



Delft University of Technology

## The Behavioral Perspective

### Working paper 1

Biely, K.

#### DOI

[10.4233/uuid:0f0a5234-ec1f-44b1-88d5-49d703814c2c](https://doi.org/10.4233/uuid:0f0a5234-ec1f-44b1-88d5-49d703814c2c)

#### Publication date

2022

#### Document Version

Final published version

#### Citation (APA)

Biely, K. (2022). *The Behavioral Perspective: Working paper 1*. (pp. 1-133). Delft University of Technology. <https://doi.org/10.4233/uuid:0f0a5234-ec1f-44b1-88d5-49d703814c2c>

#### Important note

To cite this publication, please use the final published version (if applicable). Please check the document version above.

#### Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

#### Takedown policy

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.

# The Behavioral Perspective

Working paper 1 – 2022

Katharina Biely

Delft University of Technology, TPM Energy Transition  
Lab



“Go forth on your path, as it exists only through your walking.”

Saint Augustine

Disclaimer: The research resulting in this working paper has been financed by the Delft University of Technology, TPM Energy Transition Lab. Though, this document does not necessarily reflect the point of view or opinion of the Delft University of Technology, TPM Energy Transition Lab.

Cite as: Biely, K. (2022): The Behavioral Perspective. Working paper 1. Delft University of Technology, TPM Energy Transition Lab. <https://doi.org/10.4233/uuid:0f0a5234-ec1f-44b1-88d5-49d703814c2c>.

## Foreword

This working paper is aimed to provide an overview of behavioral science perspectives that can assist in conducting research that aims at connecting human behavior and sustainability transition, including the energy transition. It has to be highlighted that not all theories are outlined in this document since there are too many. However, this document serves as a starting point and a source for references for further investigations. The theories and approaches outlined stem from different disciplines. Thus, this document has an interdisciplinary character. However, there are for sure more disciplines that could have been taken into account. Thus, while having an interdisciplinary character this working paper is not a complete representation of disciplines that could contribute to understanding human behavior and sustainability transitions.

Those who aim adding behavioral science perspectives to sustainability transition research may find this working paper useful. While a draft of this working paper was already floating around a student approached the author stating that it summarizes her whole psychology bachelor's studies. Although for sure not everything is covered, the attempt is to provide a quick introduction for those who don't have a background in behavioral science. Those who do have a background in behavioral science may find this working paper less useful. However, the working paper includes approaches that might be less often covered in other resources. Thus, even those with a background in behavioral science may find something useful in this working paper. In any case, this working paper is a starting point for further research, rather than a complete compilation of behavioral science theories, approaches, or concepts.

# Index

<b>1</b>	<b><i>Introduction</i></b>	<b>8</b>
1.1	The purpose of this working paper	8
1.2	Human behavior models	9
1.3	Behavior change matters	11
<b>2</b>	<b><i>Different theories explaining human behavior</i></b>	<b>16</b>
2.1	Environmental Behavioral Science	16
2.2	Rational choice theory	19
2.2.1	Criticism of rational choice theory	19
2.3	Behavioral economics theories	20
2.3.1	Prospect theory	20
2.3.2	Heuristics and bias school	21
2.3.3	Expectancy Value Theory	21
2.4	Theories considering the social context	23
2.5	Closed models	28
<b>3</b>	<b><i>Behavior change</i></b>	<b>34</b>
3.1	Change in steps	37
3.2	Change through low hanging fruits	38
3.3	Change as learning	39
3.4	Change in systems	49
3.5	Change through social networks	58
3.6	Change through habits	73
3.7	Change through practice	76
<b>4</b>	<b><i>Connecting levels</i></b>	<b>86</b>
<b>5</b>	<b><i>Behavioral levers</i></b>	<b>91</b>
5.1	Values, preferences, world view paradigm	99
5.1.1	Values	101
5.1.2	Beliefs	103
5.1.3	Emotions	104
5.1.4	Attitudes	104
5.2	Defense mechanisms	105
5.3	Cognitive dissonance	108
5.4	Heuristics – shortcuts	108
5.4.1	Framing	110
5.4.2	Anchoring	111
5.4.3	Attitude-behavior gap – Value-action gap – intention-behavior gap	111
5.4.4	Confirmation bias	112
5.4.5	Closed-minded	112
5.4.6	Loss aversion	112
5.4.7	Status quo bias	112
5.4.8	Present bias	113

5.4.9	Moral licensing	113
5.4.10	Self-serving bias	113
5.4.11	Projection bias	113
5.4.12	Availability bias	113
5.4.13	Limited cognitive ability	113
5.4.14	Descriptive norms	113
5.4.15	Environmental heuristics	113
5.4.16	IKEA Effect	114
5.4.17	Halo effect	114
5.4.18	Locus of control – efficacy	114
5.4.19	Agency	114
<b>5.5</b>	<b>Choice architecture - nudging</b>	<b>115</b>
<b>5.6</b>	<b>Habitual lock in</b>	<b>116</b>
<b>6</b>	<b>Conclusion</b>	<b>120</b>
	<b>References</b>	<b>122</b>

## Tables

Table 1: Most used keywords in the Journals Environment and Behavior, Environmental Sociology, and Journal of Environmental Psychology	19
Table 2: Stages of the change process, by Schein (2002)	43
Table 3: Characterization of changes in governance regimes expected for single, double and triple-loop learning From Pahl-Wostl (2009)	49
Table 4: Transformational adaptation, Table 16.1 From IPCC working group II 6th assessment report (Pörtner et al., 2022 Chapter 16, page 173)	52
Table 5: Conceptualizing the depth of leverage of various elements, exemplary of the inner transformation-sustainability-nexus Woiwode, Schöpke et al. (2021)	57
Table 6: Should I cycle or drive to the office today? (Baum & Gross, 2017)	69
Table 7: Behavioral principles, adapted from Williamson, Bujold et al. (2020)	96
Table 8: Values, From Cieciuch and Schwartz (2020)	103
Table 9: A comparison of habitual path dependence with utilitarian and normative models, from Sarigil (2015)	114

## Figures

Figure 1: Emission reduction through behavioral interventions. the first row represents the 30 behavioral solutions selected from Project Drawdown. the second row illustrates the reduction potential applied to these 30 solutions. From Williamson, Satre-mel et al. (2018)	12
Figure 2: Carbon Footprint of Mobility in Finland, from Akenji, Lettenmeier et al. (2019)	12
Figure 3: A comparison of the estimated per-capita carbon footprint reduction impacts of low-carbon lifestyle options (Finland), from Akenji, Lettenmeier et al. (2019).	13
Figure 4: Overview of challenges for various energy sectors, translated version from Andrés, Scheepers et al. (2022). Yellow = there are solutions, but they need to be implemented; orange = more solutions are needed, but many solutions are available though not yet implemented; red = solutions are missing	14
Figure 5: What are the main sources of CO2 emissions, from Milieucentraal (2021)	15
Figure 6: The interdisciplinary character of environmental behavioral science, from Günther (2009).	17
Figure 7: Stern's Values, Beliefs, Norms Theory, from Darnton (2008)	22
Figure 8: Simple Model of Pro-Environmental Behavior from Kolmuss and Agyeman (2002), sometimes called the Information Deficit Model	22
Figure 9: Model of Environmental Behavior by Kolmuss and Agyeman (2002), reproduced by Darnton (2008)	23
Figure 10: Needs Opportunities Abilities (NOA) Original by Vlek et al (1997), from Darnton (2008)	24
Figure 11: Main Determinants of Health Model from Dahlgren and Whitehead (1991), from Darnton (2008)	25
Figure 12: Basic pattern of socio-environmental processes, by Kasper (2016).	26
Figure 13: Tentative model of life dimensions reflecting ecological habitus, by Kasper (2009)	28
Figure 14: Simple feedback from Lissack (2021)	29
Figure 15: Environment Determining the control of Action, from Lissack (2021)	29
Figure 16 Feedback mechanism of behavior	30
Figure 17: Mental model as basis for human action, from Lissack (2021)	31
Figure 18: Theory of Interpersonal Behavior (TIB), from Triandis (1977), cited after Jackson (2005)	32
Figure 19 Interpretation of the ABC model added to TIB, from Salonen and Helne (2012)	33
Figure 20: Behavioral Design Steps from Williamson, Bujold et al. (2020)	35
Figure 21: Behavioral Change Model from Worldbank (2015)	36
Figure 22: Comparison of Behavior Change Models, from Bujold et al. (2020)	36
Figure 23: The behavioral change wheel developed by Michie, van Stralen et al. (2011)	37
Figure 24: BASIC model by the OECD (2019)	38
Figure 25: Framework for Environmental Education by Monroe and others, from Darnton (2008)	40
Figure 26: Double Loop Learning Model by Argyris and Schon Double Loop Learning (1978), from Darnton (2008)	41
Figure 27: Second order cybernetics, From Lissack (2021)	41
Figure 28: Force-field analysis, by Schein (2002)	44
Figure 29: Triple-Loop Learning from Pahl-Wostl (2009)	46
Figure 30 From twelve leverage points to four system characteristics by Abson et al. (2017)	53

Figure 31: Four realms of leverage points mapped against the Causality Teleology axis, by Fischer and Riechers (2019)	54
Figure 32: Cultural Theory's Typology of Social Organization and Cultural Type, compare with Jackson (2005) and Thompson et al. (1990)	60
Figure 33: Socio-environmental processes over time, by Kasper (2016)	61
Figure 34: Combining psychology, behavioral science, and sociology, from Bujold, Williamson et al. (2020)	61
Figure 35: ISM Model by Darnton and Evans (2013)	62
Figure 36: Linear versus closed models. Linear Models examine the relationship between the environment and human Behavior. Closed Models also investigate how behavior affects the environment, which in turn affects human behavior.	64
Figure 37: Intervention forces model for behavioral planning, from Schmidt and Stenger (2021)	65
Figure 38: Internal and contextual factors of behavior, from Baum and Gross (2017). The layered understanding of internal and contextual factors that influence decision making outlines the complexity of each decision (see Table 6).	67
Figure 39: S-curve of the Diffusion of Innovation, from E. R. Rogers (1983)	70
Figure 40 The x curve by Loorbach, Frantzeskaki, and Avelino (2017).	70
Figure 41: Panarchy applied to Innovation Ecosystem by Boyer (2020)	71
Figure 42: Action-Habit-Identity, adapted from Fahrenbach and Kragulj (2019)	75
Figure 43: Theory of Consumption as Social Practices form Spaargaren (2003)	77
Figure 44: Adapted Theory of Consumption as Social Practices. Original from Spaargaren (2003)	81
Figure 45: Resource, provision, and consumer differentiation, by Spaargaren (2003)	82
Figure 46: Connecting levels	90
Figure 47: Interconnection between the social and the individual, the tangible and the intangible.	90
Figure 48: Upstream, downstream model of Behavioral Change, by Londakova, Park et al. (2021)	91
Figure 49: Behavioral levers (Bujold et al., 2020)	92
Figure 50: Behavioral Levers, from Williamson, Satre-Meloy et al. (2018)	93
Figure 51: The Four Dimensions of Behaviour, from Chatterton and Wilson (2014)	97
Figure 52: The Four Dimensions of Behaviour applied to a case From Chatterton and Wilson (2014)	98
Figure 53: Iceberg model of Human behavior	99
Figure 54: Iceberg model From Bernard and Terjesen (2020)	100
Figure 55: Iceberg model applied to Practice Theory, By Jaeger-Erben and Offenberger (2014)	101
Figure 56: Value Circle from Ciecuch and Schwartz (2020)	103
Figure 57: Defense mechanisms, infographic from Adams (2017)	106
Figure 58: How we take decisions depending on the familiarity with the respective choice. From Wendel (2020)	110
Figure 59: Barriers between attitude and action from Blake 1999	112

## Boxes

Box 1: Reflection on change-Identity	58
Box 2: Science getting stuck in their bubble?	72
Box 3: Reflection on practices from daily-life	84
Box 4 Stopping to smoke as an example to overcome an addictive habit	109
Box 5: Crossing the field	118



# 1 Introduction

## 1.1 The purpose of this working paper

This working paper has been written to better understand the role of human behavior in sustainability transitions, including the energy transition. However, the paper focuses on human behavior and behavior change, rather than on an overall societal transition. This working paper is a starting point for researchers who have little to no background in behavioral science but want to include behavioral science aspects into their work. Human behavior and human behavior change are complex matters. An overall societal transition towards sustainability is a complex matter as well. Connecting both requires a basic understanding of both. Since this working paper focuses on providing basic knowledge about human behavior and human behavior change, connecting human behavior and transition theories is beyond the scope of this working paper. As human behavior is a complex matter, this working paper naturally is incomplete. Every reader will find some aspect not being covered in this working paper. The individual is the analytical unit within this working paper. Thus, the focus is on individual behavior and individual behavior change. Despite individual behavior being discussed within the societal context, the focus is not on societal (see for example Nowak & Vallacher, 2019; Rees & Bamberg, 2014), group (see for example Bamberg, Rees, & Schulte, 2018; Drury, 2014; Homans, Hare, & Polley, 1993) or institutional behavior or behavior change (see for example Campbell, 2007; Kingston, 2019; Raskovic, 2015; Wilpert, 2001).

There is already work compiling different behavior (change) models. For example, Darnton (2008) describes over 60 models. A similar overview, though from a consumer behavior perspective, is provided by Jackson (2005). Hence, this working paper does not aim at providing another detailed overview of behavior (change) models. Nevertheless, the behavior (change) models discussed by Darnton (2008) and Jackson (2005) are summarized and used as a basis for further elaborations in Chapters 2 and 3. Chapter 2 is a short summary of behavioral models. It sets the stage for those who have no previous knowledge of behavioral models. For a more in-depth comparison, I again refer to the work of Darnton (2008) and Jackson (2005). Chapter 2 indicates how models have become more and more complex and holistic. Chapter 3 expands on behavioral change models. The distinction between behavior and behavioral change models is borrowed from Chapters 2 and 3. The dynamic character of behavior change is outlined at the beginning of Chapter 3. Following the categorization of models made in Chapter 2, Chapter 3 provides behavioral change models. Thus, models gain in complexity. The chronology of chapters does not intend to express a hierarchy among models in the sense that one is better than the other. A model is never a perfect representation of reality (Mobus & Kalton, 2015; Sterman, 2002). A model is created with a specific intention (Edmonds et al., 2019). There is no perfect model that explains and captures everything. Which model to select depends thus on the purpose. This working paper is not intended to provide guidance on how to, or which model to select. A suggestion on how a suitable model can be selected is for example provided by Chatterton and Wilson (2014).

The intention of the working paper was to better understand human behavior (change) in the context of sustainability transition. The different interpretations of the sustainability concept (Attfield, 2013; Biely, Maes, & Van Passel, 2018; Common, 1996; Hediger, 1999; Holland, 1997) make it impossible to state from which angle human behavior (change) needs to be approached. The two opposing understandings of sustainability, weak versus strong, would suggest different approaches. A weak sustainability understanding would suggest that approaching human behavior via behavioral economics, using interventions that are part of the choice architecture family, would suffice. Weak sustainability limits the question of behavior change to how do we make people consume the sustainable option. Weak sustainability does not question the current socio-economic system, the paradigms that created it, and that are consequentially guiding the behavior of individuals to some

extent. Strong sustainability in contrast is not limited to the question of sustainable consumption. Strong sustainability acknowledges that the current socio-economic system and the paradigms that created it need to change. Hence, strong sustainability calls for not only using tools from the choice architecture toolset but to figuring out how people's worldviews can be changed. Hence strong sustainability calls for working on the deeper layers of behavior change.

One thing is hopefully carved out in this working paper, the mental model matters. Being self-aware about one's own mental model and world views and being transparent about them is paramount. It is the first step to facilitating change. A lack of self-awareness supports the unquestioned and unreflect reproduction of worldviews. Thus, the lack of reflection and transparency creates and supports mental lock-ins that manifest in everyday life. Accordingly, it needs to be indicated that the author of this working paper is a proponent of strong sustainability and a frequent user of systems thinking. Hence, this working paper is not free of biases. Although the author attempts to be as objective as possible, it needs to be acknowledged that it is natural to act (write) in line with one's own convictions. Though the transparency of the author should not be understood as an invitation to stop reading if the reader holds other convictions. Similarly, it is not an invitation for those who hold similar convictions to continue reading. Instead, it is an invitation to everyone to read this working paper with self-awareness and with an open mind.

The remainder of this chapter provides a sneak peek into the types of models provided in Chapters 2 and 3. It is further briefly outlined why the behavioral perspective matters when tackling the energy transition. Chapter 2 provides an overview of different behavioral models, from rather simplistic ones to more complex models. Chapter 3 reiterates some of the models presented in Chapter 2. However, Chapter 3 focuses on behavior change models. Chapter 4 summarizes some of the insights from the previous chapters and suggests how some models could be connected. Chapter 5 is a mélange of different topics all more or less related to behavioral levers. Thus, this chapter is about what makes us or makes us not act in a certain way. Accordingly, it covers motivation, behavioral shortcuts (heuristics) or psychological defense mechanisms. Finally, Chapter 6, provides a short summary of this working paper.

## 1.2 Human behavior models

According to Zimbardo and Gerrig (2004), **human behavior is the activity through which the organism adapts to its environment**. Following this definition human behavior is inherently transitory. Behavior is adaptation. Furthermore, human behavior is also contextual to a specific environment. Thus, the definition of human behavior indicates that it is relevant to understand the connection between human behavior and the environment in which it takes place. The definition does also indicate causality between a specific environment and a reaction (adaptation of the organism) to this environment. In this causality, the environment is the trigger for adaptation, not the other way around. Though, when Zimbardo and Gerrig (2004) sketch the learning process, they indicate the relevance of humans understanding of how the environment is affected by a specific behavior.

While the definition of human behavior includes a notion of change, models to understand individual behavior are not necessarily helpful in understanding individual behavior change (Darnton, 2008). The distinction between being and becoming is an old philosophical subject. **Becoming is a process of continuous transformation while being is an immutable state** (Metcalf & Kauffman, 2021). Anyhow, behavioral science (understanding a specific behavior) and behavioral change are related, and one needs to have an understanding of both, but they are not the same. "Models of behavior help us to understand specific behaviors, by identifying the underlying factors, which influence them. By contrast, theories of change show how behaviors change over time, and can be changed." While there are overlaps between theories of behavior and theories of behavior change, there are also differences.

Darnton (2008) indicates that models describing behavior are usually linear, drawing a linear relationship between factors influencing behavior and the observable behavior. In contrast models of behavioral change are usually dynamic, circular, including feedback loops (see the models compared

by Bujold, Williamson, and Thulin (2020)). Furthermore, changing an existing behavior is different to triggering a completely new behavior, or describing a certain behavior. Accordingly, behavioral models and behavioral change models are presented in separate chapters within this working paper.

However, a distinction between linear and somewhat more circular models can also be made when looking at behavioral models only. In his categorization of different socio-psychological behavior models, Darnton (2008) differentiates between linear and circular models. He points out that **most models are linear**, or multi-linear (various factors affecting behavior at once), and do not explicitly consider external factors. In these models, external factors are hidden in other factors such as agency. This is in contrast to models with a sociological footing. A famous example would be **Structuration Theory**, which places **behavior in a reciprocal relationship between the actor (agent) and the environment (structure)**. Practice theory is a further development of structuration theory, that looks at practices as an expression of the dynamic relationship between actor and environment. However, these theories have in common that there is some sort of reciprocity between the individual, the behavior, and the context. Accordingly, these theories of human behavior carry a sense of change within them. While there are automatisms of behavior that do contribute to the stabilization of behaviors (practices), there is also the notion of constant adaptation of behavior due to possible changes in the environment and self-reflection processes. Changes in the environment may have been brought about by others or the respective actor him / herself.

Models that focus on, or include habits also carry some degree of circularity as past behavior foreshadows the tendency of specific future behavior to be executed. Models that describe habits are thus inherently circular and models that describe changing habits deal with breaking the circle. Habits inhabit a special place within behavioral science. Habits create structures within one's own life and carry meaning in themselves. Furthermore, habits connect the individual with the context as they provide structure to the context and as they are triggered by the structures of the context.

Another type of model presented in this working paper are circular models. These models focus on feedbacks and on leverage points. They are strongly connected to systems thinking and underscore the relevance of paradigms or the mental model. The context in which behavior takes place is considered by circular models as well. Though, as for any other model what is considered in a specific model depends on the analytical task. In this working paper, the relevance of the mental model for behavior (change) is underscored. In this respect change through learning is connected to circular models.

As has been indicated above, no model is perfect. Nevertheless, it has been shown that linear models have substantial limitations. Regardless, linear models are still the ones most in use. Also, interventions to trigger or change behavior are accordingly often based on linear models, such as **Rational Choice Theory** (Williamson, Satrio-Meloy, Velasco, & Green, 2018). This might be owed to the history of behavioral science which has its roots in **Rational Choice Theory** of neoclassical economics (Bujold et al., 2020). Hampton and Adams (2018) investigate the popularity of behavioral economics. They compare the application of commonly used behavioral science with less commonly used practice theory. According to their research, the popularity of certain behavioral models seems to be based on accessibility, co-option, evidence, and applicability. Similarly, Chatterton and Wilson (2014) state: "This positioning of individuals at the center of the problem stems from the historical foundation of policy-relevant 'behavioral science' in economics and psychology." Darnton (2008) also states that „[s]tandard economic theory represents the starting point for modeling many aspects of human behavior.“

In this respect, this working paper attempts to provide alternative, less commonly used approaches. These approaches are rather circular, embrace complexity, differentiate between leverage points, and highlight the relevance of paradigms, worldviews, and mental models.

### 1.3 Behavior change matters

Increasingly human behavior becomes center stage to fight climate change and other sustainability issues. For example, Williamson et al. (2018) make a case for why individual behavior matters. They indicate that while an individual alone is not the largest emitter, all individuals taken together do emit large amounts of greenhouse gases. Thus, they refer to the power of the masses to underscore the role of individuals in supporting climate change mitigation. Though, they also state that “[a]chieving this potential, however, is a daunting challenge. It requires finding innovative ways of engaging individuals, households, and communities, and changing patterns of production and consumption that are ingrained in routine ways of life” (Williamson et al., 2018).

Behavior can be approached through the consumer lens. Each consumer choice has an impact on the environment. Consumer decisions are about whether or not we consume something at all, as well as on what we consume. Consumer choices are thus about sufficiency (consuming less) as well as making choices that are more in line with social and environmental sustainability. Despite the relevance of sufficiency to achieve sustainability, it is still a rather new research field (Gorge, Herbert, Özçağlar-Toulouse, & Robert, 2015; Moser, Rösch, & Stauffacher, 2015; Spangenberg & Lorek, 2019). Consumption is not only about buying something. Consumption tells much about our lifestyle, our status our identity. Therefore changing consumption is not trivial (Jackson, 2005).

Williamson et al. (2018) take options to mitigate climate change from *Project Drawdown* and further explore those options that are related to individual human behavior. They list 30 options, though many are related to agriculture. It can be argued that this option should be excluded, if income generating activities are not considered here. If agriculture is included, many other activities related to work would need to be included as well. However, Figure 1 illustrates the impact of individual behavior change in two different scenarios, as well as the contribution of different sectors (transportation, agriculture, energy, and food). In the optimal scenario, agriculture has a larger share than food. While agricultural practices are relevant, they are most likely not an area where individuals can have a direct impact. When individuals are here mostly understood as consumers, the way to influence food production is through consumer choices, rather than through being engaged in agriculture. Thus, consumer choices pertaining to food seem to be most relevant. Another major area is transportation. In this area, for sure many individuals have choices with which they can impact emissions.

