolitan city: An application of the extended Theory of Planned Behaviour". Science of The Total Environment 807, 150826. doi: 10.1016/j.scitotenv.2021.150826.
14. Schlösser, T., Dunning, D., and Fetchenhauer, D. (2013). What a feeling: The role of immediate and anticipated emotions in risky decisions. Journal of Behavioral Decision Making 26, 13–30. doi: 10.1002/bdm.757.
15. Lammers, P., Ullmann, L. M., and Fiebelkorn, F. (2019). Acceptance of insects as food in Germany: Is it about sensation seeking, sustainability consciousness, or food disgust? Food Quality and Preference 77, 78–88. doi: 10.1016/j.foodqual.2019.05.010.
16. Notaro, S., and Grilli, G. (2022). How much fear? Exploring the role of integral emotions on stated preferences for wildlife conservation. Environmental Management 69, 449–465. doi: 10.1007/s00267-022-01593-z.
17. Loewenstein, G., and Lerner, J. S. (2003). "The role of affect in decision making," in Handbook of Affective Science, eds. R. Davidson, H. Goldsmith, and K. Scherer (Oxford: Oxford University Press), 619–642.
18. Nabi, R. L., Gustafson, A., and Jensen, R. (2018). Framing Climate Change: Exploring the Role of Emotion in Generating Advocacy Behavior. Science Communication 40, 442–468. doi: 10.1177/1075547018776019.
19. Lu, H., and Schuldt, J. P. (2015). Exploring the role of incidental emotions in support for climate change policy. Climatic Change 131, 719–726. doi: 10.1007/s10584-015-1443-x.
20. Stanley, S. K., Hogg, T. L., Leviston, Z., and Walker, I. (2021). From anger to action: Differential impacts of eco-anxiety, eco-depression, and eco-anger on climate action and wellbeing. The Journal of Climate Change and Health 1, 100003. doi: 10.1016/j.joclim.2021.100003.

But does this work better than love for nature or a sense of wonder for biodiversity? Emotions are directly involved in the evaluation of stressful situations and in coping strategies, including not only one's emotions but *also one's reactions to these emotions.*

The literature is actually split on the issue, indicating insufficient research and analyses of drivers: some studies suggest that eco-anxious individuals tend to seek more information and modify their lifestyles whereas others find almost no correlation between the level of climate anxiety and the adoption of pro-environmental behaviors. Why do some turn to apathy and denial and others, to radical action, and still others to avoidance, with the same information? This is the beauty of human complexity and the most interesting part for behavioral sciences. While the role of emotions deserves more large-scale research, there are some emerging signals from the scientific literature, self-efficacy emerging as a potential important driver.

Self-efficacy relates to one's perception of one's capacity to act. It is a subjective self-appraisal of either one's capacity to act or to have an effect on the issue. If one feels capable of acting, one feels less anxiety (the feeling one feels when faced with an insurmountable problem). The perceived uncontrollability of the climate and biodiversity crises increases an individual's perceived stress and may thus lead to negation strategies and thus, climate skepticism [21]. Beyond one's belief in one's capacity to act (related to intrinsic motivations), there is also the belief in one's capacity to contribute to a problem's solutions in a measurable way (linked to extrinsic motivations). Thus, two individuals with very similar resources can have very different perceptions and capacity to mobilize their own resources, apply them in the real world, have an effect and lastly, in their feeling toward those effects (satisfaction, sufficiency, failure...). But there is also an objective reality: no matter what one individual does, one cannot solve global crises alone. This may in part explain why individuals operating on extrinsic motivations may get discouraged when "objective" data shows insufficient improvement. Which confirms, if that was still necessary at this point, that data alone does not lead to change. It may and it may not, depending on many conditions, several of them subjective. But why is the belief that "data suffices unto itself" so widespread and why do natural sciences take precedence in the public media and organisational decisions (both private and public)?