People’s income and lifestyle influence their carbon footprint (Bhoyar et al., 2014; Li, Zhang, & Su, 2019; Roy & Pal, 2009; Shigetomi, Kanemoto, Yamamoto, & Kondo, 2021). Furthermore, there seem to be clear differences in individuals’ carbon footprint depending on their country of residency (Akenji, Lettenmeier, Toivio, Nielsen, & Kamei, 2019; Ivanova et al., 2017; Kovacs, Miller, Heller, & Rose, 2021). Although a higher carbon footprint is related to more consumption, it is not related to increased wellbeing (Andersson, Nässén, Larsson, & Holmberg, 2014; Verhofstadt, Van Ootegem, Defloor, & Bleys, 2016).

Behavior change, and the adoption of climate-friendly lifestyles, are strongly featured in the 2018 IPCC Report (de Coninck et al., 2018). The *World Energy Transition* outlook mentions behavioral change in several instances as an addition to technological innovations and policies (IRENA, 2021). The relevance of behavior change in the context of reaching the 1,5°C target is highlighted by Kuhnhenh, Costa, Mahnke, Schneider, and Lange (2021), Newell, Twena, and Daley (2021), Nielsen et al. (2021), and Akenji et al. (2019). The urgency to address behavior change in the sector of mobility is highlighted in Figure 2, illustrating that in Finland the major share of mobility-related emissions come from private cars. Though, Akenji et al. (2019) also provide insights into other sectors (see Figure 3). Nutrition and housing also provide room to reduce emissions. In all of these areas, lifestyle changes would be needed. However, changing people’s lifestyles is not an easy task. Figure 5 illustrates the CO<sub>2</sub> breakdown for Dutch households. Transportation is not the main contributor to CO<sub>2</sub> emissions. Rather it is general consumption, followed by food consumption and heating. The Milieucentraal (2022) also provides six easy steps to reduce one’s CO<sub>2</sub>. Five out of these are about making more sustainable

consumer choices. One step is to reduce consumption, which is the last step presented. That is itself interesting as general consumption makes up the biggest share of household CO<sub>2</sub> emissions.

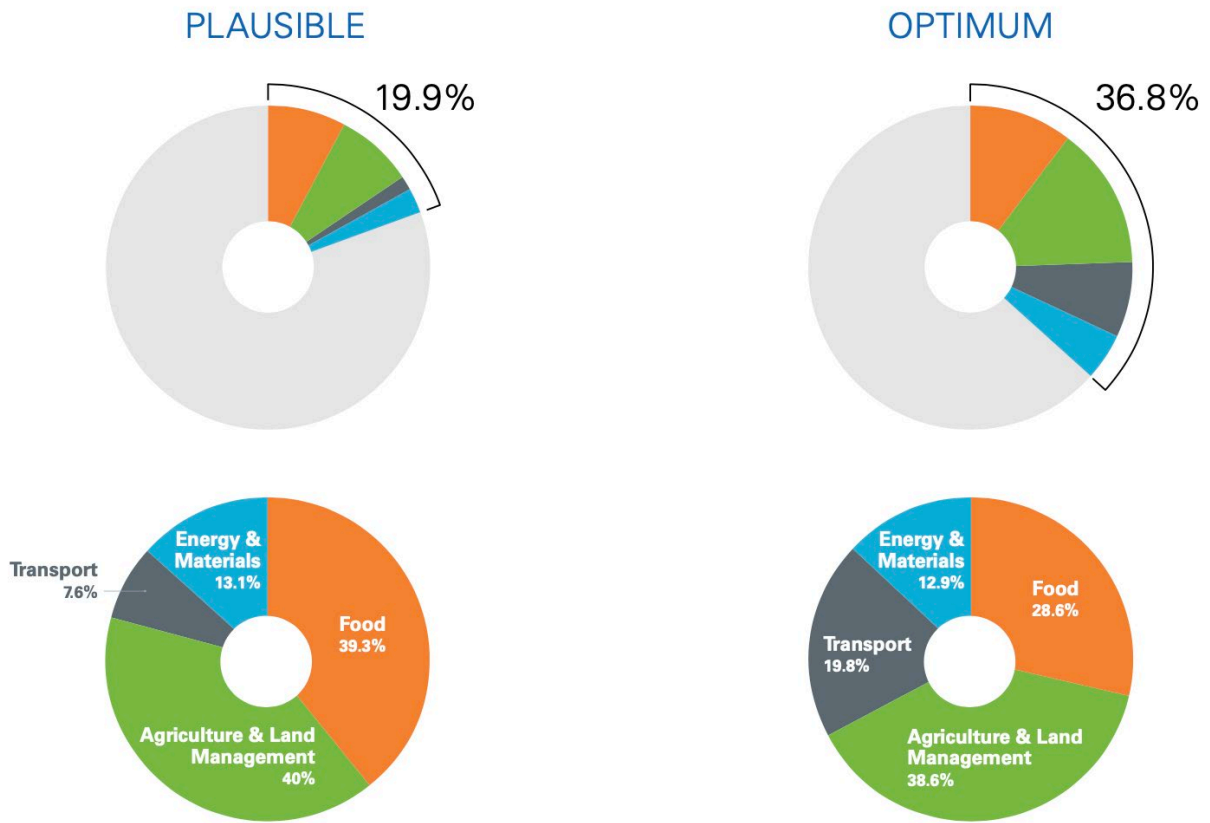


Figure 1: Emission reduction through behavioral interventions. the first row represents the 30 behavioral solutions selected from *Project Drawdown*. the second row illustrates the reduction potential applied to these 30 solutions. From Williamson, Satre-mel et al. (2018)

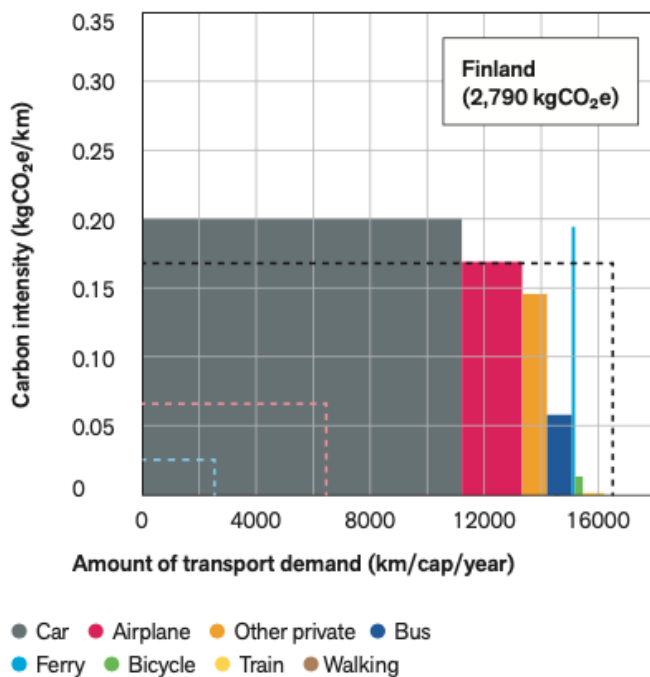
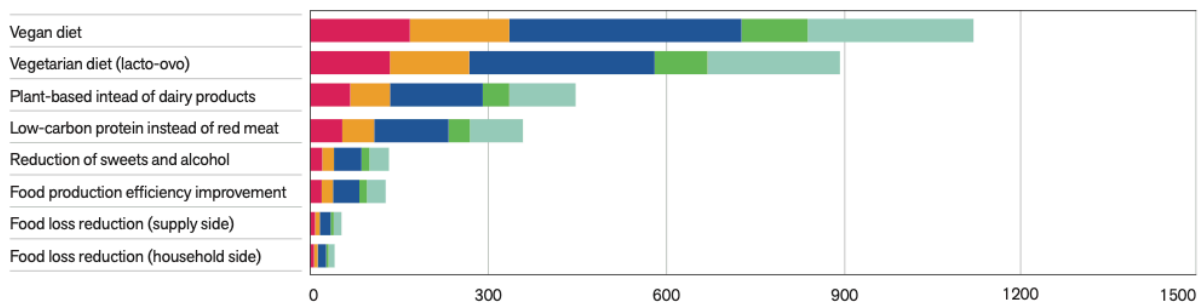


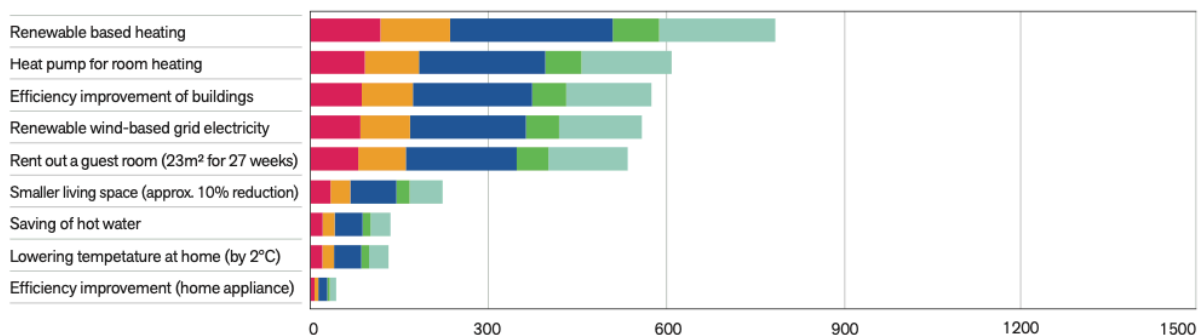
Figure 2: Carbon Footprint of Mobility in Finland, from Akenji, Lettenmeier et al. (2019)

**a) Nutrition, Finland**



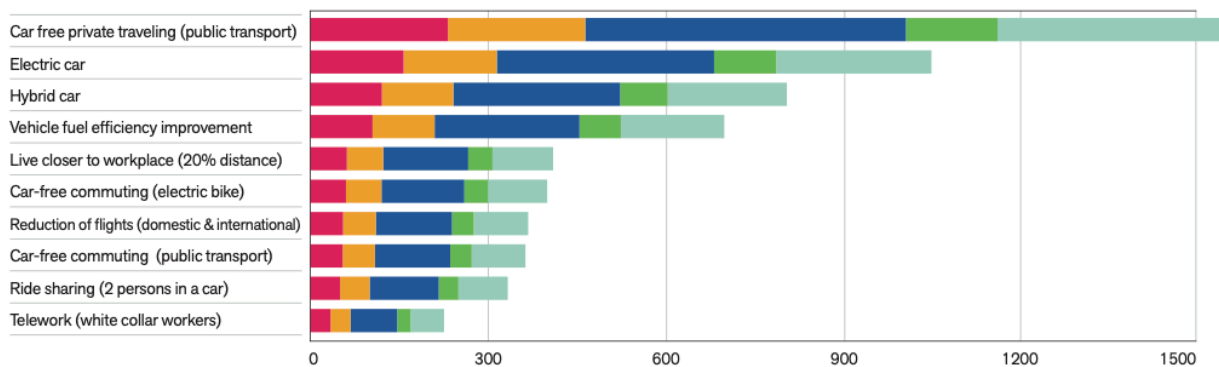
Estimated per-capita carbon footprint reduction impacts (kgCO<sub>2</sub>e/capita/year)

**b) Housing, Finland**



Estimated per-capita carbon footprint reduction impacts (kgCO<sub>2</sub>e/capita/year)

**c) Mobility, Finland**



Estimated per-capita carbon footprint reduction impacts (kgCO<sub>2</sub>e/capita/year)

● 15% adoption rate ● 30% adoption rate ● 65% adoption rate (2S target) ● 75% adoption rate (1.5D target) ● 100% adoption rate

Figure 3: A comparison of the estimated per-capita carbon footprint reduction impacts of low-carbon lifestyle options (Finland), from Akenji, Lettenmeier et al. (2019).

Communicating the necessary steps to reduce CO<sub>2</sub> emissions still seems to be a difficult task. A recent example is provided by the UK, where a report (Londakova, Park, Reynolds, & Wodak, 2021) of the behavior change unit was withdrawn within hours, as the report indicated that individuals would have to relinquish certain consumption. This message is in opposition to UK policymakers. Reason enough to withdraw the report (Laville, 2021). The difficulty to talk about the need to reduce consumption might also be the reason why this is still the least accepted behavior (see Figure 4). In a recent publication by the Netherlands Organization for Applied Scientific Research (TNO) challenges within the energy sector are discussed (Andrés, Scheepers, Brink, & Smokers, 2022). The report outlines that there are various challenges. However, when focusing on behavior, consuming less is the biggest challenge. Another illustration provided by Milieucentraal (2021) (see Figure 5) also highlights the importance of consumer good consumption on the CO<sub>2</sub> footprint of the Dutch consumer. Figure 4 shows that solutions to increase acceptance of reduced consumption are lacking. Thus, despite much research undertaken in this field solutions are lacking. This working paper does not focus per se on sufficiency or specific behavioral interventions. Rather this working paper illustrates that many different theories and approaches exist and that none of them offer a silver bullet.



































	 Technology	 Money	 Accepted behavior	 Labor market
 Electricity				
 Built environment				
 Industry				
 Mobility				
 Aviation Shipping				
 Consumption				

Figure 4: Overview of challenges for various energy sectors, translated version from Andrés, Scheepers et al. (2022). Yellow = there are solutions, but they need to be implemented; orange = more solutions are needed, but many solutions are available though not yet implemented; red = solutions are missing

Several publications highlight the role of psychology and behavioral science to fight climate change (Newell, Daley, & Twena, 2021; Nielsen et al., 2021; Whitmarsh, Poortinga, & Capstick, 2021; Williamson et al., 2018). While psychology and behavioral science have for sure a valuable contribution to make, it needs to be acknowledged that simplistic behavioral models have fallen short of delivering behavioral change (Bobrow, 2018; Nielsen et al., 2021). The reason for this failure might be based on the simplistic understanding of what behavior change entails. Whitmarsh et al. (2021) provide five shortcomings of classic behavioral models 1) their narrow theoretical underpinning, 2) their individualistic nature, 3) their linearity, 4) their neglect of the social components, and 5) their assumption of human's being rational beings. Accordingly, within this working paper, classic

behavioral models are only briefly summarized to provide context. The focus of this working paper is rather on alternative approaches to behavioral change. These alternatives are more circular, systemic, and holistic in nature and address deeper layers to behavior change.

As relevant as individual behavioral change is, it is for sure not the exclusive route to take to reduce CO<sub>2</sub> emissions. For example, literature suggests that governments and businesses need to support individual behavior that is in line with sustainability goals. Thus, for example, the infrastructure to allow sustainable choices needs to be provided and companies need to offer sustainable options (Londakova et al., 2021). Apart from his facilitating role, governments and companies emit CO<sub>2</sub> as well and, hence, need to work on reducing emissions (Starr, 2016; Taylor & Watts, 2019). Reporting, though, indicates that companies fall short of emission reductions (T. Day et al., 2022). On this note, some argue that the individualization of the reduction of CO<sub>2</sub> emissions has been a deliberate move by certain industries (Supran & Oreskes, 2021). Furthermore, the individualization of responsibility to act in line with sustainability goals limits the citizen to the role of the consumer and lets governments and businesses off the hook (Maniates, 2001). This criticism of individualization of responsibility is not further discussed within this working paper. However, what is outlined in this working paper is the reproduction of the system, world views, mental models, and paradigms that have created this system. Finding THE solution to sustainability problems in individual consumption, and behavior, in general, is not only a move to shift responsibility from businesses and governments to consumers. It is also a move that is in line with neoliberal economic thought that focuses on the role of the individual and understands the marketplace to provide solutions to all problems (Heiskanen & Laakso, 2019). The behavioral science theories, models, approaches, and interventions that align with the tradition of neoliberal thought thus, contribute to the reproduction of the notion of individualized responsibility. Hence, it needs to be understood how the framing, the analysis, and the offered solutions to a problem contribute to the persistence of the very problem.

## WAT VEROORZAAKT DE MEESTE CO2-UITSTOOT? CO2-UITSTOOT VAN EEN NEDERLANDS HUISHOUDEN

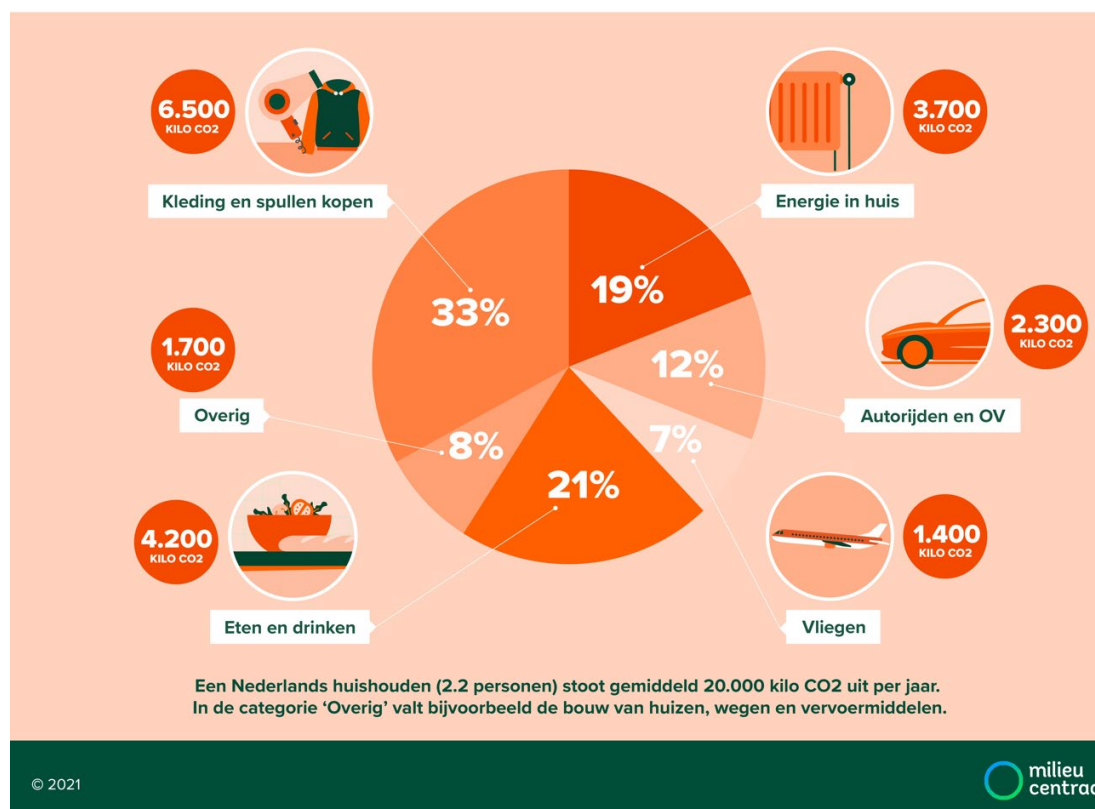


Figure 5: What are the main sources of CO<sub>2</sub> emissions, from Milieucentraal (2021)



## 2 Different theories explaining human behavior

In the following, some models and approaches to understanding human behavior are presented. Many more models than presented in this chapter exist. It is beyond the aim of this document to inventory and compare all existing theories and models of human behavior. Darnton (2008) has provided an overview of over 60 socio-psychological behavior models. Similar to Williamson et al. (2018), who provide a much more condensed introduction to the development of behavioral science, Darnton (2008) starts with simplistic linear theories and models based on rational choice theory. The report provided by Darnton (2008) is in part built on the work of Kollmuss and Agyeman (2002), who end their paper with a new more elaborate model to understand environmentally friendly behavior. An even longer overview of behavioral models is provided by Jackson (2005). His report is a 170 pages long outline of behavioral (change) models taking a sustainable consumer perspective. His report covers similar models as the report provided by Darnton (2008). A shorter overview of relevant behavioral models is provided by Chatterton (2011), whose report is specifically tailored for energy behavior. Chatterton and Wilson (2014) provide a framework that assists in selecting the appropriate models for a specific research question. Such a framework is indeed needed as there is a myriad of models and scientists and analysts are left with the question of which model to best choose (Kasper, 2009).

Before expanding on different theories, a brief insight into the sub-disciplines of environmental psychology and sociology is provided.

### 2.1 Environmental Behavioral Science

Environmental psychology, as well as environmental sociology, have developed as distinct subdisciplines that focus on the reciprocal relationship between individuals as well as societies with their environment (Lockie, 2015a; Uzzell & Moser, 2009). Environmental psychology developed in the 1960s as a reaction to emerging environmental problems (Canter & Craik, 1981; Kollmuss & Agyeman, 2002). Though the roots of environmental psychology go much farther back (Gifford, 2009; Günther, 2009). Environmental psychology is described as an applied and interdisciplinary research field. Although environmental psychology is a rather young research field, it is quite diverse (Gifford, 2009). Despite the diversity in approaches “all acknowledge its unity of purpose to understand the complex relations between people and the built, natural, and living environments around them” (Gifford, 2009). Since the reciprocal relationship between individual and natural environment is core to environmental psychology, approaches that include the context in which behavior takes place have been part of environmental psychology from the beginning (Günther, 2009).

Environmental psychology is yet just one aspect of environmental behavioral science (Günther, 2009). In section 2.4, the need for interdisciplinary research to understand human behavior will be emphasized further. Figure 6 shows that many more scientific disciplines than just psychology and sociology would need to be included to get a comprehensive idea of human behavior. Providing a view on human behavior from all the disciplines as illustrated in Figure 6 is, however, beyond the scope of this working paper. Mostly psychology, sociology, and learning theory are touched upon in this working paper. Systems science is another discipline providing insights on human behavior that is discussed in this working paper, but which is not included in Figure 6. Unfortunately, by focusing on psychology and sociology, this working paper may contribute to the already existing predominance of these two disciplines in understanding environmental behavior (Kasper, 2009). As noted, exploring other disciplines in context to environmental behavior would for sure be a daunting endeavor.

Environmental Sociology developed in the 1970s and thus, a little later than environmental psychology (Lidskog & Waterton, 2016). Within the discipline of sociology, there is environmental sociology as well as the sociology of the environment. The former is about the reciprocal relationship between society and the environment, the latter is about the application of sociological theories to topics such as environmental conflict or environmental politics (Lockie, 2015a). In an attempt to define environmental sociology and to distinguish it from the sociology of the environment, Lockie (2015a)

and Lockie (2015b) emphasize the practical and interdisciplinary character of environmental sociology. Thus, they state environmental sociology is about what sociologists do. This is similar to some definitions of environmental psychology which are also emphasizing the practical approach to environmental psychology (Günther, 2009). Without expanding on this issue, it might be natural that grand theories of a (sub)discipline only develop over time and that while the (sub)discipline is forming research is rather focused on the practical (on the doing). Another reason for the lack of grand theories could be the ongoing struggle to perform interdisciplinary research (Kasper, 2016).

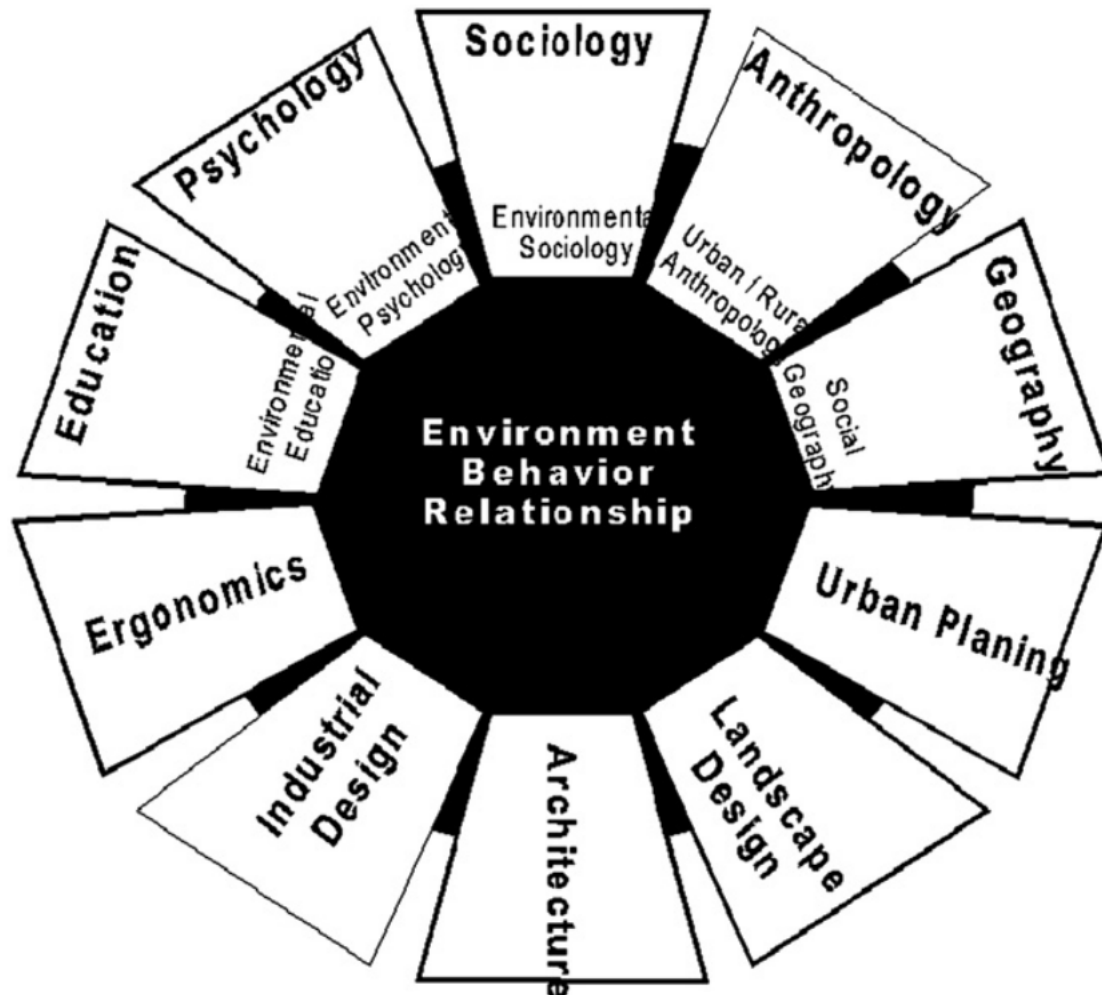


Figure 6: The interdisciplinary character of environmental behavioral science, from Günther (2009).

Environmental psychology and sociology are subdisciplines in the making. While it would for sure be worthwhile to review behavioral science perspectives that are limited to these two subdisciplines, this working paper is not limited to them. Furthermore, since environmental psychology and sociology are subdisciplines in the making that are based on their parent discipline, this working paper rather looks at behavioral science in general and on environmental behavioral science in particular. Nevertheless, an overview of the most important issues within environmental psychology and sociology is provided.

Looking at the keywords used in three of the most important journals in the field of environmental psychology and sociology (Environment and Behavior, Environmental Sociology, and the Journal of Environmental Psychology), provides insights into the main themes. Table 1 contains the 20 most used keywords, extracted from a Web of Science query conducted on 07.03.2022. All Web of Science entries for the three mentioned Journals have been exported to EndNote and subsequently to Excel to analyze keyword occurrence. In sum 4190 references were extracted (2078 Environment and Behavior, 1946 Journal of Environmental Psychology, and 166 Environmental Sociology). The number of extracted

entries per journal reflects the age of the respective journal and to some extent also the maturity of the sub-discipline. The list of keywords has been manually changed slightly as different spellings led to double entries. For example, some entries contained a British and an American English version (behavior vs behaviour), or hyphens were used for some entries and for others not (climate-change vs climate change). Furthermore, where possible either the plural or the singular keyword was chosen. For example, when attitude and attitudes existed the keyword attitude was chosen. A pivot table was created with the resulting adapted keyword list. From this list, the 20 most common keywords per journal were extracted and are provided in Table 1.

It becomes obvious that Environment and Behavior rather focuses on psychology than on sociology since it shares more keywords with the Journal of Environmental Psychology. Both have the keywords behavior, attitudes, values, preferences among the top 20. The more societal orientation of environmental sociology becomes apparent as well through the keywords, justice, power, race, or politics. All three share the keywords environmental science and ecology, environment, health, and perception. The listed keywords are in line with the observation made by others that environmental psychology mainly focuses on human attitudes and pro-environmental behavior (Kasper, 2009; Kollmuss & Agyeman, 2002). The journal Environmental Sociology is the newest of the three compared environmental behavioral science journals. Contributions of sociology to environmental behavioral science are newer and add on to the narrow focus of environmental psychology (Kasper, 2009).

journal	Environment and behavior	count	environmental sociology	count	Journal of environmental psychology	count
1	psychology	1122	environmental sciences & ecology	166	psychology	2027
2	environmental sciences & ecology	1078	environmental justice	37	environmental sciences & ecology	1946
3	Behavior	178	climate-change	32	behavior	265
4	Attitude	163	justice	18	attitude	225
5	physical activity	97	intersectionality	16	perception	196
6	environment	87	science	15	climate-change	170
7	Health	87	power	13	pro-environmental behavior	146
8	pro-environmental behavior	82	risk	13	environment	137
9	Values	79	consumption	12	model	133
10	Model	67	environment	12	identity	128
11	children	66	race	12	health	128
12	participation	66	health	11	values	122
13	perceptions	65	politics	11	preference	110
14	preference	65	sustainability	11	place attachment	109
15	Stress	65	community	10	stress	97
16	community	64	gender	10	performance	96
17	Walking	63	discourse	9	planned behavior	83
18	neighborhood	62	knowledge	9	impact	82

19	built environment	60	perceptions	9	sense	79
20	environments	59	policy	9	determinants	78

Table 1: Most used keywords in the Journals *Environment and Behavior*, *Environmental Sociology*, and *Journal of Environmental Psychology*

## 2.2 Rational choice theory

**Rational Choice Theory** is based on a utilitarian approach, assuming that humans weigh the costs and benefits of the outcome of some action and go for the action that maximizes the benefits (Darnton, 2008; Jackson, 2005). Theories that use rational choice theory are for example **Theory of Reasoned Action**, **Theory of Planned Behavior**, **Behavioral beliefs**, **Consumer Preference Theory**. Such approaches have in common that they understand the individual as an appropriate unit of analysis, they assume individuals to be rational, profit maximizers, and take preferences as given (influenced by external factors). Within social sciences, **Rational Choice Theory** became propagated as THE approach to studying human behavior (Goldfield & Gilbert, 1995). It was understood to be a complete theory that explains all human behavior (Boudon, 1998).

Interventions that fit **Rational Choice Theory** are for example based on education. For these interventions, it is assumed that more information will change someone's behavior (Jackson, 2005). In a similar vein fall interventions based on extrinsic motivation. Thus, a specific behavior should be triggered through some reward or sanction. However, research shows that such interventions may only have short-term effects (Darnton, 2008; Williamson et al., 2018).

### 2.2.1 Criticism of rational choice theory

**Rational Choice Theory** approaches are criticized for the basic assumptions that underpin them. Individuals usually do not have perfect knowledge, they may also not be able to process all the information, neither may individuals strive to maximize profit (Boudon, 1998; Jackson, 2005)<sup>1</sup>. For example, the theory of bounded rationality suggests that individuals rather have a minimum benefit benchmark which they apply to choose an option (satisficing). Another critique is related to shortcuts (see heuristics) that people may apply when making a decision. Shortcuts, also called **heuristics**, may be taken because individuals are cognitively not able to consider all information. The attitude-behavior-gap is probably one of the most known criticisms of **Rational Choice Theory**. This gap expresses that people's actions are not necessarily guided by their attitudes (assuming attitudes are formed by information) (Williamson et al., 2018). Furthermore, it is suggested that individuals do not only act out of self-interest but that the social context, norms, and ethics are a factor as well (Darnton, 2008; Williamson et al., 2018; Worldbank, 2015). Though, it may not be a sign of irrationality that one's actions are based on e.g. social norms. Quackenbush (2004) in defending **Rational Choice Theory** states that rationality is not only based on instrumentalism. This stance connects to the distinction between *homo economicus* and *homo sociologicus*, which will be addressed later (section 2.4).

The 2015 World Development Report about mind, society, and behavior by the Worldbank (2015) criticizes **Rational Choice Theory**, stating that

*“[t]his approach can be powerful and useful, but in a number of contexts, it also has a liability: it ignores the psychological and social influences on behavior. Individuals are not calculating automatons. Rather, people are malleable and emotional actors whose decision making is influenced by contextual cues, local social networks and social norms, and shared mental models“* (Worldbank, 2015).

It is further argued that the limitations of the human mind, the biases that influence an individual's behavior as well as the impact of the social context on an individual's behavior have long been

<sup>1</sup> Jackson (2005) provides a longer discussion of criticism of rational choice theory.

acknowledged by private sector actors and that this acknowledgment should also be embraced by the public sector.

### 2.3 Behavioral economics theories

From **Rational Choice Theory**, **Behavioral Economics** developed, responding to some shortcomings of Rational Choice Theory. That is Behavioral Economics embraces the *rational irrationality* of human behavior. The aforementioned **heuristics** or shortcuts are included as factors influencing human behavior. Through the identification of heuristics, human behavior was once more understood to be predictable (Hampton & Adams, 2018; Williamson, Bujold, & Thulin, 2020). **Behavioral Economics** is the amalgamation between psychology and economics, aiming at including *irrational* behavior and thus, considering the shortcomings of **Rational Choice Theories**. The development of this discipline can be traced back to Herbert Simon (~1955) who coined the idea of **Bounded Rationality** (Collet, 2009; Darnton, 2008). The Worldbank (2015) does ascribe the foundation of **Behavioral Economics** to the work of Kahneman and Tversky who developed prospect theory, a further development of the Theory of Bounded Rationality. In any case, the recognition that humans do not only think rationally but also socially and automatically led to the development of **Behavioral Economics**, which combines economics, psychology, as well as other social and cultural science to understand human decision-making (Worldbank, 2015). Though, even if **Behavioral Economics** is more comprehensive it is still criticized for its oversimplification of reality. Collet (2009) for example provides an interesting critique of Simon's **Theory of Bounded Rationality** confronting it with Bourdieu's concept of **habitus**. He discusses that although Simon may have attempted to transcend certain assumptions his theory remained loyal to (linear) economic thought. Kasper (2009) similarly states:

*“The practice of distinguishing and trying to isolate ever more discrete parts of self, as well as other factors, affecting behavior is standard in environmental behavior literature. In fact, much of the work in this area is driven by the desire to show that a given part of the self is not only distinct but also has an independent and more significant effect than some other, previously posited, component. Models portray things, such as knowledge, attitudes, beliefs, values, and the like as distinct and measurable components of self. The use of linear regression analyses – which assume the independence of “independent variables” among other things – underscores the belief in the separateness of these parts. Building on what have become classic behavioral theories (examples include Schwartz’s Norm-Activation Model and Ajzen and Fishbein’s Theory of Planned Behavior), models competing to best explain and predict certain environmental behaviors have proliferated.”*

#### 2.3.1 Prospect theory

**Prospect Theory** was developed by Kahneman & Tversky this theory suggests that a decision is influenced by how an action is framed (see for example Kahneman, 2003). For example, the same action can be framed as a loss or as a gain. Due to loss aversion, the negative framing of action may influence whether a respective action is taken up or not. Research in this field investigates heuristics, biases, and psychological factors that influence decision-making (Jackson, 2005). This theory addressed the critique of shortcuts, by embracing them as part of decision making. Based on these insights approaches focus on the *irrationality* of decision making. Such approaches are **nudge** and **boost**. “While nudges attempt to make the target behavior easier by influencing a person’s environment, boosts also engage directly with human agency and cooperation by building competence, skills, and knowledge in the decision-making process” (Williamson et al., 2018). Thaler’s work on Nudging showed that individuals act irrationally but that irrational actions are still predictable (Williamson et al., 2018). Framing does also build on the idea of salience, which means that some attitudes are present but only expressed in certain circumstances. Through framing salient attitudes become triggered and thus, become part of the decision-making process (Jackson, 2005).

### 2.3.2 Heuristics and bias school

The World Development Report 2015 by the Worldbank (2015) concluded after reviewing literature about human behavior that humans do not only think rationally but also think automatically, socially, and in *mental models*. The recognition of these insights led to the development of Behavioral Economics: “Kahneman and Tversky developed a new understanding of human action that helped lay the foundation for the field of behavioral economics – a subfield of economics that draws on the psychological, social, and cultural foundations of human decision making” (Worldbank, 2015).

Kahneman & Tversky were initially intrigued by the observation that people’s deliberate reactions differ from their spontaneous reactions. Which lead to the development of the notion of **judgment heuristics**. Kahneman & Tversky developed the idea of system one and system two thinking. This is the idea of two cognitive processes being in place when decisions are being made. Heuristics, or shortcuts, are part of the fast-thinking track, which is the rather *irrational* thinking path. **Affect heuristics**, are an example of heuristics where our actions are based on emotions. **Habits** could as well be understood as a heuristic (Darnton, 2008). The two-system thinking is reflected in other theories as well. Darnton (2008) refers to the work of Bamberg and Schmidt, who state that intent in the **Theory of Interpersonal Behavior** “is generated via two paths: cold cognition (the expectancy value construct) and hot evaluation (the affect factor, or emotional response).” There are also models that account for **attitudinal heuristics** (e.g. the MODE model by Fazio (see: Richardson, Tortoriello, & Hart, 2020).

Behavioral interventions using heuristics and biases are usually based on choice architecture (see section 5.5). However, these interventions have been criticized for being manipulative and for not being able to trigger the necessary changes needed to tackle sustainability problems (see section 5.5).

### 2.3.3 Expectancy Value Theory

**Expectancy Value Theory** does address one shortcoming of classic rational choice theory in the sense that it takes into consideration the source of attitudes. That means that it attempts to understand people’s preferences, thus the underlying causes of preferences. Further **Expectancy Value Theory** does not assume the commensurability of values, which would assume that values can be assigned a financial value. Some **Expectancy Value Theory** also consider social influences, habits, or moral concerns (Jackson, 2005).

Examples of **Expectancy Value Theory** are the **Theory of Reasoned Action** developed by Fishbein and Ajzen, Rogers’ **Protection Motivation Theory**, or Ajzen’s **Theory of Planned Behavior**, which is an extension of the Theory of Reasoned Action (Darnton, 2008). Kollmuss and Agyeman (2002) indicate that the popularity of the Theory of Planned Behavior rests on the mathematical formulation that Fishbein and Ajzen provided to support empirical studies. The **Theory of Planned Behavior** adds social norms and the notion of behavior efficacy to the analysis of observable behavior. Nevertheless, it is a linear model based on the assumption of humans acting rationally (Kollmuss & Agyeman, 2002). Darnton (2008) indicates that the more factors are added to how attitudes are formed the lower the actual contribution of attitudes in causing some observable behavior. However, these more complex models seem to be better at predicting behavior. Still, Darnton (2008) highlights:

*“However psychological understandings of behavior have continued to evolve, to the point where attitudinal factors are often found to be relatively minor contributors to behavioral outcomes. For instance, in a meta-analysis of pro-environmental behaviors, Fliegenschnee and Shelakovsky (1998, in Kollmuss and Agyeman 2002) found that at least 80% of the factors influencing behavior did not stem from knowledge or awareness.”*

Darnton (2008) lists several extensions to the **Expectancy Value Theory** to include: 1) values, beliefs, and attitudes, 2) norms and identity, 3) agency, efficacy, and control. Since these are extensions of the **Expectancy Value Theory**, these models are still linear, though multi-linear and thus more complex. Interventions that fit to this category of behavior models target intrinsic motivations (Williamson et al., 2018). Values, beliefs, attitudes, and emotions are understood to influence our motivations (see section 5.1). A behavioral model that captures this is Stern’s **Values, Beliefs, Norms**

**Theory** (Figure 7) (Darnton, 2008; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Other interventions that fit in this category are information processing-based ones. These interventions provide information about the effectiveness and meaningfulness of an action (Williamson et al., 2018). This relates to the concepts of locus control, agency (see section 5.4.18), and self-efficacy (Ajzen, 2002).

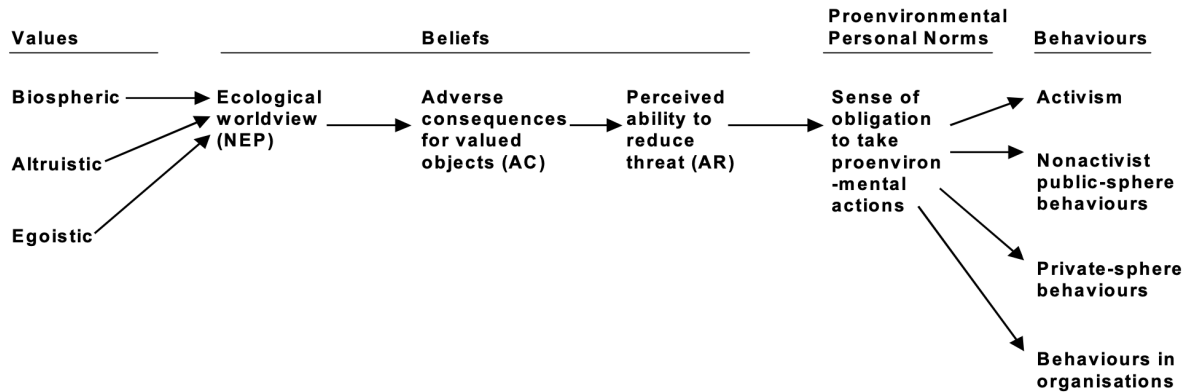


Figure 7: Stern’s Values, Beliefs, Norms Theory, from Darnton (2008)

To outline the development of the models discussed by Darnton (2008) the simplest and one of the more complex models are provided below (Figure 8 and Figure 9) (see also: Kollmuss & Agyeman, 2002). The linearity of the **Expectancy Value Theory** and theories that are built on it assumes behavior to be rather mechanistic. Even if more complexity is added through the introduction of e.g., norms and attitudes, the reason for specific behavior to appear is understood rather straightforward (in literally one or multiple straight lines). Environmental psychology, looking at attitudes and pro-environmental behavior, also exhibits this mechanistic view on behavior (Kasper, 2009). Kasper (2009) points out that illustrating and modeling human behavior as the outcome variable influenced by independent, discrete variables does not provide room for understanding the rather reciprocal character between human behavior and all kinds of relevant variables. “Such models fail to accurately reflect the nature of human social life, which occurs not as a series of changes brought about in static states by the reactions of dependent variables to independent variables but as an *ongoing process always embedded in inter-dependent relations*” (Kasper, 2009). Further, Kollmuss and Agyeman (2002) state that despite the great number of models that have been developed to understand the gap between knowledge, awareness, attitude, and environmental behavior, there is no consensus about the connection. Furthermore, they refer to research indicating that many more factors, apart from attitudes, affect human behavior.



Figure 8: Simple Model of Pro-Environmental Behavior from Kollmuss and Agyeman (2002), sometimes called the Information Deficit Model

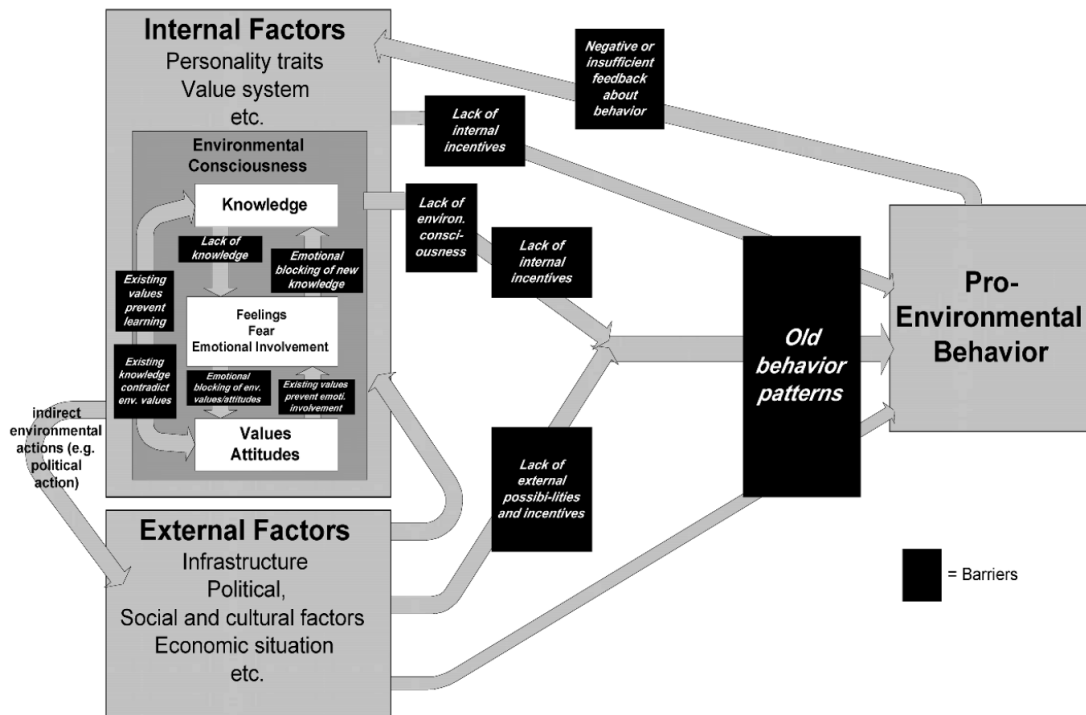


Figure 9: Model of Environmental Behavior by Kollmuss and Agyeman (2002), reproduced by Darnton (2008)

According to Darnton (2008), the **Model of Environmental Behavior** by Kollmuss and Agyeman (2002) is still a rather linear model, although it provides feedback loops, and although it is fairly complex. After all, it is an extension of the **Theory of Planned Behavior**. The **Model of Environmental Behavior** has one<sup>2</sup> clear feedback between behavior and internal factors. This indicates the possibility of a reflection process. The external factors affect the internal factors. It is, however, striking that behavior does not affect external factors. Hence, this model only envisions a feedback between behavior and the internal world, but not with the external world. This is in contrast to, for example, **practice theory** (see section 3.7), where behavior shapes the structures in which behavior takes place and vice versa.

The **Model of Environmental Behavior**, as well as other models discussed by Darnton (2008), include the societal realm to different degrees. The social realm and external factors are discussed below. However, another shortcoming of Behavioral Economics models needs to be mentioned. Apart from these models being linear to some extent, they all treat the individual and the social as two separate spheres. This applies as well to the rather complex and partially circular **Model of Environmental Behavior**. This is different from some concepts offered by sociological approaches, such as **habitus** (Kasper, 2009).

#### 2.4 Theories considering the social context

Even if an individual's behavior is approached from a psychological perspective, the context in which behavior takes place cannot be ignored. Günther (2009) reflecting on environmental psychology, states that understanding the relationship between individuals and their environment calls to understanding the reciprocal relationship between the individual and the various social contexts. That is as any behavior is not only influenced by the individual but also by the context.