As some chapters of this report point out, natural sciences enjoy a form of dominance, an "epistemic privilege" [22], that translates into higher public and media exposure, more funding, greater legitimacy and the belief that natural sciences suffice unto themselves to solve human problems. Natural sciences have such legitimacy that if science says so, then it should be so and thus, it stands to reason, so cognition tells us, that it will be translated into action. But scientific information is also subject to the same operating modes as any other form of communication when it enters the public arena (Saint-Charles, Yates, Alloing and Gousse-Lessard), with complex and dynamic processes of meaning construction and

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21. Witkowski, D., Boy. D., (Ed). L'opinion mondiale face au changement climatique. https://www.edf.fr/sites/groupe/files/2023-04/obscop22_e-book_planete-mobilisee_complet_20230427_planches.pdf. Pp.102-107. 2023.
22. Suldovsky, B., Taylor-Rodríguez, D. Epistemic engagement: examining personal epistemology and engagement preferences with climate change in Oregon. Climatic Change 166, 48 (2021). https://doi.org/10.1007/s10584-021-03138-5

change at play. It too, is subject to interpretation, disregard, indifference, interest and debate. The reader might have noticed but ecology as a driver of behavioral change has barely been mentioned in these pages, even though this report focuses on ***ecological transition times*** (both climate and biodiversity). What is then, the relationship between drivers of change and non-change and ecological crises in this first volume?

O ECOLOGY WHERE ART THOU?

Globally, ecological values do play a role but only among a minority of stakeholders. What is missing at the cultural level is the capacity to "think like a mountain" as Bessa and Couvet put it. By this, they mean collectively (culturally, in the anthropological sense of the term) developing and integrating an eco-systemic and dynamic approach into our analyses and daily practices, and deep in our mentalities. Where can we get inspiration for the development of such thinking and attitude? Biomimetics and biosystemic analyses offer a path: long-term, diversity, multiple-fail interactions, trials and errors and robustness rather than performance [23].

Specifically, emotions relative to nature play a role : feelings of awe, compassion and gratitude for nature and biodiversity are likely to lead to **pro-environmental and, interestingly, pro-social behaviors**. Fear of future natural catastrophes, on the other hand, may lead to denial and cognitive avoidance as defense mechanisms, such as minimization of risk, attribution of blame to others, distraction, hedonism and apathy because one feels that one's efforts are meaningless. Earthworms are 'ugly' and elicit one of the universal emotions, disgust, but they are a keystone species, without which the ground ecosystem would die. But knowing this, rationally, does not automatically lead to changes in emotions nor in behaviors. No one has ever seen a popular movement centered on "save the earthworm".

Trujillo shows that socio-economic class also has an impact on how one feels about i) nature and about the ecological transition; ii) how and why we should care about it or not and finally, iii) whether one has the capacity to do so. For example, the working-class value of «a taste for a job well done» would make them more critical of planned obsolescence, without having an ecological mindset about it.

Nature does exist in itself, of course. But at stake here is not nature as such rather than our objective and subjective interactions with it.

Drivers that are conducive to ecological protection are related to the capacity to conceptualize oneself as part of a larger whole, human and non-human. Environmental psychology shows that individuals with high pro-social preferences also exhibit a higher propensity for pro-environmental behaviors (which becomes tautological when one considers that humans are also animals!).

23. Hamant, O. (2024). The Benefits of Imperfection: Biology, Society, and Beyond. CRC Press.

Could we see the emergence of an integrated stance, marrying ecocentrism and human-based self-transcendence values (Couvet and Bessa's *ecological citizenship*)? For behavioral sciences, this implies the development of a relational and systemic view of humans in relationship to each other, to non-human living beings and to the non-living world. This leads us to a few observations, deserving far more reflection.

The first relates to the implications for our social representations of nature's value and our place in it (our cosmogony), related to the deep cultural foundations of our modern societies. The difference between anthropocentric and ecocentric approaches is that, for the second, nature and living beings are important on their own, not just because they are useful or beautiful to look at. Yet, in order to correctly take into account nonhuman living being, we need to understand how us, humans, enter into a relationship with them.

Then, one cannot help but notice that many drivers of behavioral change and non-change analyzed in these pages also exist outside ecological transition, such as in eating, exercise, mobility, or health (see the up-coming Volume 2 on this). But chapters tackling biodiversity also suggest that there are specificities related to this particular issue, compared to climate change. With biodiversity, one's view of oneself as a human and of one's place in nature seems to have a stronger impact as a driver of change or non-change than for climate issues. The issue of biodiversity also seems more conducive to inter-relational and systemic approaches and mindsets. We still need to explore if, how and why, taking into account 'natural' phenomena in our behavioral sciences will change what we know about humans, and whether it will change the way we explore behavioral drivers of behavioral change and non-change.

Toward a systemic behavioral science of living beings?

While behavioral sciences have much to contribute to our understanding of the human-caused ecological crisis, they face a triple challenge.

First challenge (methodology): how can we analyze the complex interactions between a very high number of drivers of change and non-change interacting at different scales of analysis? While it is necessary to develop non anthropocentric macro and systemic approaches, one of the risks is the loss of individual-level consideration. This could lead to overly homogeneous and superficial analyses and recommendations for interventions, lacking in customization and applicability, a point strongly made by Bonaiuto and Vitale. In reality, this has already shown its limits and weaknesses. On the other hand, not taking into account macro-level drivers (lack of infrastructure, economic incentives, societal norms, productivity and consumerist norms and values...) is bound to failure. One cannot recycle if there is no infrastructure for it; while we can use normal streets to move around on our bike, having secure bike lanes makes it safer, attracting far more users.

The way to a systemic thinking in behavioral sciences is a tight-rope walking exercise, and it is even riskier if one wishes to add ecology to the systemic and adopt an ecosystemic approach. **If one goes too quickly into transversal and transcalar mode, the possibility**

of mistakes and negative rebound effect increases. It thus seems that first we need to understand specific drivers of change and non-change for each scale and then analyse transversal ones and then, move on to systemic drivers that integrate different scales. As Bonaiuto et Vitale explain: multi-component interventions associating motivational elements with practical support and environmental restructuring are more successful in promoting sustainable behavior change and using different types of motivations: one may want to cycle to work for ecological reasons (ecology) or because it is faster than the car (time efficiency) but will not do so due to fear of accidents (individual level emotions) related to a lack of secure bike paths (public policy).

This leads to the second challenge (sciences' usefulness): how can we make our sciences accessible and useful? Every discipline touch on a part of the systemic truth (each blind man touching upon one part of the proverbial elephant) and thus we need to transcend disciplinary boundaries as well as those between academics and practicians. How can we integrate the fact that drivers of change are in dynamic interactions with drivers of non-change – in other words, that stagnation and immobility are just figures of the mind? That the flow toward change is made of eddies, counter currents, backlash, stagnation, waves, storms and droughts? And how do we translate this into understanding, into methods and recommendations for action at different scales (useful and usable knowledge for all)?

The third challenge (developing an ecoanthroposcience): considering humans as units in a systemic whole that interact and are organized in ecological networks, made from micro-organisms, flora and fauna, interacting with one another. What Couvet and Bessa called "thinking like a tree", which they directly link with ecocitizenship. Behavioral and ecological sciences could inspire one another: how do humans and their artefacts interact with each other and with nature? All chapters plead for a greater diversity of epistemological approaches and for tighter inter- and trans-disciplinary collaborations – the greatest challenge of them all? But ecological sciences tell us that diversity is synergistic: the diversity of i) composition contributes to the diversity of ii) functions and vice versa. Then, iii) structural diversity favors the maintenance and resilience of the two previous ones.

Fortunately, climate and biodiversity studies have encouraged (and even require!) the development of such interdisciplinary work, often attracting researchers whose thinking modes are more compatible with it. Hence, for example, economists, sociologists, psychologists and energy technicians have worked together around specific objects such as ecodistricts, new forms of mobility and energy consumption and appliances. Climate change sciences (oceanography, atmospheric physics and chemistry, glaciology and so on) first worked individually without crossing the river that divided them. But eventually, they started throwing bridges and sharing their results and methods, working transversally, to finally reach a common conclusion: climate change is occurring, and it is anthropogenic. At that point, their conclusion became truly solid and beyond doubt.

To conclude these reflections, behavioral sciences could explore another pathway: faced with this human diversity and with human-nature complexity, ***can we not conceive of possible invariants in human behaviors?*** Faced with the incredible human individual and cultural diversity, how could one even posit the hypothesis of invariants?

What if, as a hypothesis, specific drivers of change and non-change were contextualised expressions of potential invariants? While the idea of invariants across human cultures and individuals may not be a popular one, there is not sufficient studies allowing to discard nor confirm the interest of pursuing the question. Of course, one trap absolutely needs to be avoided: presuming that one's results on a few human beings apply to all.