The World Development Report 2015 by the Worldbank (2015) expands on how human behavior is affected by humans being social animals. There are different facets to how society impacts human

<sup>2</sup> There is a second feedback between internal and external factors. Kollmuss and Agyman (2002) state that their model is self-explanatory and do not explain what the arrow from internal to external factors means.



behavior. However, what is key is that behavior cannot be seen separate from our social context (Kasper, 2009). Some theories even suggest that all individual values, attitudes, etc. are socially constructed. Accordingly, behavioral change needs to be tackled on societal level (Jackson, 2005). Factors that matter are, for example, getting social recognition and status (rewards), altruism, identity, and group dynamics, intrinsic reciprocity, and the attainment of collective goods. Kollmuss and Agyeman (2002) refer to the **Model of Ecological Behavior** by Fietkau & Kessel (1981), illustrating that many factors affect human behavior. Among those factors are incentives, knowledge, values, the possibility to act in a certain way, and the perceived efficacy or consequences of a specific behavior (self-efficacy / agency). Newell, Daley, et al. (2021) refer to a heuristic that connects to the social sphere. They call this heuristic behavioral contagion which is based on imitation: A heuristic that they attribute to shallow scaling.

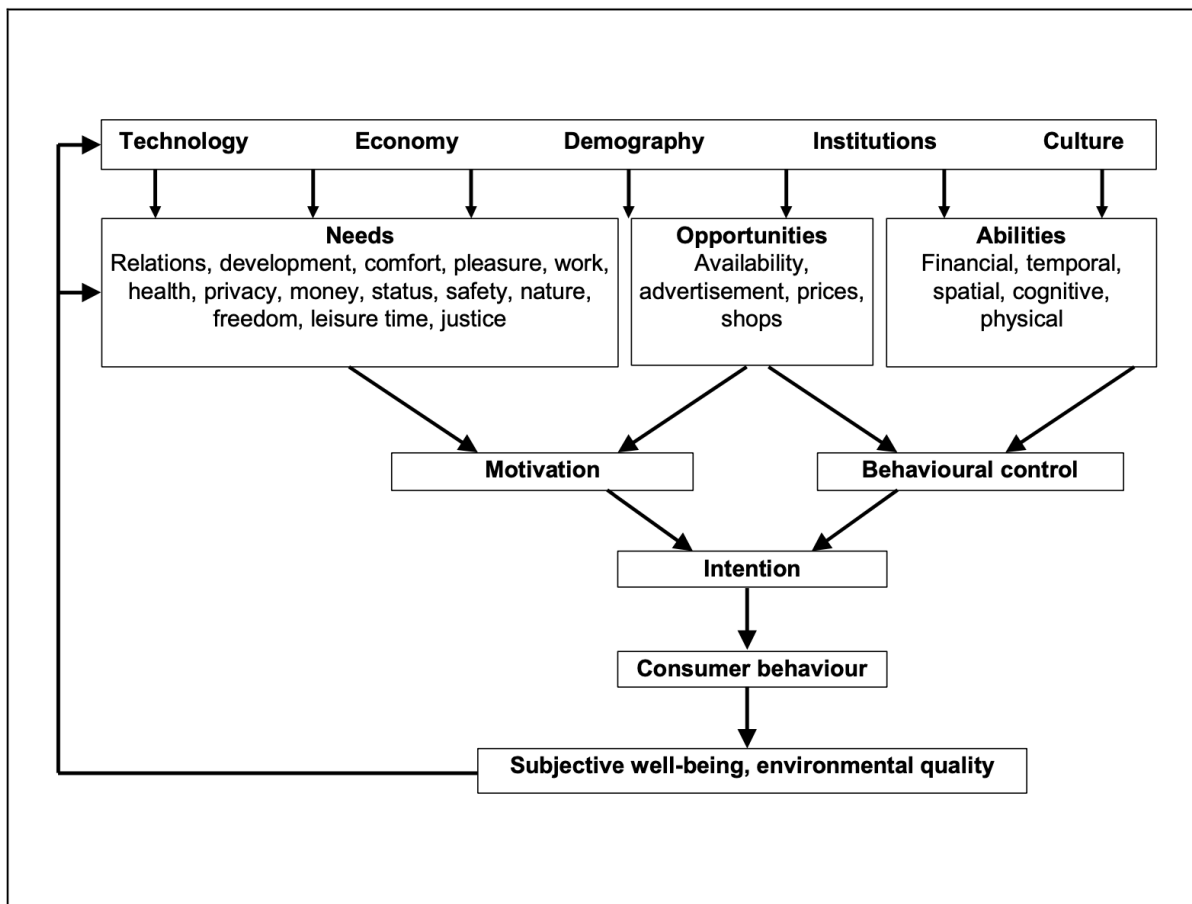


Figure 10: Needs Opportunities Abilities (NOA) Original by Vlek et al (1997), from Darnton (2008)

Darnton (2008) provides in his report several theories that relate to the social context. For example, human behavior might be influenced by social norms. Theories that might be relevant here are **Focus Theory of Normative Conduct** by Cialdini (Bergquist et al., 2021; Kallgren, Reno, & Cialdini, 2000), **Theory of Normative Social Behaviour** by Rimal and others (Borg, Curtis, & Lindsay, 2020; Rimal, 2008; Rimal & Real, 2005), **Social Identity Theory** by Turner and Tajfel (Brown, 2000; Hornsey, 2008), **Self-Categorization Theory** by Terry and others (Hornsey, 2008; Reynolds), **Norm Activation Model** by Schwartz (De Groot & Steg, 2009; Onwezen, Antonides, & Bartels, 2013; Park & Ha, 2014), or the **Theory of Planned Behavior** by Ajzen (Chao, 2012; de Leeuw, Valois, Ajzen, & Schmidt, 2015; Yuriev, Dahmen, Paillé, Boiral, & Guillaumie, 2020). In these models, social norms, for example, are understood as a reference point for human behavior. The reference to what is understood to be the norm is part of the cognitive processes that lead up to the execution of a specific behavior (Williamson et al., 2018). However, Darnton (2008) argues, that in **most theories the societal impact is rather**

**implicit.** He refers to the **Needs Opportunities and Abilities (NOA)** model by Vlek and others (Vlek, 2000) as an exception to most other models he reviewed. Figure 10 illustrates the NOA model, which contains a feedback loop between individual behavior and macro scale components. Thus, the model indicates that individual behavior can affect the macro scale. This feedback provides a clear distinction to the **Model of Environmental Behavior** by Kollmuss and Agyeman (2002). As outlined before, the Model of Environmental Behavior does not include a feedback from behavior to external factors.

Another example provided by Darnton (2008) is the **Main Determinants of Health Model** (Figure 11). It indicates feedback loops between each tier of the wheel and the model developers argued that an intervention does not only need to address the individual but each tier of the wheel.

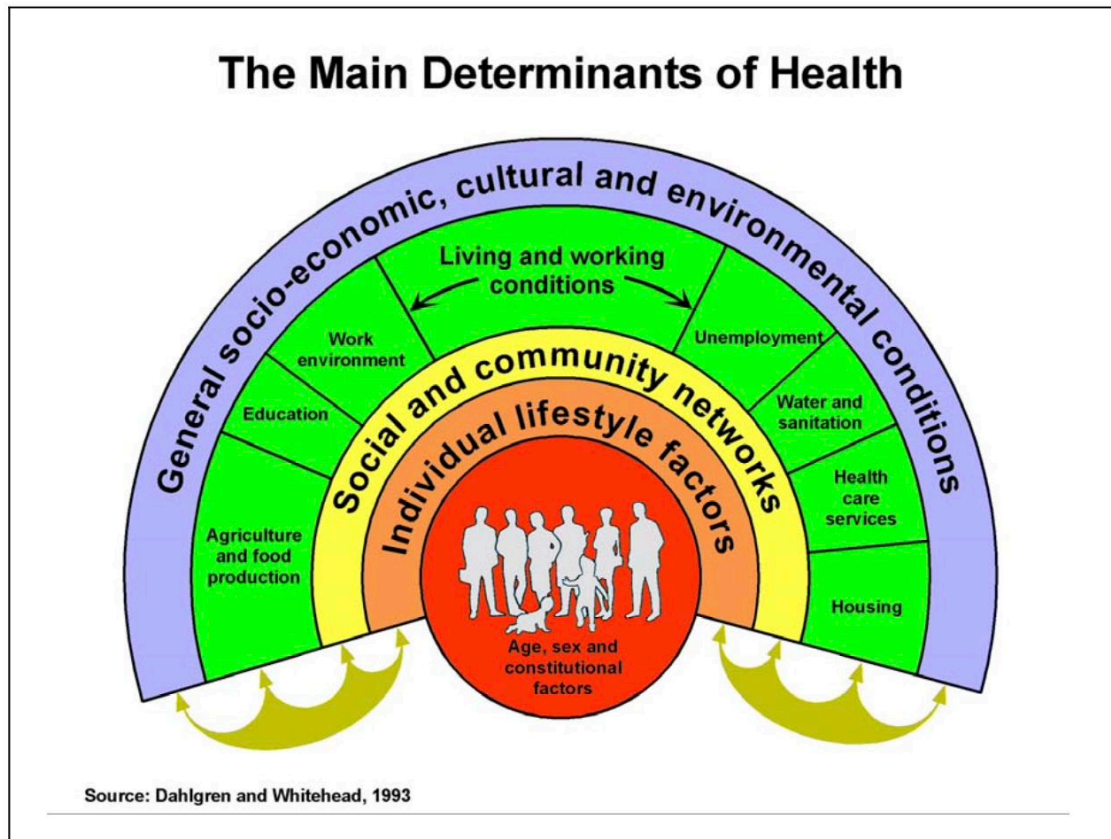


Figure 11: Main Determinants of Health Model from Dahlgren and Whitehead (1991), from Darnton (2008)

In section 2.1. it has been indicated that part of environmental behavioral science is environmental sociology. The analysis of the most used keywords in the journal Environmental Sociology shows that sociology adds contextual aspects to the analysis of behavior (see section 2.1, Table 1). The sociological approach to environmental behavioral science adds, amongst others, structural and institutional aspects. Above it has been indicated that **Behavioral Economics** is criticized for its linearity. Though, the criticism can be extended to **Behavioral Economics** farming the individual and the social as two distinct factors (Kasper, 2009). Kasper (2009) argues that a sociological understanding of an individual does not allow to distinguish between the individual and the social, as the individual is always also social. She indicates that the need to differentiate between them stems from treating them as two separate measurable independent variables. This, in turn, is based on the attempt to predict behavior and thus provide some magic formula that will make people act in a specific way.

By adding the context, sociology also adds insights into an internal aspect; people’s worldviews. Lidskog and Waterton (2016), introducing a special issue about conceptual innovation in environmental sociology, highlight an extensively featured issue in this working paper; the recreation

of *reality* through people’s often unquestioned worldviews. They highlight how frames and concepts help understand the world and shape analysis. Though, the lack of awareness about frames and concepts being constructs leads to the unreflected reproduction of these frames and concepts (Collet, 2009). The discipline of sociology, though, provides concepts, such as Bourdieu’s habitus (Kasper, 2009), to understand the effect a lack of awareness of one’s worldview can have.

Edgerton and Roberts (2014) summarize that “*habitus*, as conceived by Pierre Bourdieu, is a culturally and structurally conditioned set of dispositions that shapes how one orients to the social world, including one’s perception of one’s life chances and corresponding styles of thought and behavior.” Collet (2009) provides a concise introduction to the notion of habitus compared to the concept of **Bounded Rationality**. One aspect of habitus is that it describes what most people take for granted. While individuals need to become aware of their worldview for change to happen, there is an important practical aspect of not questioning underlying assumptions. Collet (2009) also points out that some things need to remain unquestioned as humans would otherwise get stuck in constant reflections on and re-examinations of their actions.

Kasper (2016) calls habitus humans’ second nature, whereas the first nature refers to humans’ biology. **Habitus**, in contrast, is the social nature that allows humans to navigate through the world. Though habitus is not limited to a single person but is an understanding that is shared with others as well (Kasper, 2016). This is since there are certain unquestioned rules that people in the same context follow (Collet, 2009). This is why Kasper (2009) argues that using **ecological habitus** as an analytical lens allows for connecting different scales; the individual and the social. The *habitus per se* is not observable, though, it can be expressed and thus described and categorized. Here a link with practice theory can be found, as people’s practices are understood to be one expression of their **habitus** (Kasper, 2016). Or rather, practices are the result of the interaction between a person’s **habitus** and the person’s ability to engage with the (specific) capital relevant to take a specific action (Edgerton & Roberts, 2014). The **habitus** cannot be studied by only looking at the individual; the context (the *field* as Bourdieu calls it) is equally important. This is as it is acknowledged that a **habitus** forms through the limiting and supporting features of the environment in which the individual lives (Kasper, 2016).

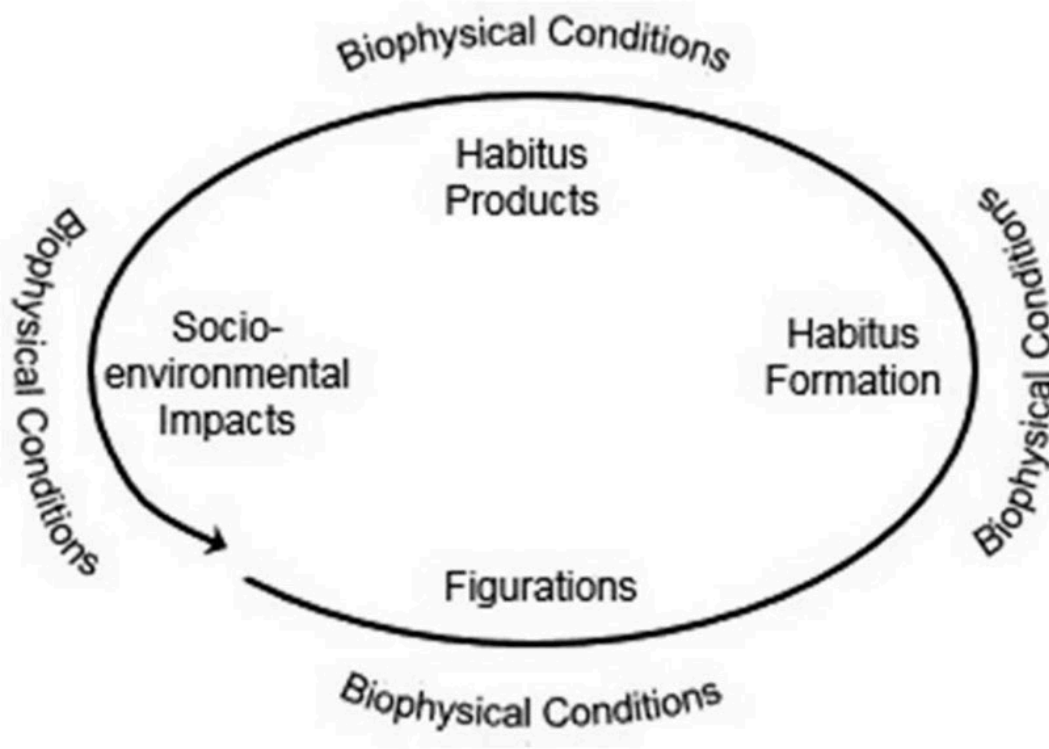


Figure 12: Basic pattern of socio-environmental processes, by Kasper (2016).

Kasper (2016) provides a closed model of the formation of **habitus** (see Figure 12). It is a zoomed-out perspective that maps the landscape of **habitus** formation. She explains that the starting point are the bio-physical conditions which can be influenced<sup>3</sup>, and which influence human beings. What Kasper (2016) calls “figurations” seem to partly be societal and social structures. **Habitus** formation involves the contextual factors provided by the bio-physical reality as well as the figurations a person is part of. **Habitus** products are the observable output of one’s habitus. This is where the circle closes as the output is how humans impact the bio-physical realities as well as the figurations.

Above the **Theory of Bounded Rationality** has been mentioned. It has been a foundational theory for other linear theories, among which the **Theory of Planned Behavior** is the most prominent one. Collet (2009) provides an insightful confrontation between the **Theory of Planned Behavior** and Bourdieu’s habitus. He, too, highlights the linearity and simplicity of the **Theory of Bounded Rationality**. Although the **Theory of Bounded Rationality** considers the social context, Simon (the founding father of the theory) only had a limited understanding of the impact of the social context on human behavior. Collet (2009) states that Bourdieu’s **habitus** is more complex as the concept indicates that the context forms the habitus, and that the habitus is (unconsciously) adapted to changing contexts. Further, Simon understands intuition (habit, automatic action) as either switched on or off. Bourdieu’s habitus permits more grey spaces in between. That is in part because habit and habitus are not the same. **Habitus** is not simply patterned behavior that is executed when triggered. **Habitus** is constantly objected to change. It potentially changes through the exposure to changing environments, or by making new experiences. Thus, it cannot be assumed that past behavior is a strict predictor for future behavior. That does though not mean that a change of habitus is based on a conscious reflection process. When the environment changes an actor may reflect on the change and the needed adaptation, but at the same time, the actor may not reflect on the existing habitus and whether this habitus may need to change altogether. That is mostly as an actor may not even be aware of the existence of one’s habitus (see section 3.3). Since one’s habitus has been formed as a result of one’s upbringing and past experiences, one’s habitus seems not to require questioning. It has been the result of a *logic* progression (Collet, 2009).

The awareness about one’s own habitus is not only relevant for substantial change to happen it is also relevant to understanding the reproduction of the current system (Morrison, 2005). The lacking awareness of one’s own habitus or worldview is not only a problem for people in general but for scientists in particular. Collet (2009) points out that although scientists are well aware of the fact that a model is not an exact representation of reality, models are often nevertheless treated as such. Furthermore, models are usually built on certain unquestioned or unquestionable assumptions. This may lead to the reproduction of these assumptions. For example, as outlined in this working paper, behavioral science has historically focused on the individual (Williamson et al., 2018). This historical focus on the individual is connected to the Newtonian worldview applied in economic thought and the prominent role economic thought has within society (Heiskanen & Laakso, 2019; Kasper, 2009). Anyhow, Collet (2009) uses Simon’s quest to provide an alternative to Armchair Economics (people being triggered by incentives) as an example of an explanation fitting one’s (the researcher’s) own habitus. Collet (2009) criticizes that Simon did not undertake an investigation into the bias of his own scientific field. Thus, he may have reproduced his habitus by providing explanations that support and are in line with his own habitus.

While not completely disregarding the partial usefulness of **Behavioral Economics** approaches, Kasper (2009) attempts to provide an alternative approach to analyze and understand human behavior. He refers to approaches that do not look at single factors, but rather at compounds or overarching structures that inform human behavior. Such overarching structures are worldviews or paradigms. Furthermore, he highlights the possibility to understand human behavior through a relational lens. Thus, human behavior needs to be understood within a relational web of factors rather than as a result

---

<sup>3</sup> Only to a certain degree. Some biophysical conditions cannot be changed, such as the laws of physics.

of discrete, independent variables. It is this reciprocity among factors that bring sociological approaches closer to closed models that for example employ systems thinking (see section 2.5 and 3.4). Bourdieu's **habitus**, as well as Gidden's **Structuration Theory**, transcend dualistic views (Morrison, 2005). They do so by highlighting that behavior is structured and structuring, that **habitus** is influenced by and influencing the *external* world. The habitus is neither solely the result of an individual's choice, nor solely the result of *external* forces. Habitus also connects to **Practice Theory** which will be discussed in section 3.7. One's habitus is manifested in one's lifestyle (Kasper, 2009), which is the complex of practices an individual follows (Spaargaren, 2003). In a sense, practices are similar to behavior. They are both the observable expression of what *triggers* behavior (e.g., motivation or worldview). Though, in contrast to behavior, practice theory acknowledges that a practice is supported or inhibited by structure, that a practice is shaped by, and that it does shape structures.

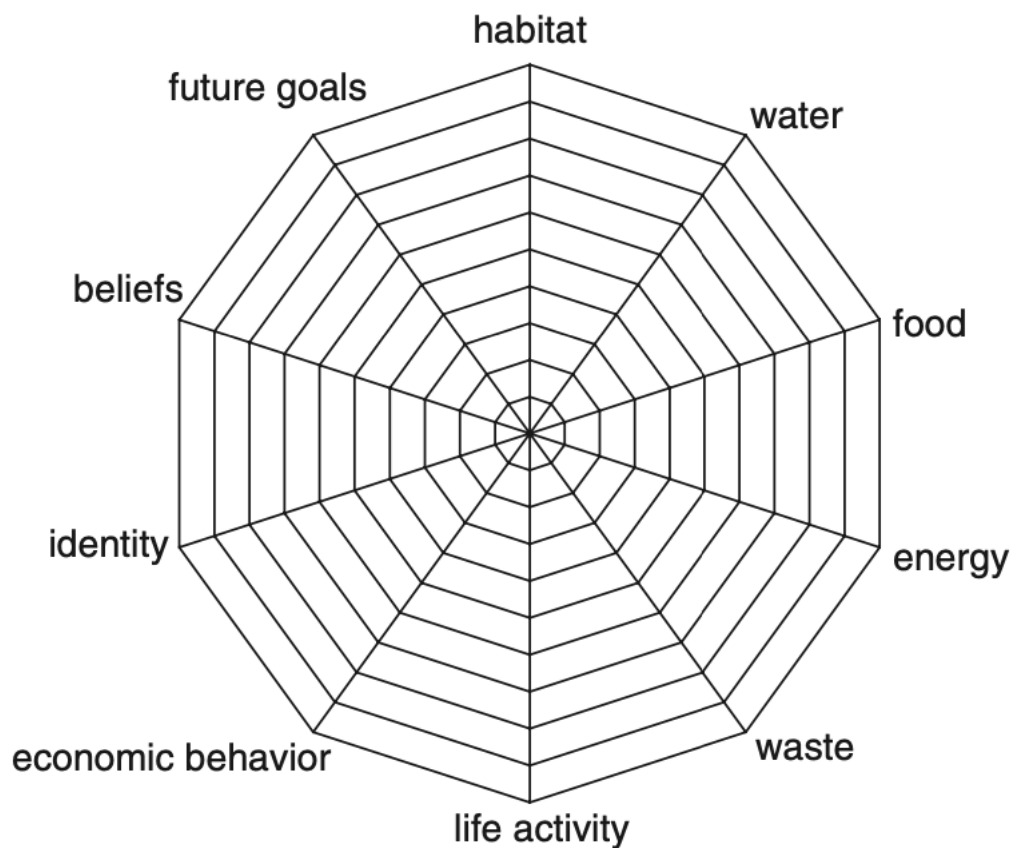


Figure 13: Tentative model of life dimensions reflecting ecological habitus, by Kasper (2009)

In her attempt to provide an alternative view on human behavior Kasper (2009) suggests the usage of a radar chart (see Figure 13). While the model would still single out different variables, they together would describe a certain lifestyle. Thus, similarly to other models, to measure something intangible, such as attitude, through an observable variable (e.g., a specific behavior), she suggests investigating someone's habitus via someone's observable lifestyle. However, in contrast to other models, the variables or dimensions are not independent but intertwined. This model could be used to capture individuals' as well as groups' habitus. The identification of variability of some dimension with otherwise overlapping habiti could provide insights in differing context variables. This would allow connecting specific contexts with specific habitus characteristics.