One problem is that we, scientists, are also humans and sometimes resist the idea that we are also subject to path dependencies and traditions, as well as operating modes and preferences. We tend to love our individual and disciplinary specificities, even when it does not entirely make sense, as Lahire points out [24]. It is of course necessary to understand the parts if one wants to also understand the whole and then, interactions between the parts and the whole, but our sciences tend to get lost in the micro specifics. As path for further questioning, here are a few examples of potential invariants.

- While most research identify very specific conditions, criteria, etc., to explain a behavior or lack thereof, we also generalize, within boundaries, our micro level findings at the macro level. While we are over 8 billion people on the planet, there are not 8 billion ways of interacting with nature. General trends and categories do exist, but they take on different colours in different places or time.
- All human cultures have a culinary tradition. But, and thankfully for our tastebuds, there is an incredible number of ways to cook the same vegetables, the same noodles, the same meat. What a bore it would be if all of us cooked in the same way. And what a waste of human wealth it would be to lose that diversity: only western fast food across the world?
- Pride, humility, sharing and reciprocity [25] exist in all cultures but are not valued nor expressed in the same way.
- All cultures have oral traditions; many in recent history have translated this into written forms and made it accessible to as many individuals as possible.
- All cultures have norms and values that formalize family structures, but these vary.
- Every culture has its own relation to nature, including biophilia – an innate love for nature [26], and to the sacred (and a diversity within each culture) and separateness from humans.
- Power relations exist at all analytical levels and across all societies be it at the individual level and within a family as well as collectively, within an organization, a society and at the international level. But they do not take the same shapes everywhere.
- Feminist studies have revealed some invariants in men-women relationships.

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24. B. Lahire (2025). Vers une science sociale du vivant. La découverte. Paris.
25. For example, see the work by: Molm, L. D. (2010). The Structure of Reciprocity. Social Psychology Quarterly, 73(2), 119-131. https://doi.org/10.1177/0190272510369079 (Original work published 2010); Molm, L. D., Schaefer, D. R., & Collett, J. L. (2007). The Value of Reciprocity. Social Psychology Quarterly, 70(2), 199-217. https://doi.org/10.1177/019027250707000208
26. Wilson, E. O. (2017). Biophilia and the conservation ethic. In Evolutionary perspectives on environmental problems (pp. 250-258). Routledge.

For the IpBc, one key question would be: "which variants and invariants are drivers of change or non-change, for which types of categories, etc.?"
Which are more significant than others?

While the existence of human invariants is not a hypothesis on which the IpBc was founded, it is nevertheless one that should be investigated and explored even if it is only to be discarded for lack of salience. At least, we will know why it can be discarded. It could even be a false hypothesis worth pursuing because on the way to demonstrating that it does not hold, we might learn important lessons as to how and why we, humans, tick the way we do. This necessitates a strong involvement from ethnology and anthropology. And, what if, by exploring the potential existence of invariants, we discover what makes us common to each other and... to other non-human living beings, an issue also explored in the IpBc's Main Report #1, Vol.2. This will pursue the IpBc's work of fostering conversations between discipline and identifying emerging conclusions between different disciplines.

We hope that, following this discussion, our position that the ecological transition is wrongly named has become obvious. The underlying human drivers of change and non change that lead to the ecological crises requires behavioral sciences to understand them and transform the human factor into a driving healing force. We will succeed in resolving this ecological crisis not by trying to save bees but by changing the social, economic, political and psychological drivers of non-change while keeping drivers that are conducive to changes compatible with ecological objectives.

This report's introduction started with a story, one without an end (hopefully).
If natural sciences brought the magical tools and ingredients of our destruction (pollutants, greenhouse gazes...), behavioral sciences bring a new ambiguous yet fundamental character: subjectivity at both individual and collective scales.
But is it a super-villain or super-hero?

A good storyteller lets the reader judge for him/herself.

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Each chapter was commented upon by one specialist of the chapter's field; one whose speciality was secondary to the discipline or subject and one from another discipline. By doing so, we aimed at ensuring that each chapter avoided as much as possible overly specialized jargon and that basic notions were well and clearly defined.

This report thus does not aim to be read only by experts but also by readers from other disciplines, while remaining scientific. A summary for the public-at-large and decision-makers (private, associations, public policy makers and individuals) with a focus on solutions is also available.

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