## 2.5 Closed models

The **Needs Opportunities and Abilities** (NOA) model by Vlek was one example of a closed model introduced above. Previously, it has been mentioned that historically most models have been linear,

rather than circular. **Circular models include some sort of feedback between the action and 1) the person who exerted the action and 2) the environment in which the action took place.** The former refers to models that include **self-reflection** on the exerted behavior. The **Model of Environmental Behavior** by Kollmuss and Agyeman (2002) does include such a feedback. The **Needs Opportunities and Abilities (NOA)** model by Vlek is in contrast not as pronounced in depicting a reflection process. However, the NOA model does depict a feedback mechanism from the result of the action to the Needs, Opportunities, and Abilities. These then feed into motivation and intention. Though the cognitive process of how e.g., motivations are amended or changed due to a reflection on past experiences is not depicted in the NOA model.

Pertaining self-regulation as a form of reflection, Darnton (2008) refers to two theories **Control Theory** by Carver and Scheier (Mansell & Marken, 2015) and **Social Cognitive Theory of Self Regulation** by Bandura (Bandura, 1991). Bandura's theory is more elaborate in terms of explaining the cognitive processes of observing and evaluating past behavior. **Control Theory** is describing the whole process of behavior adaptations based on a negative feedback loop (homeostasis) (Parker & Tavassoli, 2000; Piko & Brassai, 2016). A specific behavior is set, and the manifestation of the behavior is compared to the wished manifestation. If there is a discrepancy between wished outcome and observed outcome the behavior is adapted (Lissack, 2021) (see Figure 14). These self-regulation models are addressing how behavior is mentally processed by the person who executed a specific behavior. However, they do not shed light on how behavior affects the environment in which the behavior takes place. Cybernetics does add to these closed models, as adaptations are based on the change occurring in the environment (see Figure 15) (Lissack, 2021; Mobus & Kalton, 2015).

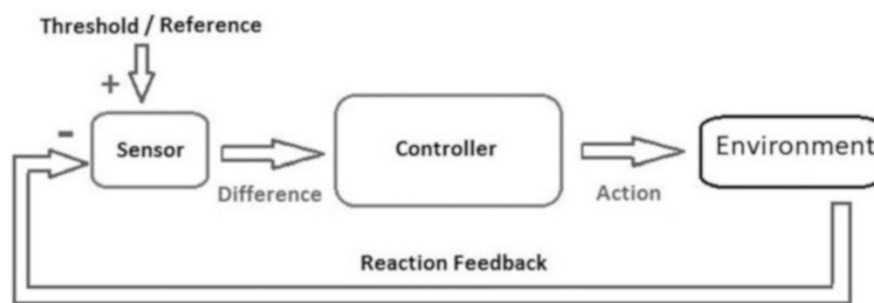


Figure 14: Simple feedback from Lissack (2021)

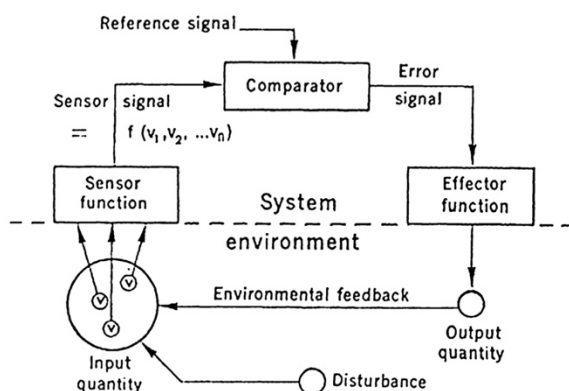


Figure 15: Environment Determining the control of Action, from Lissack (2021)

In Figure 14 and Figure 15 the controller or comparator decides on how an action is adapted. If these cybernetic models are applied to human decision making the controller is the actor. The actor changes a behavior based on the goal the actor has in mind. Cybernetics and systems thinking do not only add

the notion of feedbacks, but they also emphasize the complexity of real-world situations. Above heuristics were already mentioned. Systems thinking uses a related concept, the **mental model**. Due to the complexity of real-world situations, humans are not able to include all factors in decisions making. Hence humans simplify reality. This simplified representation of reality is called a **mental model** (Lissack, 2021; Mobus & Kalton, 2015).

The concept of the mental model aids to understand our own biases. It has already been pointed out that human behavior is not merely steered by rational considerations. Rather decision-making and thus behavior is influenced by several factors among which is one's mental model (Worldbank, 2015). In connection to mental models, the Worldbank (2015) refers to Bourdieu and the notion of **habitus**. They connect those two concepts as similar to the concepts of **habitus**, they state that **mental models** are usually taken for granted and assumed to be the norm. These mental models are not questioned and provide a guiding principle for what is right, normal, and natural. Through perpetually acting in accordance with our mental models these mental models become institutionalized in the social realm. Then the structures created in the social realm further stabilize our mental models. Thus, for example, social division, class culture, gender differences become part of our mental models and are also institutionalized (e.g., pay gap). This connection between the mental realm, the behavior, and structures, is reflected in practice theory, which is discussed below (see section 3.7). It is vital to understand how the reproduction of mental models and institutions via perpetual behavior becomes locked in.

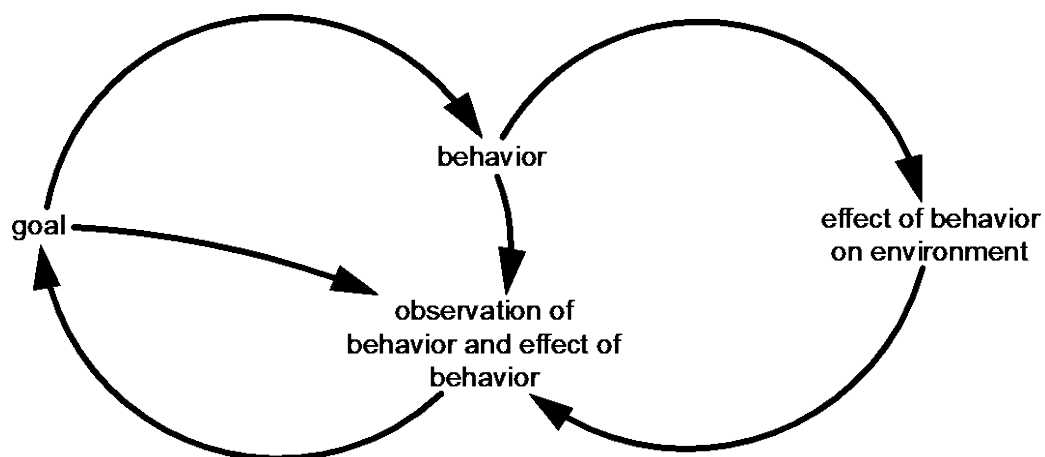


Figure 16 Feedback mechanism of behavior

Figure 16 attempts to illustrate the above-mentioned feedback mechanisms in a simple manner. The “goal” is the intention to behave in a certain way, to do something specific. This intention is followed by an actual behavior. Depending on the set behavior some effect on the environment can be observed. The person who sets the behavior is then observing whether the behavior, as well as the effect of the behavior, meet the intention (goal). For sure there are external factors, which are not included in Figure 16, that support or inhibit someone's ability to observe. However, also internal factors affect a person's observation, or rather one's evaluation of the goal achievement and the consequences of this evaluation. Here, the role of our mental model comes into play. Thus, a person does (usually) not objectively observe and evaluate the goal achievement but uses the filter of one's own mental model. Hence behavior influences the environment, behavior affects ourselves (reflection process), and how these effects are observed, evaluated and what reactions follow depend on our mental models (see also Figure 17).

The Worldbank (2015) report describes mental models as a sort of heuristic that simplifies our lives. “*Mental models* include categories, concepts, identities, prototypes, stereotypes, causal narratives,

and worldviews“ (Worldbank, 2015). On the one hand, it is stated that these are personal models that guide our actions; on the other hand, it is indicated that some sort of socially shared mental models exist that provide guidance on how to interact with other people. Through these shared mental models, a mutual understanding and a sense of belonging are created. Furthermore, since these are shared models, they guide action of the collective. In contrast to social norms, shared social mental models are not enforced and are general guiding principles. In that sense, the description of mental models resembles the definition of values (see section 5.1.1). Since socially shared mental models are constructed within a particular society. These mental models are not necessarily transferable to another context. Further, the description of mental models offered in the report by the Worldbank (2015) resembles the concept of habitus. The habitus is as well individual to every person but at the same time shared by certain groups.

In scientific terms, the difference between what is and how we perceive what is can be described as the difference between ontology and epistemology (Mobus & Kalton, 2015). Awareness is not only needed to change a certain behavior. Awareness is also the basis for deliberately forming a new **mental model**. The mental model is the basis for understanding and steering actions. Hence depending on our mental model, conclusions about real events differ (Worldbank, 2015). It takes awareness to know that we do not know everything, that conclusions are based on simplifications. Consider the phenomenon of information bias, where we seek information that supports our mental models. Bourdieu’s **habitus** comes into play again when we think about how our mental models may entrap us in our reality. Mental models, understood as shortcuts, tell us what to pay attention to, how to filter information, and how to interpret this information. Since we take our mental model for granted, neither the perceiver nor the sender of information may be aware of biases. The biases may neither be unveiled by our environment, since the environment also adheres to the same socially shared mental model (Worldbank, 2015).

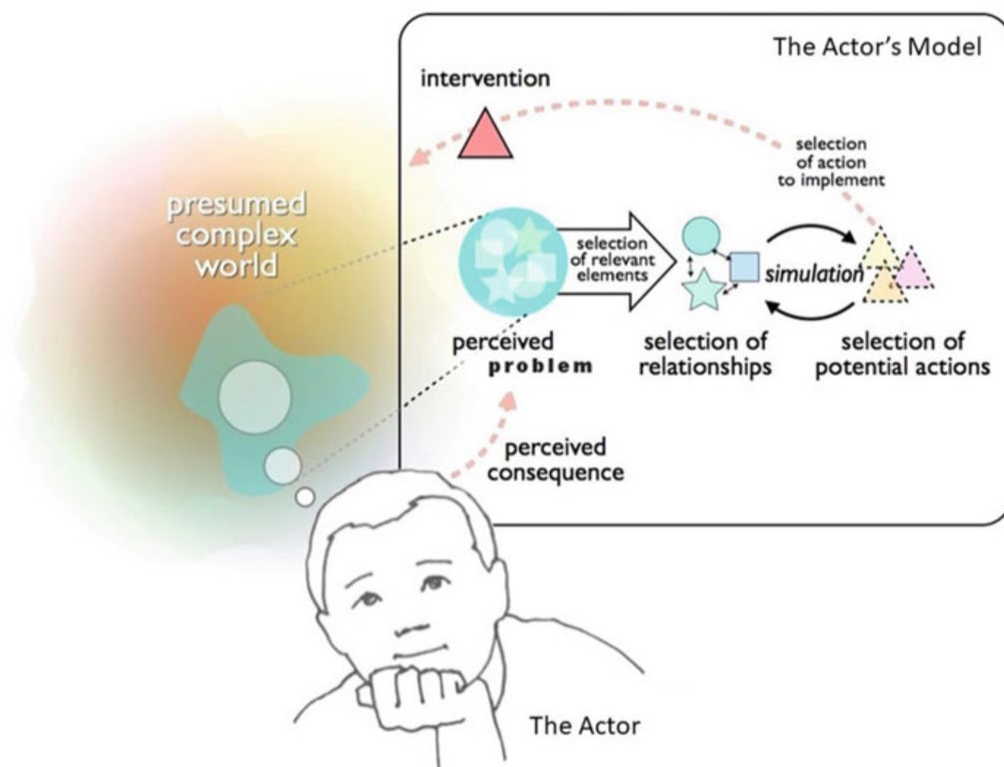


Figure 17: Mental model as basis for human action, from Lissack (2021)

To question the foundations on which our decisions are based, double or even triple loop learning is needed (see sections 3.3 and 3.4). Apart from this, a drastic change in the environment may trigger a



reflection process. Such a change can be brought about through moving to another area or country (Bujold et al., 2020). This instance will also be outlined below. However, Figure 17 illustrates a feedback mechanism between action, the environment, and the actor (Lissack, 2021).

The environment in which an action takes place has an impact on observable behavior. Darnton (2008) and Jackson (2005) refer to the **Theory of Interpersonal Behavior (TIB)** by Triandis (Issock Issock, Roberts-Lombard, & Mpinganjira, 2020; Russell, Young, Unsworth, & Robinson, 2017) as an example of a model that explicitly considers external factors. In TIB, external factors influence whether or how a specific behavior can be implemented. An example would be the needed existence of public transport to go by bus. However, the TIB does not provide a closed model as the observable behavior neither affects the actor nor the environment in which the behavior occurs (see Figure 18). **Practice Theory**, for example, addresses the connection between actor, action, and environment in which the action takes place. The relationship among these elements is understood to be dynamic, and thus models within **Practice Theory** are, in contrast to orthodox socio-psychological behavioral models, not linear. **Practice Theory** will be discussed in more depth in section 3.7.

Nevertheless, TIB does include habits, which is an advantage over another model that includes the context; Stern’s **Attitude-Behavior-Context (ABC)** model (Jackson, 2005). “A” is not limited to attitudes, but includes beliefs, norms, and values which then trigger a certain behavior<sup>4</sup>. Though the behavior might be moderated by the context (e.g., social structures) (Jackson, 2005). In the ABC model, a behavior is thus the result of the struggle between attitude and context. It is stated that depending on the circumstance, either attitude or the context dominate the decision to take a certain action (Jackson, 2005; Salonen & Åhlberg, 2012).

Furthermore, Salonen and Helne (2012) made an addition to the TIB to include agency (see Figure 19). This addition is an interpretation of the ABC model (Salonen & Åhlberg, 2012). On the left-hand side of the model, they added “importance to aimed goal”, in the center the added “feasibility of aimed action” and on the right-hand side they added “action.” The importance indicates a person’s willingness to overcome barriers. The barriers are expressed by the feasibility, which is a mixture of internal and external factors, hence the ABC model (Salonen & Åhlberg, 2012).

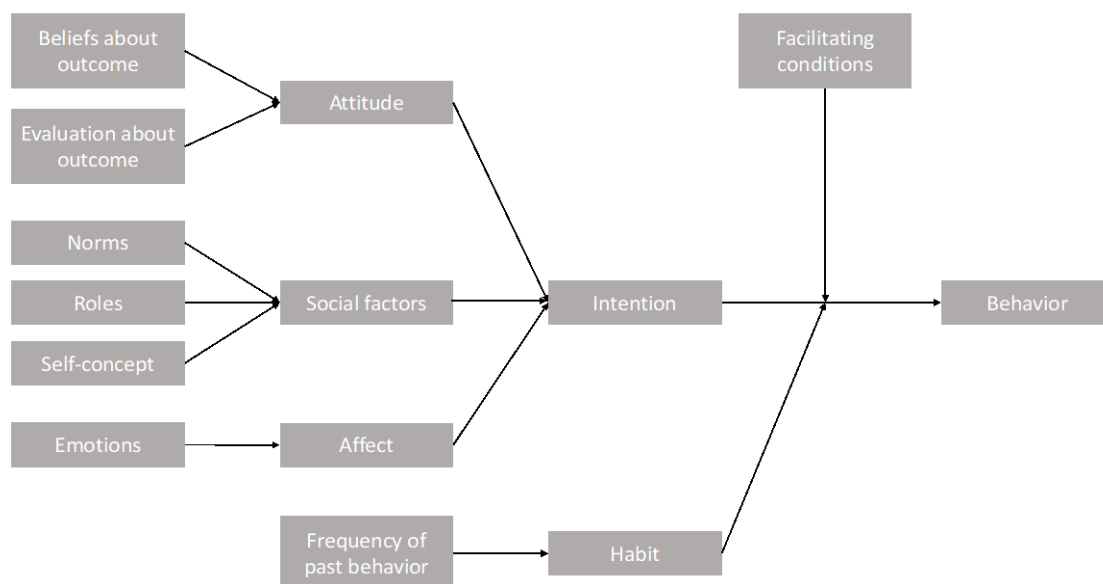


Figure 18: Theory of Interpersonal Behavior (TIB), from Triandis (1977), cited after Jackson (2005)

<sup>4</sup> These factors make up what is called motivation. See section 5.1

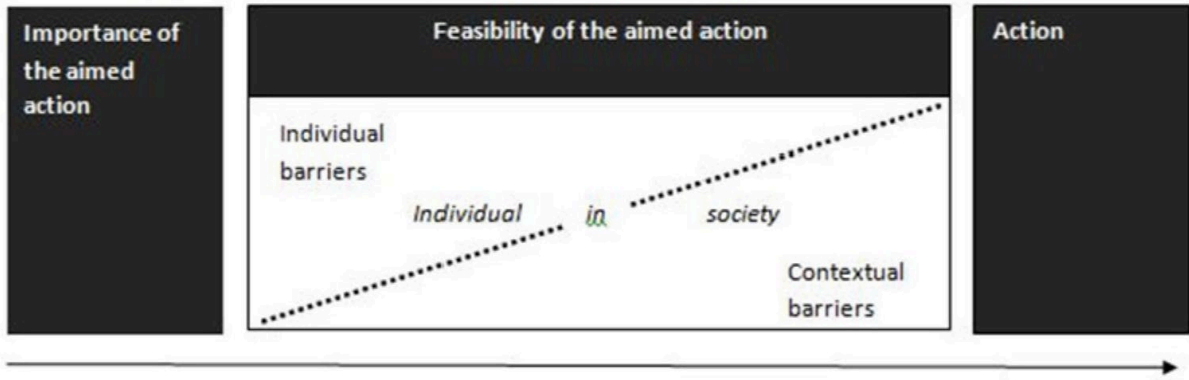


Figure 19 Interpretation of the ABC model added to TIB, from Salonen and Helne (2012)

### 3 Behavior change

As already stated understanding behavior is not the same as understanding behavior change. Darnton (2008) distinguished between 5 different avenues to understanding behavior change. 1) changing habits, 2) change in steps, 3) change through social networks, 4) change as learning, and 5) change in systems. The same categorization of avenues is applied in this working paper. However, two avenues have been added, change through low-hanging fruits, which is an extension of change in steps, and change through practice, which expands on practice theory. Change as learning, change through social networks, and change through habits are all connected to practice theory. It is pointed out in this working paper that low-hanging fruits should not be disregarded as they may be needed as a preparation for further change. However, it also needs to be highlighted that models that understand change to be a linear-stepwise process are born out of mechanistic thinking applied to human behavior. Thus, these models and approaches are often characterized by oversimplification. Change as learning can also be understood in this manner. **Rational Choice Theory** implies that providing information will lead to a different behavior. Though, change as learning is in section 3.3, rather discussed as a way to achieve a reflection process which is needed for a fundamental change. Change in systems is very much connected to change as learning, since certain logics of systems thinking are applied to learning. Change in systems is a continuation of closed models (see section 2.5). Compared to the rather static, linear models, systems thinking does perceive the world as dynamic and is thus potentially better suited to understand change. Furthermore, feedbacks, direct as well as indirect relations among system components are core to systems thinking. Systems thinking also provides leverage points to intervene. This connects back to a topic covered in change as learning. Leverage points indicate that some interventions will only lead to minor changes, while other interventions can lead to a complete change of the *system* itself (deep transformation). Change through social networks provides an insight into models and approaches that attempt to place human behavior within a societal context. It needs to be highlighted that this working paper does not cover group behavior. Thus, the models and approaches covered in section 3.5 are about individuals within a societal context. The social context builds a bridge to practice theory and structuration theory. In both theories the structure in which behavior, or a practice takes place are key. The structure is understood to shape and to be shaped by individual behaviors (practices<sup>5</sup>). While change through practices has elements of change through social networks and change in systems, it does not as much incorporate the agent. However, it is suggested that an agent perspective can and potentially should be added to practice theoretical analysis.

It has been pointed out that behavior change is dynamic, rather than static. Several behavioral change models very well illustrate this point. For example, the idea of **spiral scaling** by Newell, Daley, et al. (2021) perfectly illustrates this dynamic approach to behavioral change. They describe spiral scaling as:

*“[...] transformation from ‘shallow’ to ‘deep’ scaling [which is] a dynamic sequence of interactive feedback loops between individuals, society, institutions and infrastructures. It envisages an iterative, reciprocal and reflexive social learning approach, and responds to the need to move away from linear and even circular understandings of scaling, towards multiple, deep transformations - i.e. axial behavior and systems change across diverse contexts, which are conceptualized as an upward-moving vortex or ‘spiral of sustainability’. This perspective aims to better reflect the empirical reality whereby elements of shallow and deep scaling often operate in tandem within and across contexts over time, until deep scaling prevails and transformation is achieved” (Newell, Daley, et al., 2021).*

The approach offered by Newell, Daley, et al. (2021) has some parallels with the concepts provided by Kasper (2016). Similar to Chapter 2, this chapter starts with rather linear approaches to then cover

---

<sup>5</sup> Behavior and practice are not the same.

closed approaches. Kasper (2016) uses the concept of ecological habitus which is a sociological and closed approach that will be discussed in section 3.5.

Williamson et al. (2020) review six different behavioral change models, some of which are circular, rather than linear. The behavioral change approaches that they review are all combining behavioral science, social science, and behavioral design and have been used in the context of environmental protection. They also provide their own behavioral design models, which follow a circular approach (see Figure 20).

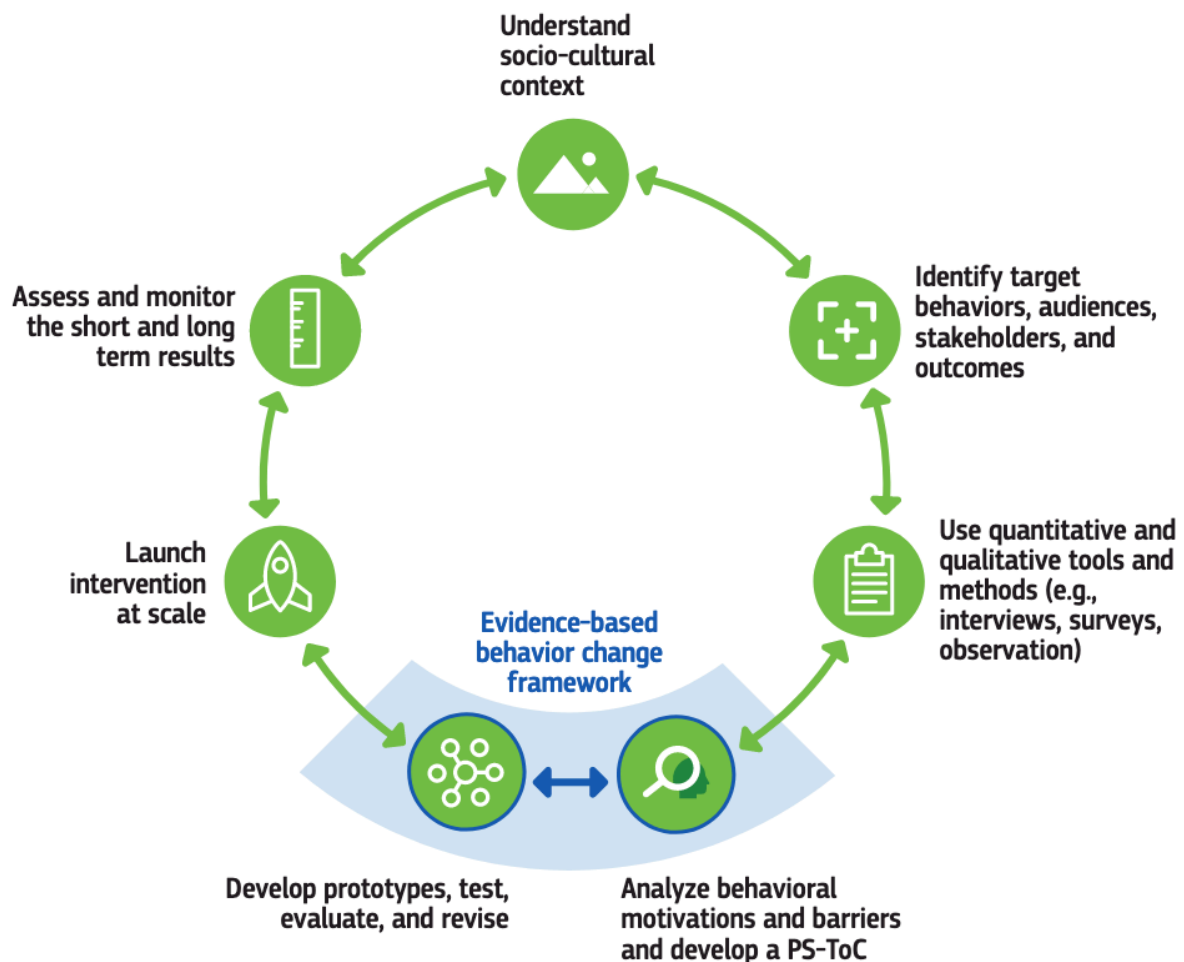


Figure 20: Behavioral Design Steps from Williamson, Bujold et al. (2020)

Another example of a dynamic process is the model developed by the Worldbank (2015). As Figure 21 shows, behavior change is understood to be an iterative approach, which calls for a continuous adaptation of behavioral interventions. Williamson et al. (2020) apply a similar understanding to behavioral change. **They state that behavioral change follows a non-linear, adaptive, and iterative process.**

Bujold et al. (2020) provide a scheme to compare different behavioral change models. The scheme provides seven criteria: 1) Strength of behavioral principles, 2) Comprehensive design steps, 3) Durability and evaluation, 4) Diverse actors and scales, 5) Socio-ecological context integration, 6) Emphasis on non-linearity and iteration, 7) Ethics and power consideration (see Figure 22). Strikingly their comparison shows that all approaches are weak pertaining the consideration of the socio-ecological context. This is interesting as the publication does highlight the relevance of considering

the embeddedness of behavior within the environmental<sup>6</sup> context. Thus, Bujold et al. (2020) call for such an integration, as several approaches may not consider the interconnectedness of behavior with its environment enough. Figure 22 summarizes the findings by Bujold et al. (2020). In Figure 22 light dots indicate that at least one main aspect in a respective category is missing, the dark blue spots indicate that all is perfectly addressed, and white dots mean that several aspects are missing. It seems that it has become a common-place practice to address a wide set of stakeholders as this has been perfectly addressed by all approaches. Non-linearity of the behavioral change process is perfectly addressed by almost all of the approaches. Ethics and power relations are not well considered by one approach, while the other approaches either consider it perfectly or lack only one specific aspect. Interestingly, most of the reviewed behavioral change approaches do not perfectly consider behavioral principles. These principles are basic hypotheses about human behavior (see Chapter 5).



Figure 21: Behavioral Change Model from Worldbank (2015)

Criteria	Behavior Change Approach					
	BIT	COM-B	OECD	Rare	World Bank	Ideas42
Strength of behavioral principles	●	●	●	●	●	●
Comprehensive design steps	●	●	●	●	●	●
Durability and evaluation	●	●	●	●	○	●
Diverse actors and scales	●	●	●	●	●	●
Socio-ecological context integration	●	●	●	●	●	●
Emphasis on non-linearity, iteration	●	●	●	●	●	●
Ethics and power consideration	○	●	●	●	●	●

Figure 22: Comparison of Behavior Change Models, from Bujold et al. (2020)

<sup>6</sup> I had an e-mail conversation to clarify what they mean by socio-ecological, since this is not explained in any of their publications. I got the response, that it refers to the connectedness of everything. They use the term socio-ecological, since socio-ecological systems are based on the idea that everything is connected. Thus, socio-ecological does not refer necessarily to the natural environment.

### 3.1 Change in steps

Darnton (2008) states that most socio-psychological models of change understand a certain behavior as a point in time deliberate action. Similarly, Kasper (2009) emphasizes that human life is not “a series of changes brought about in static states by the reactions of dependent variables to independent variables (Kasper, 2009). Though following the logic of this static approach, change is understood as a singular event, rather than a continuous process. This fits well with the linear understanding of human behavior. The **Behavioral Change Wheel** (Figure 23) developed by Michie, van Stralen, and West (2011) is an example of a linear stepwise approach (Williamson et al., 2020). The wheel does not describe circularity in the approach, but rather a wide array of information that needs to be gathered and matched with the right intervention.

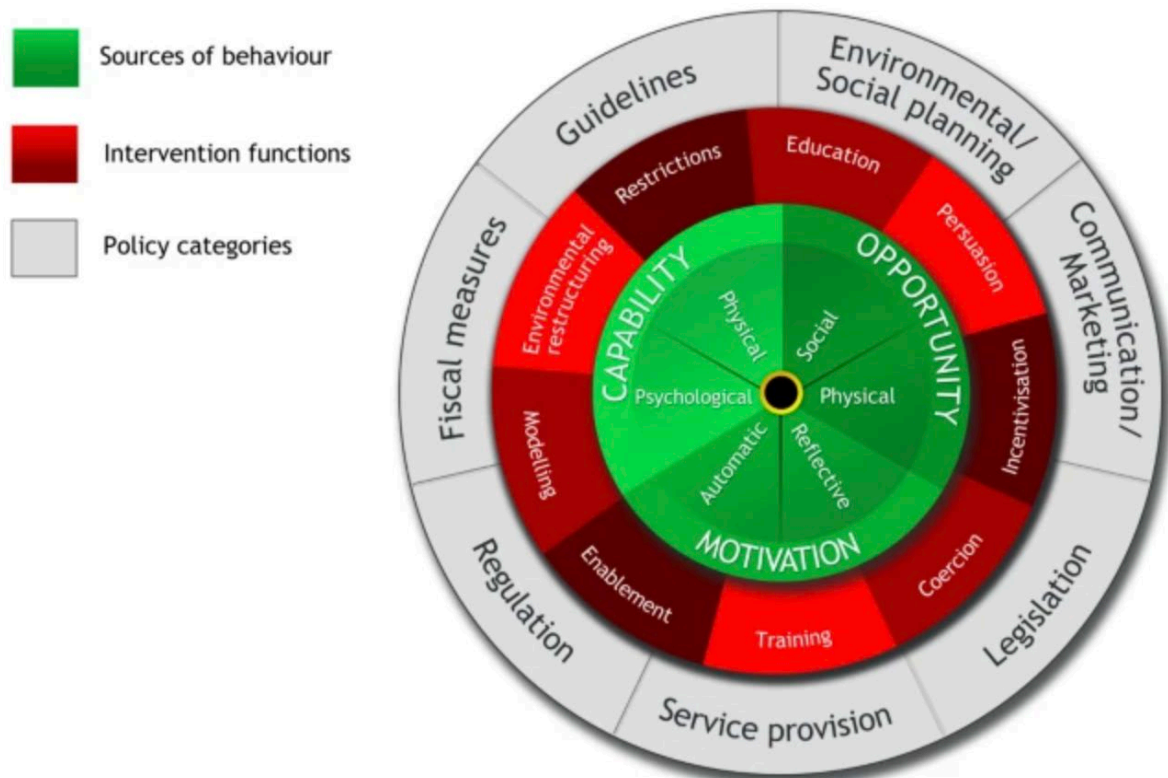


FIGURE 23: THE BEHAVIORAL CHANGE WHEEL DEVELOPED BY MICHIE, VAN STRALEN ET AL. (2011)

The BASIC model by the OECD (2019) is also a stepwise approach, which is based on the ABCD model. ABCD stands for Attention, Belief, Choice and Determination and they are understood to be drivers of human behavior. ABCD are the foundational elements on which the BASIC model is built. While the model is rather linear, it needs to be pointed out that there is a feedback loop between intervention and behavior. Thus, the efficacy of an intervention is analyzed by checking on the behavior (see Figure 24). Such a loop between intervention and effect is also present in the Behavior-Centered Design and Levers of Behavior Change model developed by RARE (Williamson et al., 2020). However, this feedback is not necessarily about the dynamics of behavioral change. The feedback in these models describe a control mechanism of the analysis of the effectiveness of an intervention. Thus, the analysis follows a dynamic approach, but that does not imply that behavior change is understood to be dynamic. Hence the BASIC model is a dynamic analysis tool applied to a linear understanding of behavioral change.

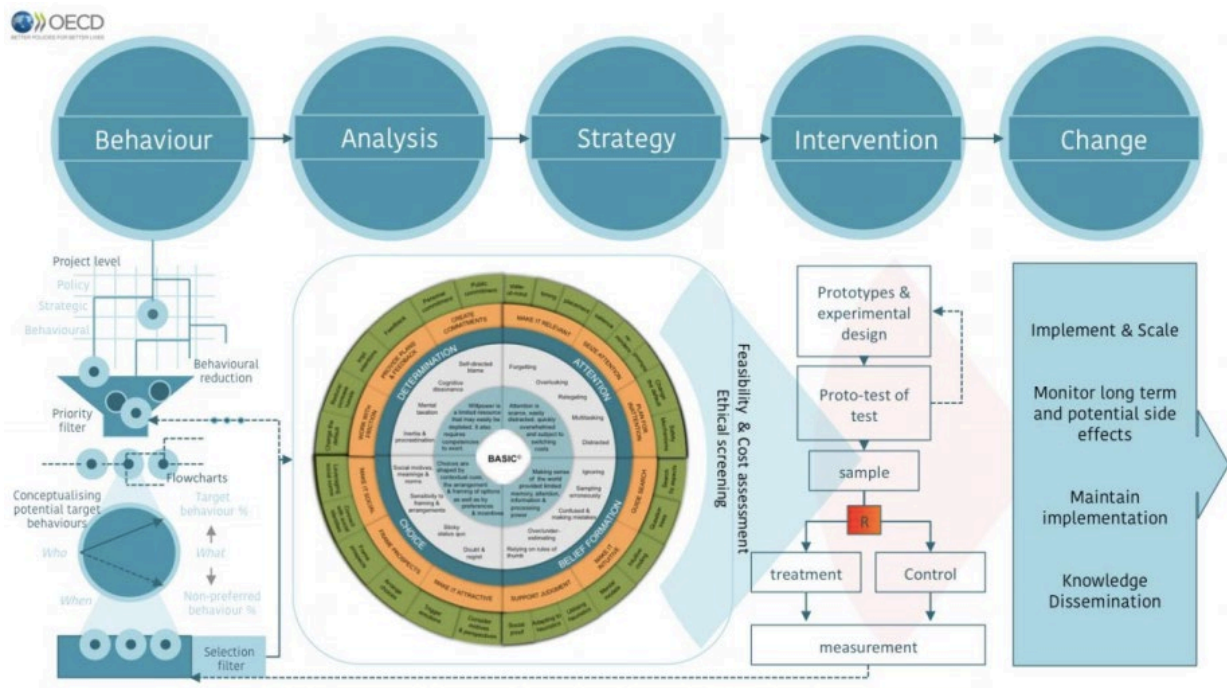


FIGURE 24: BASIC MODEL BY THE OECD (2019)

### 3.2 Change through low hanging fruits

Change through low-hanging fruits has been the predominant strategy to adapt consumer behavior (Heiskanen & Laakso, 2019; Williamson et al., 2018). Low hanging fruits refer to interventions that are based on linear behavioral change models that often make use of information and choice architecture to trigger a specific behavior. Models that mostly use information as leverage assume that people are rational entities whose behavior can be steered by providing the *right* information. It has already been outlined that this thinking is connected to orthodox economic theory that frames the human as *homo economicus* (Heiskanen & Laakso, 2019). However, such behavioral interventions have shown to only have limited success (see attitude-behavior gap in section 5.4.3) (Jackson, 2005; Kollmuss & Agyeman, 2002; Verplanken & Whitmarsh, 2021). Some indication of the limited success of low-hanging fruit interventions is given by society not having transformed into a sustainable one. If we could all just be informed about the better choice or nudged into taking the better choice, many problems would have already been solved. These tools have not delivered as hoped since behavior is much more complex (Jackson, 2005).

Anyhow, the insight that humans are not purely guided by rational thinking, led to the development of tools that are summarized with the umbrella term **Choice Architecture**. A commonly used synonym is nudging, and it describes the attempt to gently push someone to take a decision that is deemed to be *good*. Nudging is here framed as a tool that only addresses low-hanging fruits since it usually bypasses higher-order information processing (Heiskanen & Laakso, 2019). Below other approaches are discussed that aim at higher-order information processing and self-reflection. However, if a deep transition is envisioned, nudging alone may not suffice.

Hampton and Adams (2018) highlight the limiting effect of structures. They interviewed experts working with behavioral economics methods (e.g., nudging) and who consulted policy decision-makers. They were amongst other things lamenting about the limitations of nudging caused by the structures in which behavior takes place:

*“These quotations demonstrate that the interviewees were aware that the scope of behavioral economics was not sufficient to match the scale of change necessary to meet stretching climate targets. However, GSRs’ [government social researchers] ability to effect change is*

*mediated by the structures surrounding them, including the design of energy markets and the remits and norms of government institutions“ (Hampton & Adams, 2018)*

Due to the mediating effect of structures, Hampton and Adams (2018) suggest to make more use of practice theoretical approaches.

Dickinson (2009) indicates that raising awareness does not lead to long-term behavioral changes. Usually, only short-term changes can be observed. This needs to be considered as many think that the vehicle for change could be information and education. Below it is indicated that many behavioral interventions are still based on the assumption that rational choices are the basis for decisions (Williamson et al., 2018). While information and education may not be sufficient to achieve long-lasting or profound behavioral change, it needs to be underscored that some information is still needed to instigate behavioral change. Why information alone is not enough is not only explained by structural barriers, for example, but also by cognitive mechanisms such as confirmation bias (Pahl-Wostl, 2009). These mechanisms that block change, will be discussed further down below (see section 5.4).

A report by the Cambridge Sustainability Commission also indicates the limitations of initiatives that are not changing the fundamentals on which behavior is based (Newell, Daley, et al., 2021). They compare shallow and deep scaling behavioral interventions, whereat shallow scaling includes many approaches that are popularly taken up, such as nudges or market interventions. These approaches do not target people’s worldviews and are thus limited in their effectiveness. This is because without changing underlying mechanisms, endeavors might be undercut directly or indirectly through phenomena such as the rebound effect or moral licensing. Such unintended side-effects are the consequence of the system still striving to fulfill the overall paradigm (Abson et al., 2017; Meadows, 1999). However, it also needs to be highlighted that their proposed spiral scaling, includes both, shallow and deep scaling. Thus, behavioral interventions that are rather shallow are understood as a starting point for interventions that go deeper.

It has been pointed out that some research investigating human behavior (change) combines psychology, behavioral science, and social science in order to generate a richer understanding of a respective situation. Behavior is understood to be context-specific. Depending on, for example, the norms within a specific society behavior may differ. Therefore the societal context needs to be considered (Bujold et al., 2020) (see section 2.4 and 3.5). Williamson et al. (2020) argue that not only the societal, but the socio-ecological context needs to be taken into account and understood when studying human behavior. With socio-ecological they refer to the general connectedness of everything with everything. This highlights the complexity of human behavior and indicates of the usefulness of the systems thinking approach. Due to this complexity, simple solutions may not suffice to change behavior. “But we know that people are more complicated than the narrow solutions we often design to influence them“ (Williamson et al., 2018). Schmidt and Stenger (2021) also state that nudges are not sufficient as they do not consider the complexity in which human behavior is embedded.

*„[E]volutionary biology tells us also that people are inherently social animals and that ‘self-interest’ is far more complex than once assumed. Under the right conditions, we excel at cooperation, seek reciprocity, and act on the basis of social cues. And we have learned that our decision-making process is strongly influenced by the contextual environment in which we make decisions and the way choices are presented to us“ (Williamson et al., 2018).*

### 3.3 Change as learning

“Learning is the cognitive process of acquiring a skill or knowledge. It can also be defined as a relatively permanent *change in performance that results from practice*“ (Parente, 2011). Learning is a means to acquire new behavior (a new way to adapt to the environment), though not everything learned can be detected in observable behavior. Some learning may lead to a change in attitude, which then may have the potential to be expressed in a specific behavior. Thus, attitudes and values bear a specific



potentiality to create a certain behavior (Zimbardo & Gerrig, 2004). The simple connection between information, learning, attitude change, and subsequent behavior is captured by **Rational Choice Theory** models. Though, if learning leads to some sort of (self-)reflection process it is by some referred to as **double or triple-loop learning** (Fahrenbach & Kragulj, 2019; Peschl, 2007). These concepts will be discussed in more detail below. However, something is understood as being learned if, for example, the new behavior is consistently applied in various circumstances. Learning happens through experiencing, whereat experience refers to the reception and processing of information, as well as executing reactions that have an impact on the environment. (Zimbardo & Gerrig, 2004).

There are different approaches to learning (Parente, 2011). However, learning can be achieved through reflection on past behavior. Thus, reflection can be understood as key to learn a new behavior (Ellis, Carette, Anseel, & Lievens, 2014; Zimbardo & Gerrig, 2004). Darnton (2008) states that even if socio-psychological models do not make it explicit, reflection about previous behavior is a cornerstone to behavior change. The **Information – Motivation – Behavior Skills (IMB)** model is a model in which change rests upon information (Ehret et al., 2021; Fleary, Joseph, & Chang, 2020). This model ties into simplistic linear thinking of **Rational Choice Theory**. A similar model specifically developed for the environmental context is the **Framework for Environmental Education** by Monroe, Andrews, and Biedenweg (2008) (Figure 25).

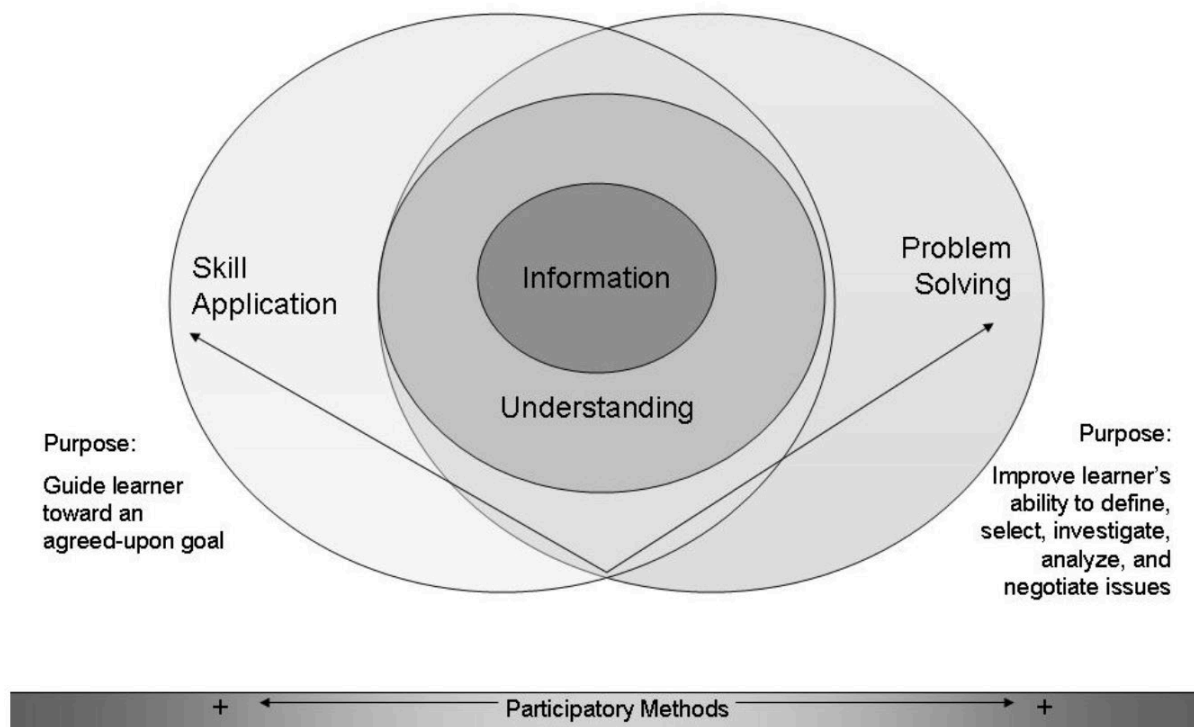


Figure 25: Framework for Environmental Education by Monroe and others, from Darnton (2008)

The framework of **Environmental Education** is also based on **Rational Choice Theory**, where information is understood to be key. Other models about learning, for example, the **Double Loop Learning Model** by Argyris and Schon, are not linear (Pahl-Wostl, 2009; Williams & Brown, 2018). Reflecting on the discussion about “closed models” above (see section 2.5) it can be seen that the **Double Loop Model** (see Figure 26) is also based on feedback mechanisms (Peschl, 2007). It combines the effect that an action has on the environment, with the effect the action has on the actor. **Double Loop Learning** has similarities with **Control Theory**. It comes not as a surprise when Darnton (2008) states that: “Argyris and Schon state that they modelled their diagram on the homeostatic feedback loops of early systems thinker Ross Ashby. Their model is thus consistent with non-linear conceptualizations of behavior, based on feedback.” The first loop can also be compared with the

concept of proto learning, which means the adaptation of a behavior to some events (Visser, 2003). Single-loop learning does not question the underlying assumptions, the “why something is done” (Pahl-Wostl, 2009). Therefore, **single-loop learning** does not permit the creation of “paradigmatically new knowledge and radical innovation” (Peschl, 2007). The second loop can be compared to the concept of deuteron learning, which is a change in proto learning based on insights about underlying conditions (Fahrenbach & Kragulj, 2019; Visser, 2003). Thus, the second loop represents a reflection process about underlying factors. An example of **double-loop learning** within cybernetics is provided by Lissack (2021) (see Figure 27). The second feedback loop represents an additional control mechanism.

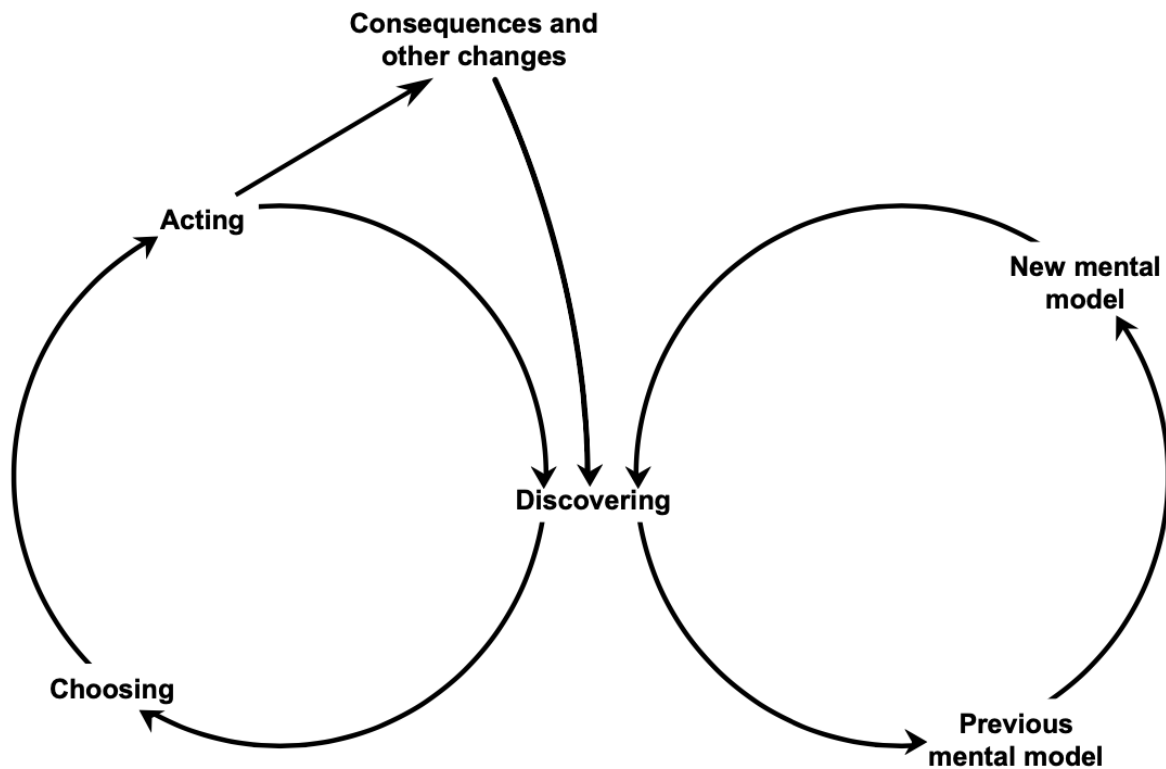


Figure 26: Double Loop Learning Model by Argyris and Schon Double Loop Learning (1978), from Darnton (2008)

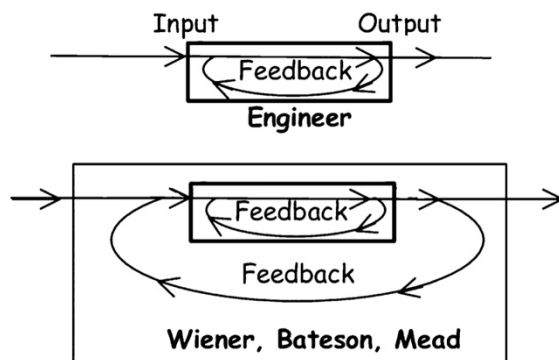


Figure 27: Second order cybernetics, From Lissack (2021)

The **Double-Loop Learning** model resonates with Bourdieu’s concept of habitus as well as with the idea of deep scaling advocated by Newell, Daley, et al. (2021). Darnton (2008) reports that Argyris and Schon describe the first loop as “*paradigm constrained*” and the second loop “*paradigm breaking*”. Hence, in the first loop errors might be detected and corrected, and in the second changes

to underlying assumptions can be achieved. “The unspoken ‘theories in use’ which inform the instrumental learning processes are necessarily overthrown in ‘double loop’ learning [...]” (Darnton, 2008).

The word unspoken can be interpreted as a reference to **habitus** since this concept does as well refer to taken-for-granted assumptions and worldviews. If we remain in the paradigm-constrained loop, we will not question the taken-for-granted assumptions and worldviews. For Bourdieu, a change of **habitus** can only happen when the unconscious habitus becomes conscious, which would be facilitated by **Double-Loop Learning**. Newell, Daley, et al. (2021) describe the difference between shallow and deep scaling of behavioral change. Following **Double-Loop Learning**, shallow scaling falls in the realm of the first loop and deep scaling in the realm of the second loop. Ultimately Newell, Daley, et al. (2021) propose spiral scaling which is a combination of shallow and deep scaling. Darnton (2008) does not refer to Bourdieu, but rather to Lewin’s work (unfreezing-refreezing) since **Double-Loop Learning** was originally developed for organizational change (Coghlan, 2021). Darnton (2008) refers to Lewin, as for *unfreezing-refreezing* as well as for **Double-Loop Learning**, the social setting is attributed to be vital. Moreover, in both cases, some sort of emotional unsettling is necessary to start the reflection process.

Edgar H. Schein (1996) calls paradigm breaking “frame braking,” and he regards this as necessary for change to happen. He even states that frame braking needs to happen periodically otherwise assumptions become locked in. As mentioned before, unfreezing or “frame breaking” is connected to making uncomfortable experiences (Darnton, 2008; Edgar Henry. Schein, 2002). This links to work by Weintrobe (2021) who writes about the necessary but painful step to acknowledge that our perceptions have been wrong. Such an acknowledgment will according to Weintrobe (2021) lead to a process of mourning which then permits finding new pathways. It also relates to **Terror Management Theory** (Dickinson, 2009) according to which people tend to deny their own transience. This denial may lead to inaction. The insights from **Terror Management Theory** relate to the emphasis Edgar Henry. Schein (2002) places on another aspect that needs to be in place to make change happen; psychological safety. “The essence of an effective unfreezing process is a balancing of enough disconfirmation to arouse an optimal level of anxiety or guilt, without arousing so much learning anxiety as to cause denial, repression, projection, or some other defense mechanisms” (Edgar Henry. Schein, 2002). It is currently a much-discussed topic if people should be confronted with negative information about climate change or whether the provision of positive information is more beneficial for behavioral change (Brosch, 2021). Some argue that negative information would lead to inaction, while others (Weintrobe, 2021) state that this is the way to go. Edgar Henry. Schein (2002) emphasizes that fear, as well as hope, is needed providing a bridge between those two views.

Someone might be ready for change, but may not undertake the change, if one does not feel safe enough to undertake change (Edgar Henry. Schein, 2002). Similarly as proposed by **Terror Management Theory**, one may remain stuck in denial if there is a lack of hope (Dickinson, 2009; Edgar Henry. Schein, 2002). Edgar Henry. Schein (2002) states that most research focuses on the unsettling aspects (discomfort and anxiety, guilt) but not on the aspect that allows people to act (psychological safety, hope, agency). To some extent, this relates to the aspect of agency and locust control (see section 5.4.19). For change to happen people need to have the impression that they can make a change happen. They need to trust in their abilities. While discomfort is not the only aspect it does have a major impact on the readiness for change. Edgar Henry. Schein (2002) points out that people are more willing to change if they are close or amid an uncomfortable situation. That once more reminds of the work of Dickinson (2009) indicating that people are more likely to take action if they are forced to. Although Edgar Henry. Schein (2002) applied this logic to the organizational setting, it also lends insights into climate inaction.

Similar to Lewin, Edgar Henry. Schein (2002) also distinguishes between three stages of change, unfreezing, changing, and refreezing (see Table 2). Though, Coghlan (2021) states that in later work, Schein focuses less on refreezing as he more and more frames behavior as a constant cycle of adaptations. This understanding can already be found in Schein’s (2002) reflection on change in human systems. However, by focusing more on continuous dynamics, Schein responds to the understanding that life is complex and that linear models may not suffice to provide insight or solutions (Coghlan, 2021). Edgar Henry. Schein (2002) describes two ways to change, which are both described as learning. One is the imitation of others, the other describes a trial-and-error process in which the individual finds the tailored solution him/herself. He states that imitation is quicker, but less likely to stick as for example the behavior of someone else may not fit with some other person’s circumstances. In contrast, trial-and-error takes longer but has more chances to achieve long-term change. Though, it needs to be added that for trial-and-error to be an option, a diversity of alternatives needs to be available. Edgar Henry. Schein (2002) does not refer at length to contextual factors, though structures can support or hinder the learning process.

<b>Unfreezing</b>	<b>Creating the motivation to change</b>
	Disconfirmation
	Creation of survival anxiety or guilt
	Creation of psychological safety to overcome learning anxiety
<b>Changing</b>	<b>Learning new concepts, new meanings, and new standards</b>
	Imitation of role models
	Scanning for solutions and trial and error
<b>Refreezing</b>	<b>Internalizing new concepts, meanings, and standards</b>
	Incorporating into self-concept and identity
	Incorporating into ongoing relationships and groups

Table 2: Stages of the change process, by Schein (2002)

Still, Edgar Henry. Schein (2002) covers the context through a force-field analysis. Edgar Henry. Schein (2002) states that behavior is embedded within a specific system, whereat a system can be a person or an organization, or some other analytical unit. The force-field analysis aims at identifying the forces that keep the system in a quasi-stationary equilibrium. Before undertaking the force-field analysis Edgar Henry. Schein (2002) advises investigating which direction the system intends to change. He suggests using the Beckhard-Harris change map to do so. Thereafter, the forces can be identified (see Figure 28).

The last stage in the change model suggested by Edgar Henry. Schein (2002) and Lewin (Darnton, 2008) is refreezing, which is about making changes stick. For the refreezing process, Edgar Henry. Schein (2002) highlights the importance of 1) the person being able to comprehend alternatives and 2) then making these alternatives part of one’s identity. The first point refers to the importance of a person being cognitively able to understand that the current behavior or attitude is suboptimal. This cognitive ability for change connects to double-loop learning and the vital role of being able to reflect about oneself. The second point is referred to as “personal integration.” The relationship between change and identity will also be discussed in section 3.6 (see Figure 42). Though, even if the new

behavior or attitude has become part of one’s identity, it may not be sufficient for the new behavior or attitude to stick. This could be understood as a reference for the constant change individuals are exposed to. Edgar Henry. Schein (2002) states that if people are recurrently experiencing opposition, or if structures may not support the change, individuals may abandon it again. With this suggestion Edgar Henry. Schein (2002) highlights the complexity of change, and that achieving change needs the consideration of many factors. “In other words, for change to stick, it has to be integrated into the total psychic framework or personality and has to be supported by others whose opinions and perceptions the person cares about” (Edgar Henry. Schein, 2002). Reflecting on low-hanging fruits, Schein’s work provides an explanation for why interventions such as nudging often do not stick.

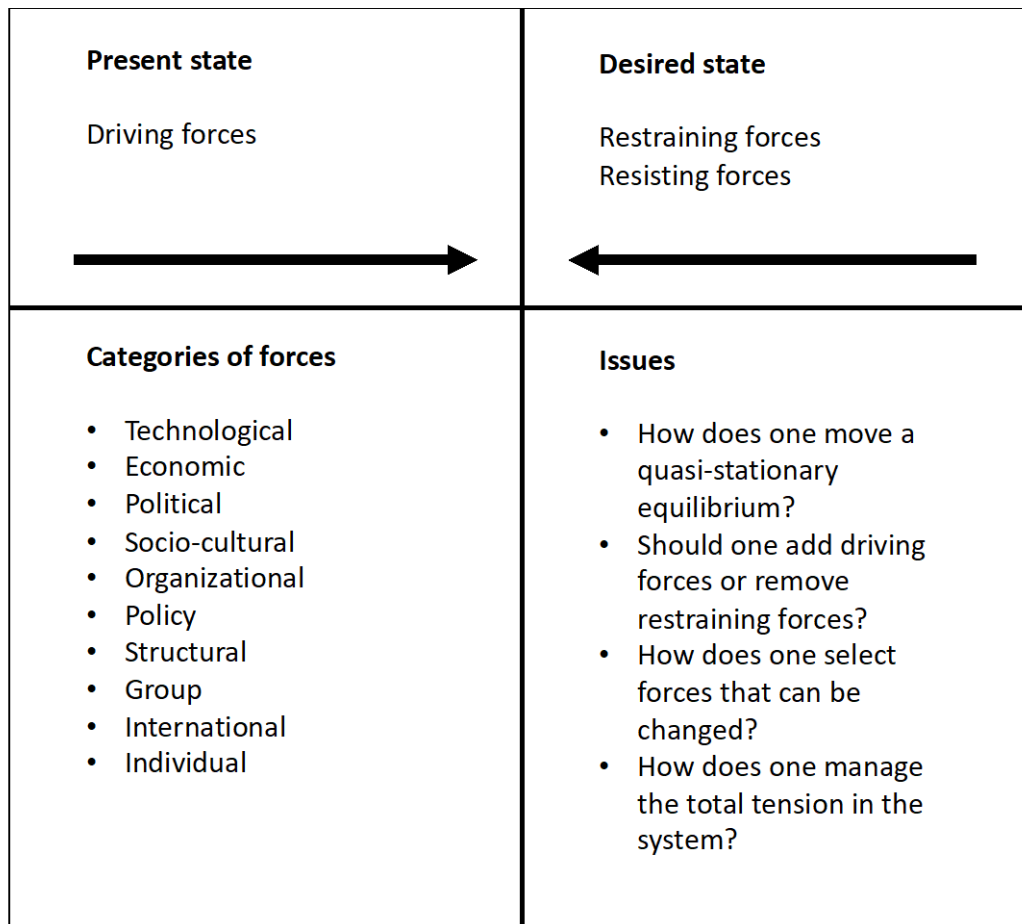


FIGURE 28: FORCE-FIELD ANALYSIS, BY SCHEIN (2002)

A further adaptation to **Double-Loop Learning** is **Triple or Multi-Loop learning** (see Figure 29). **Triple-Loop Learning** might be applied differently depending on the field. For example, Leifer and Steinert (2011) apply it to design thinking. This application of **Triple-Loop Learning** differs from other explanations of what triple-loop learning constitutes (Fahrenbach & Kragulj, 2019; Pahl-Wostl, 2009; Peschl, 2007). For Fahrenbach and Kragulj (2019); Pahl-Wostl (2009); Peschl (2007) **Triple-Loop Learning** is characterized by a questioning of underlying values, worldviews, and paradigms. Such a deep questioning is not reflected in the example of Leifer and Steinert (2011). However, what they all have in common is the need for openness to provide circumstances that allow change. Fahrenbach and Kragulj (2019) apply **Triple-Loop Learning** to a deep change of the self, a change that is rarely

happening. They connect it to the concept of **Learning III** by Gregory Bateson<sup>7</sup> (Visser, 2003). **Double-Loop Learning** already indicated a questioning of underlying assumptions. Thus, the question is what another loop may add. The explanation by Pahl-Wostl (2009) might be helpful. He indicates (see Figure 29) that **Double-Loop Learning** is causing a reconfiguration and **Triple-Loop Learning** a transformation. “Double-loop learning refers to a revisiting of assumptions (e.g. about cause-effect relationships) within a value-normative framework. In triple-loop learning one starts to reconsider underlying values and beliefs, world views, if assumptions within a world view do not hold anymore” (Pahl-Wostl, 2009). Table 3 illustrates how the different loops manifest in different institutional settings. Fahrenbach and Kragulj (2019) refer to the third loop as a metanalysis of one’s reflection process. A reflection about the reflection, so to say. For Peschl (2007), in contrast, the second loop is already a meta state. This meta state deals with assumptions, but not with the values on which these assumptions are built. The third loop is then a reflection that is related to values, **habitus** as well as metaphysical considerations. Though, the distinction Peschl (2007) makes is a bit blurry. He refers to habitus for third-loop learning, but already his description of the second loop reminds of a Bordieuan lens.

*“In general, knowledge always has to be seen as being embedded in and pre-structured by a particular **framework of reference**. Knowledge receives its meaning and structures from his framework of reference. Normally, this framework of reference is not explicitly present in our processes of cognition, learning, or knowledge construction. This implies that we do not have a conscious experience of these premises, assumptions, etc. on which our thinking and constructing simplicity is based” (Peschl, 2007).*

Already the double-loop, but even more so the **Triple-Loop Learning** model connects with ideas from **Systems Thinking** and cybernetics. A hierarchy of change or learning or intervention points become obvious. It has also been indicated that **Triple-Loop Learning** might be hard to achieve (Fahrenbach & Kragulj, 2019; Peschl, 2007). The simplest way of learning is, according to Peschl (2007), reacting and downloading. He describes this form of learning with the application of “already existing and well established behavioral, perceptual, or cognitive patterns”. A form of learning that reminds of the concepts of heuristics (see section 5.4). For example, **nudges** based on heuristics are a simple form of learning, that do not cause a change of deeper sitting attitudes or values (see low-hanging fruits in section 3.2). As already highlighted changing attitudes or values call for a reflection process, which needs emotional and cognitive ability and readiness to do so. Hence a change of attitudes and values is harder to achieve. Fahrenbach and Kragulj (2019) refer to **Learning II**, the second loop, and state that this is where the personality is formed and that a change of one’s personality is difficult to achieve. Usually, personality development strives to create stability and resilience rather than change. The third loop, which they compare to **Learning III**, calls for an even deeper change, which may only be triggered through psychotherapy or spiritual quests. Their description of **Learning II** and **Learning III** resembles leverage points 2 and 1 in systems thinking (see section 3.4). Thus, there is a hierarchy of behavioral interventions, just as suggested by Meadows (1999). Changes in systems will be discussed next.

---

<sup>7</sup> Bateson called first loop proto learning, second loop deuteron-learning or learning II and third loop, trito learning or learning III. Bateson was also doing research in cotext with cybernetics (see Visser 2003). However, he seems to have not come up with a simple diagram similar to Figure 26.

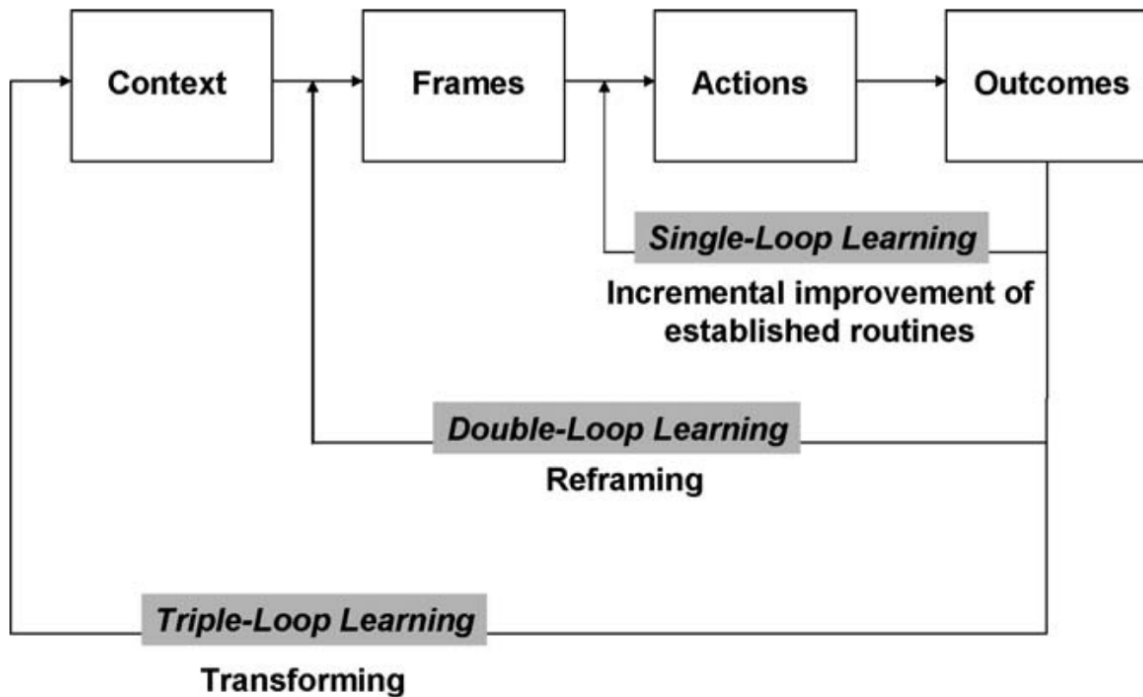


Figure 29: Triple-Loop Learning from Pahl-Wostl (2009)

	<b>SINGLE LOOP</b>	<b>DOUBLE LOOP</b>	<b>TRIPLE LOOP</b>
<b>INSTITUTIONS - GENERAL</b>	No calling into question of established institutions, signs of unilateral reinterpretation	Reinterpretation of established institutions by many parties	Established institutions changed and/or new institutions implemented
<b>REGULATIVE INSTITUTIONS</b>	Existing regulations are strictly followed and used to justify established routines  New by-laws and interpretations of existing law to accommodate exceptions	Regulatory frameworks identified as major constraints for innovation  More juridical conflicts about rule interpretation  Exemptions allowing innovative	Formal substantial changes in regulatory frameworks, new policies implemented  Institutional change towards more flexible regulations that leave room for context specific implementation.  More process regulations

		approaches and experimentation	
<b>NORMATIVE INSTITUTIONS</b>	Established norms are used to justify prevailing system  Relying on codes of good practice	Established norms and routines are called into question	Change which can be identified in public discourse and new practices
<b>CULTURAL-COGNITIVE INSTITUTIONS</b>	Discourse remains in established paradigms that are refined.  Radical alternatives clearly dismissed.	New ideas emerge beyond isolated groups  Strong arguments about alternative views—“ideological” debates	Discourse dominated by new paradigm (media, political debate, public hearings, scientific conferences)  Powerful representatives of “main-stream” argue in new paradigm
<b>UNCERTAINTY</b>	Uncertainty used to justify non-action  Activities to reduce uncertainties. Reliance on science to find the truth/a solution  Discourse focuses on technical approaches to dealing with uncertainty with goal to improve predictive capabilities	Uncertainty accepted and perceived as opportunity in processes of negotiations and reframing  Existence of different perspective and world views explicitly acknowledged  Established approaches to managing uncertainty and risks are called into question	Uncertainty discourse emphasizes different perspectives and world views  New approaches to manage uncertainty (e.g. participatory scenario development) and risk (e.g. risk dialogues, robust action) are implemented with corresponding efforts to change structural constraints  Conscious decision-taking under (irreducible) uncertainty with the prospect of adapting the measures when necessary



**ACTOR NETWORK**

Actors remain mainly within their networks—communities of practice

Explicit search for advise/opinion from actors outside of established network (e.g. invitation to meetings)

Changes in network boundaries and connections

Established roles and identities are not called into question

New roles emerge—e.g. facilitators in participatory processes

New actors groups and roles have become established

Arguments about identify frames— e.g. what does it mean to be an “engineer”

Boundary spanners of increasing importance that start to connect different networks— communities of practice

Changes in power structure (formal power, centrality—new actors in centre)

Identity frames/roles get blurred/ less important, rather joint approaches than isolated performance according to one’s role

**MULTI-LEVEL INTERACTIONS**

Vertical coordination in established patterns— e.g. increased regulation from the top level

Increased informal knowledge exchange between levels

Formalized participation of actors at different levels

Pattern of flow of authority (by institutions) does not change. Mainly uni-directional

Informal coordination groups to improve exchange in planning processes established

Established practices of knowledge exchange across levels More polycentric structures and balance between bottom-up and top-down approaches

**GOVERNANCE MODE**

No change in the relative dominance of governance types

Other than dominant governance types start to become more visible and dominant

New governance types implemented, established governance types substantially changed

	governance type called into question (e.g. discussion of market based instruments if absent before, introduction of participatory approaches, emergence of bottom-up participatory processes, argument about dominance of one type—bureaucratic hierarchies or privatization)	
Improvement of performance within established governance modes	Informal networks shaping discourse and supporting experimental innovations become more prominent	More diverse governance structures—less dominance of one type Learning networks challenging dominating structural assumptions become effectively connected to and influence established policy arenas

Table 3: Characterization of changes in governance regimes expected for single, double and triple-loop learning From Pahl-Wostl (2009)

### 3.4 Change in systems

At the outset, it has been pointed out that orthodox behavioral models are linear. Consequentially, according to these models, behavior change is understood as a linear mechanistic process. Circular models, in contrast, contain some sort of (re-)evaluation of past behaviors through a feedback mechanism. **Systems Thinking** and cybernetics provide tools to illustrate this process of (re-)evaluation, as they aim at identifying feedbacks (Lissack, 2021; Mobus & Kalton, 2015). Naturally, models that contain some sort of feedback are circular (closed), rather than linear (open). Psychology and behavioral science have become part of systems science (Mobus & Kalton, 2015). In the previous section Schein, who adapted Lewin’s three-stage model, has been mentioned. Schein proposed that due to the complexity of our world, linear models of change have become obsolete (Coghlan, 2021).

As indicated the **Double-Loop Learning Model** by Argyris and Schon is connected to systems thinking and cybernetics. Though systems thinking can not only be used to help illustrate behavior change (e.g., via a learning process). **Systems Thinking** is a tool that supports the learning process itself. This is because it asks the modeler to think about how things are connected and thus, the tool instigates a reflection process (Mobus & Kalton, 2015). Darnton (2008) highlights that particularly the soft systems

thinking tools support reflection processes and that the tool can also be used in group settings. The activity of systems thinking could be understood as a means to go meta, to reflect on the reflection. Thus, systems thinking itself could be a form of **Triple-Loop Learning**. Furthermore, **Systems Thinking** provides insights on how change or rather where interventions can be placed to reach a specific change. This insight is called leverage points.

Thus, there are three different ways in which **Systems Thinking** can help in the field of behavioral change. 1) It can help mapping out a system. Unlike other behavioral change models this system can contain factors that constitute motivation, as well as contextual factors such as certain structures or social norms. Mapping these factors using systems thinking calls for illustrating direct and indirect links among these factors and identifying feedback loops. 2) It can be a reflection tool. By mapping out a system one needs to thoroughly think about the factors that constitute the system, as well as, how these factors are connected. Hence **Systems Thinking** is a tool that formalizes a reflection process about a problem at hand. 3) The notion of leverage points provides guidance on where to place interventions. Having mapped out the system and having thought about it thoroughly allows identifying intervention points. If system dynamics is used interventions can be simulated to illustrate how system behavior would change. Though, it needs to be noted that every model is a simplification of reality which is based on certain assumptions. This is a potential source of errors. Modeling will not be discussed in this working paper. For more information about modeling consult for example Mobus and Kalton (2015) or Metcalf, Kijima, and Deguchi (2021)

Reflection cannot only happen on an individual level; it can also be a group exercise. The relevance of group reflection has been outlined in the work of Lewin (Burnes, 2004a, 2004b). For Lewin to achieve behavioral change, group norms need to change. This is as the individuals use social norms as benchmarks for their own behavior. Group modeling would support reflection processes that could instigate the second loop and / or the third-loop learning and thus it provides a potential for paradigm-breaking (Darnton, 2008). **Systems Thinking** embodies qualities that have been discussed in the section about closed models (see section 2.5). Self-regulation, a mechanism based on homeostasis, is key to systems thinking. As outlined above, self-regulation needs some sort of reflection process, where the status quo is compared with the wished status.

As illustrated by the **Triple-Loop Learning** Model change has three facets, incremental, re-framing, and truly transformational. Incremental change (paradigm constrained) refers to shallow scaling, a change within the current structures. Incremental change does not question the underlying assumptions. This is in contrast to transformational change which questions the underlying assumptions (deep scaling, paradigm-breaking) (Darnton, 2008). Darnton (2008), in reference to Senge (the Fifth discipline), states that the application of linear models rather resembles incremental change. A *solution* to a problem is tested and if found to be effective it is replicated in various similar situations. Transformational change would, however, require *solutions* to each respective situation. It would also require the involvement of stakeholders for the development of suitable solutions as well as to start a reflection process among participating stakeholders.

The Cambridge Sustainability Commission issued a report that expands on the role of human behavior and on how individual behavioral changes can be upscaled to achieve a system-level sustainability transition (Newell, Daley, et al., 2021). They start by highlighting the relevance of individual behavior change and point out that this potential is widely neglected. However, they also state that due to the magnitude of the needed changes, the sustainability transition cannot be left to individuals alone and that the individual and higher-order organizational levels are re-enforcing each other. They start their analysis from the individual level and provide a scheme on how to scale individual-level endeavors up. They distinguish between conventional and new upscaling approaches. The upscaling approaches are: 1) upscaling through size, 2) scaling out, 3) scaling through depth and 4) reactive scaling. Upscaling (1) refers to mainstreaming of a behavior, scaling out (2) refers to (globally) connected community initiatives, deep scaling (3) pertains to values and norms, and reactive scaling is a response mechanism to a crisis.

Newell, Daley, et al. (2021) call for deep scaling, which aims at a paradigm shift. This paradigm shift happens when a new behavior is taken up widely and is embedded in respective values and norms (related to social tipping point theory, see section 3.5 about **Diffusion of Innovations**). The role of the paradigm for behavior or system change is also indicated by Göpel (2016) who, however, uses socio-technical transition theory as basis. Similarly, Bouman, van der Werff, Perlaviciute, and Steg (2021) connect the individual and the society level by looking at values. The greater frame of their work is that values connect with individuals' behavior. Actions or behaviors that are supportive or in line with one's own values are understood to be positive, whereas those that are in opposition to one's own values are understood to be negative.

Darnton (2008) refers to **the U-Theory**, which is a theory criticized by some (Heller, 2019; Scharmer, 2020). The U-Theory builds on systems thinking and connects to philosophy and it suggests that change is brought about through a (re-)connection with a higher power. The phases of "letting go" and "letting come" remind of the book of Weintrobe (2021) who advocates the need of mourning to open the way for alternative pathways. Similarly, **Lewin's three stages model** for planned change entails a similar concept: unfreezing, moving and refreezing (Burnes, 2004b). Thus, these models indicate that for change to happen, one needs to let go of old assumptions, world views, and paradigms. Peschl (2007), as well as Dickinson (2009), claim that studying spiritual and / or philosophical scripts may help individuals to achieve a deep transition (see Woiwode et al., 2021). Dickinson (2009), using a **Terror Management Theory** lens, suggests that this may reduce psychological defense mechanisms (see section 5.2), which hinder a deeper transformation. Other tools mentioned by Dickinson (2009) are awareness and mindfulness. This is as rational thinking can reduce irrational behavior triggered by defense mechanisms. However, rational thinking needs to be trained. The first step seems to be being aware of one's own actions and the reasons for those actions. "Making the unconscious conscious is both a cause of and a cure for distal defenses" Dickinson (2009). This once more relates to Bourdieu's habitus which can only be changed through a self-reflection process.

Peschl (2007) connects **Triple-Loop Learning** with the **U-Theory**, indicating that for deep learning letting go is necessary. He points out that for a deeper change to happen one needs to prepare cognitively and emotionally for that change. Again, it reminds one of Weintrobe (2021) who describes the emotionally painful process of mourning. It also reminds one of Edgar Henry. Schein (2002), who emphasized the necessity of cognitively grasping the change and feeling safe enough to actually change. Thus, for a deep change to happen, at least two conditions need to be met: 1) cognitive ability for self-reflection and abstraction, 2) emotional readiness to potentially let go of the known worldview. I argue if this is not the case, psychological defense mechanisms will kick in to prevent a shock to the internal system (Edgar Henry. Schein, 2002). A change in one's worldview can be destabilizing. Thus, it might be a protection mechanism to defend one's worldview from changing. "Of course, this process [of letting go] can cause existential fear on some cases, because one loses the (epistemological) ground on which one is standing and which normally provides a rather stable cognitive framework" (Peschl, 2007).

The connection between the individual, the collective, the mindset, and the system is also acknowledged by the Working Group II contribution to the IPCC Sixth Assessment Report. For example, it is stated that:

*„Transformational changes in the pursuit of CRDPs [climate-resilient development pathways] involve interactions between individual, collective, and systems change (see Figures 18.1–18.3). There are complex interconnections between transformation and transition (Feola, 2015; Hölscher et al., 2018), and they are sometimes used as synonyms in the literature (Hölscher et al., 2018). Much of the transitions literature focuses on how societal change occurs within existing political and economic systems. Transformations are often considered to involve deeper and more fundamental changes than transitions, including changes to*

*underlying values, worldviews, ideologies, structures, and power relationships (Göpel, 2016; O'Brien, 2016; Kuenkel, 2019; Waddock, 2019). Systems transitions alone are insufficient to achieve the rapid, fundamental and comprehensive changes required for humanity and planetary health in the face of climate change (high confidence). Transformative action is increasingly urgent across all sectors, systems and scales to avert dangerous climate change and meet the SDGs (Pelling et al., 2015; IPCC, 2018a; IPCC, 2021b; Shi and Moser, 2021; Vogel and O'Brien, 2021) (high confidence)” (Pörtner et al., 2022 Chapter 18, Page 197f.).*

Within the report (Pörtner et al., 2022 Chapter 16, page 173) it is indicated that instead of a deeper transformation usually only siloed adaptations take place and that there is no means to measure the adaptations or transformations that take place. To this end Table 4 is proposed. The “depth” dimension differentiates among low, medium and high, which could be understood in reference to **Triple-Loop Learning** or to leverage points, which will be discussed next. The table clearly shows that a transformation is understood to take place at multiple levels, that it involves the adoption of completely new practices and complete change in mindsets. Thus, the findings of the IPCC report are congruent with the insights provided within this working paper.

Transformative potential for adaptation			
Dimensions	Low	Medium	High
Overall	Adaptation is largely sporadic and consists of small adjustments to business-as-usual. Coordination and mainstreaming are limited and fragmented.	Adaptation is expanding and increasingly coordinated, including wider implementation and multi-level coordination.	Adaptation is widespread and implemented at or very near its full potential across multiple dimensions.
Depth	Adaptations are largely expansions of existing practices, with minimal change in underlying values, assumptions, or norms.	Adaptations reflect a shift away from existing practices, norms, or structures to some extent.	Adaptations reflect entirely new practices involving deep structural reform, complete change in mindset, major shifts in perceptions or values, and changing institutional or behavioral norms.
Speed	Adaptations are implemented slowly.	Adaptations are implemented moderately quickly.	Change is considered rapid for a given context
Limits	Adaptations may approach but do not exceed or substantively challenge soft limits.	Adaptations may overcome some soft limits but do not challenge or approach hard limits.	Adaptations exceed many soft limits and approach and challenge hard limits.

Table 4: Transformational adaptation, Table 16.1 From IPCC working group II 6th assessment report (Pörtner et al., 2022 Chapter 16, page 173)

Turning to leverage points, Meadows (1999) has formulated twelve leverage points in hierarchical order:

1. The power to transcend paradigms
2. The mindset or paradigm out of which the system arises

3. The goals of the system
4. The power to add, change, evolve, or self-organize system structure
5. The rules of the system
6. The structure of information flows
7. The gain by driving positive feedback loops
8. The strength of negative feedback loops, relative to the impacts that they are trying to correct against
9. The length of delays, relative to the rate of the system change
10. The structure of material stocks and flows
11. The size of buffers and/or stabilizing stocks, relative to flows
12. Constants, parameters, numbers

Abson et al. (2017) applied these leverage points to sustainability transition and added four system characteristics to the leverage points (see Figure 30). According to their scheme leverage points can be summarized in four different groups. Within each group, the leverage points address specific aspects of the system. Leverage points 12 to 10 only address parameters and do, thus, not change the system. In contrast leverage points 3 to 1 have the potential to change the underlying values, worldviews, and paradigms that provide shape to a respective system. The logic of the hierarchies is that there is a trickle-down but no bottom-up effect. Thus, leverage point 1 affects all other leverage points, though leverage point 12 has no effect on any other leverage point. However, Fischer and Riechers (2019) indicate that bottom-up chains could exist. They highlight that research should focus on identifying such bottom-up chains and be cautious with those leverage points that have no potential to achieve deep change.

This leads to another distinction Abson et al. (2017) apply to the leverage points; deep and shallow. This distinction reminds of Newell, Daley, et al. (2021) who differentiate between shallow and deep scaling for behavior change.

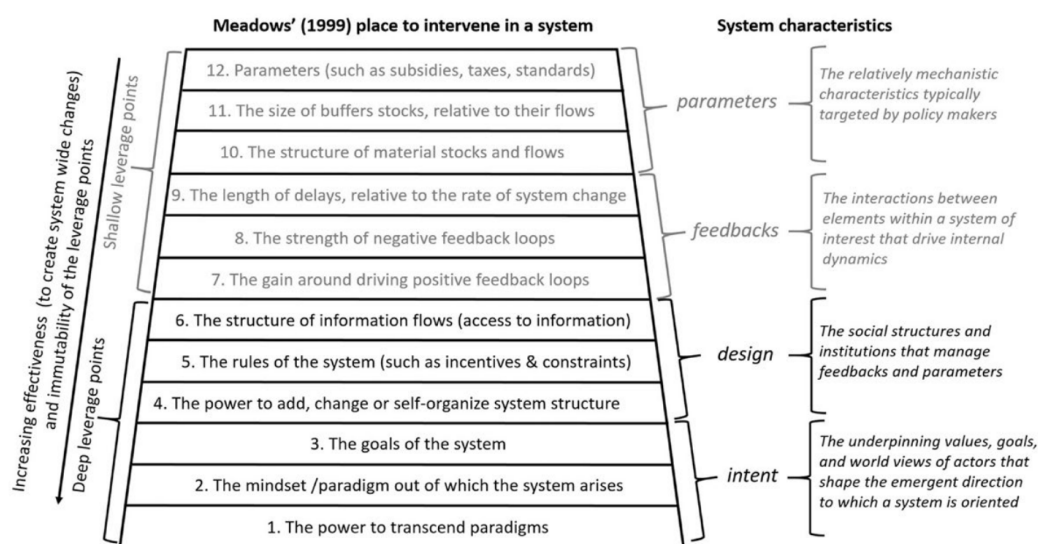


Figure 30 From twelve leverage points to four system characteristics by Abson et al. (2017)

Fischer and Riechers (2019) expand on the work of Abson et al. (2017), not only highlighting that research about deep leverage points is lacking, but also that the scope of the leverage point changes from causal to teleological (see Figure 31). Similarly, to shallow leverage points, causality is far more

often the goal of research endeavors. This is as many models (including systems thinking models) aim at identifying causal relations (or at least correlations). That applies to all behavioral (change) models that have been reviewed for this working paper. For example, **Rational Choice Theory** applies the logic of cause (information) and effect (a specific behavior). What is less often done is identifying the normative foundation for certain behaviors. While this also implies cause and effect the cause is different, as it is not just a cause but rather a purpose that triggers a specific behavior. Fischer and Riechers (2019) state that the elegance of the leverage point concept is “[...] that two frequently conflicting perspectives (causality and teleology) are integrated within one meta-perspective (leverage points) – providing a place where quite fundamentally different modes of thinking can meet.” They also indicate the potential normativity behind agency, thus the ability to influence a situation based on one’s own paradigm (see the discussion about Simon and Bourdieu provided by Collet (2009), see section 2.3). That connects back to the importance of mental models and the potential of being trapped within one’s own **mental model**. It has been indicated that information bias might lead someone to remain trapped in one’s own worldview and that there needs to be a willingness to let go of one’s own worldview (e.g., **U-Theory**). The relevance to acknowledge that in the end, all is just a construct is integrated into the leverage points provided by Meadows (1999). This is what the most powerful leverage point, leverage point 1 is about: The power to transcend paradigms.

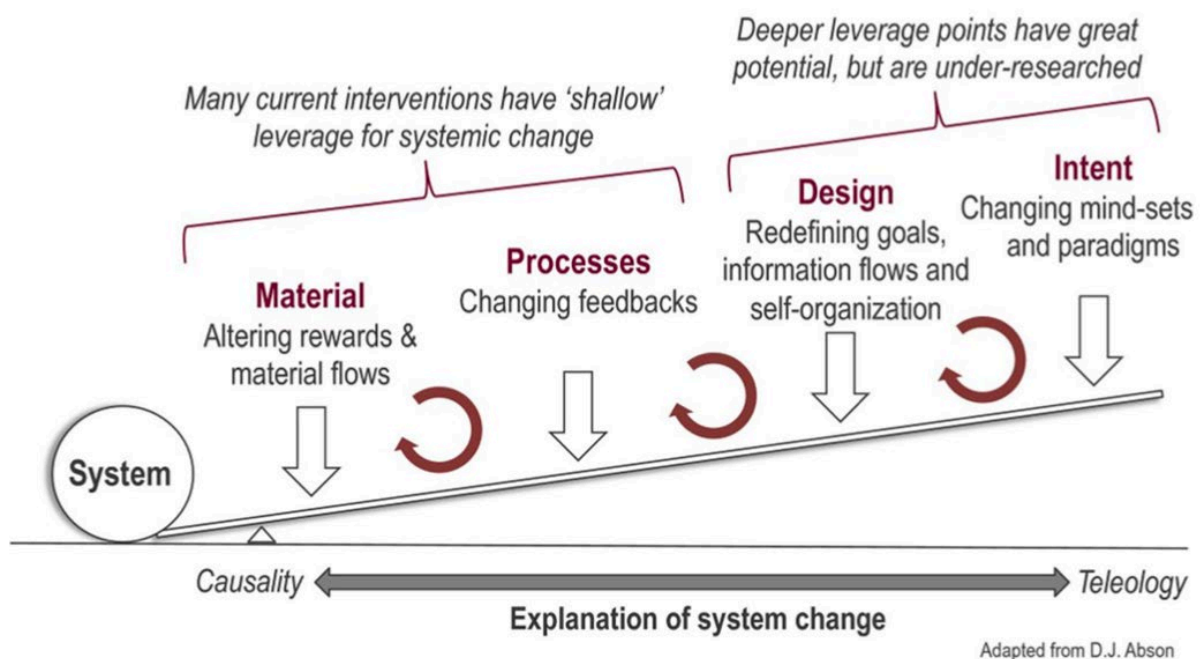


Figure 31: Four realms of leverage points mapped against the Causality Teleology axis, by Fischer and Riechers (2019)

A further adaptation of the work of Abson et al. (2017), and of Fischer and Riechers (2019) is the work by Woiwode et al. (2021) who applied the leverage points to behavioral change. They indicate that it has been acknowledged by scholars that shallow leverage points are insufficient to trigger behavioral change necessary to bring about a transformation. According to the authors, only an inner (deep) transformation can bring about the change needed to achieve sustainability. It requires a shift from technocratic, egocentric worldviews to animated, eco-centric worldviews. Woiwode et al. (2021) also highlight the relevance of spirituality to trigger a deep transition. Furthermore, they also point to the key role of someone’s ability to self-reflect to achieve a deep transition.

Woiwode et al. (2021) make the connection between leverage points and change as learning. Single- and / or double-loop learning is found in the design and process cluster of leverage points (see Table 5).

If that would be amended to include **Triple or Multi-Loop Learning**, it would be in the intent cluster. Thus, once more the connection between circular concepts and deep change is visible. The contribution by Pahl-Wostl (2009) on triple loop learning fits well to this leverage point perspective. He indicates as well that a deep change needs a top-down rather than a bottom-up approach. That is as the paradigm and structures in place hinder changes on process and parameter level. For example, in a world guided by economic growth, absolute resource consumption will never be strived at. The result is green growth, and weak sustainability, rather than strong sustainability or an economic system decoupled from econ growth indicators. On the other hand, he argues that due to the structures in place, reframing of the paradigm may not be possible. Therefore, he concludes that

*“[i]t is assumed that social learning proceeds in a stepwise fashion moving through the phases of single to double to triple-loop learning. Since higher levels of learning are associated with higher costs it is plausible to expect a succession where the next higher level is entered only when constraints at a lower level are encountered” (Pahl-Wostl, 2009).*

Further, he refers to Giddens’ structuration theory where the agent reproduces and re-interprets the structures. By doing so the structures are either maintained or changed.

Woiwode, Schöpke et al. (2021) apply the notion of inner transformation to eco-villages and the transition movement. While this is for sure insightful, it might not provide insights that can be applied to the wider public. Above it has been mentioned that for a deep transition to happen one needs to be emotionally and cognitively ready. Potentially, people who are already part of an eco-village or a transition movement are also ready for a deep transition. To upscale a deep transition people who are not yet ready need to be addressed (Edgar Henry. Schein, 2002). Thus, what is needed is a framework on how to get from shallow to deep scaling, how to get from the parameter cluster to the intent cluster, how to get from single to triple-loop learning. Mindfulness, spiritual practices, or even psychotherapy might for many people not be the right hook.



<b>Realms of leverage</b>	<b>Intent</b>	<b>Design</b>	<b>Processes</b>	<b>Material</b>
Orientation	Leaning more towards teleology	Interlinking teleology and causality	Interlinking teleology and causality	Leaning more towards causality
Exemplary elements from the inner transformation sustainability- nexus, related primarily to individual actors	<p>Integrative/integral, multi-perspectival, pluriversal worldviews</p> <p>Reflective awareness of self and self-realization</p> <p>Perceived human-nature connection Intrinsic/non-materialistic/ pro-social/pro-environmental values Sense of belonging and interconnectedness, compassion</p>	<p>System and design thinking capacities</p> <p>Experimentation capacities Envisioning and ideation capacities</p>	<p>Subjective wellbeing and physical health</p> <p>Personal resilience and burnout prevention</p> <p>Coherence of values, attitude and behavior</p> <p>Disruption of routines and automatic behavior</p>	<p>Individual elements guiding actions effecting the “material”, including:</p> <p>Pro-environmental/ pro-social attitudes and consumer choices</p> <p>Pro-environmental/ pro-social attitudes and overall behavioral choices</p>
Exemplary elements from the inner transformation sustainability- nexus related primarily to collective actors (e.g., organizations)	<p>Integrative/integral, multi-perspectival, pluriversal worldviews</p> <p>Reflective awareness of collective (regarding culture,</p>	<p>Sustainability-oriented innovations Deliberate, adaptive and flexible group attitudes</p> <p>Social learning (e.g., double-loop learning)</p>	<p>Conflict resolution</p> <p>Social learning (e.g., double and single-loop learning)</p> <p>Communication tools and methods</p>	<p>Collective elements guiding action effecting the “material”, including:</p>

	<p>rules, paradigms) and relationality</p> <p>Social learning (e.g., triple-loop learning)</p>	<p>Value-based organization (based on intrinsic, universal and relational values, including social justice and equity)</p>		<p>Sustainable consumption practices (shared)</p> <p>Social activism</p>
--	--	--	--	--

Table 5: Conceptualizing the depth of leverage of various elements, exemplary of the inner transformation-sustainability-nexus Woiwode, Schöpke et al. (2021)

## Box 1: Reflection on change-Identity

### Reflection by the author on the connection between practices and identity

A friend and Yoga-teacher posed the other day how to achieve your goals. He stated that one should not so much focus on the end-goal but rather set out a specific plan for action. Thus, if you want to do yoga more often, decide which days, decide how you can make room for it in your day-to-day life, set out a precise time, decide where you practice, etc. I was a yoga practitioner for many years. Only Ashtanga yoga could make me **practice** yoga on a regular basis. The reason is that Ashtanga yoga is rigid. You do the same thing, every day. While that may seem to be boring it reduces the cognitive burden and energy needed to step on your mat. It becomes a heuristic and thus it is easier. The heuristic is provided by the specific yoga practice. The teachers tell you, just step on your mat and see what happens. By stating this, they reduce the stress, the expectation. They also reduce the need to overthink it. Just do it, so to say. This applies to many changes I made in my life. The likelihood of a change to become a new habit is higher if I set out a precise plan.

The same might also help for **Triple-Loop Learning**. Woiwode et al. (2021) report about the importance of mindfulness practices for the inner transformation. That reminded me of yoga once more. Mindfulness is a crucial part of yoga. The end goal is enlightenment. Yoga provides precise steps to follow that may increase the chance to get enlightened. These are practical steps. There is no need to overthink the path, you just do it. There is for example plenty of guidance on meditation. A common recommendation is to do it every day but just for 5 minutes. Thus, an easy entry point is provided. Furthermore, when I think of religious **practices**, they all have an element of regularity, or habit. One goes to church on a specific day at a specific time. The mass also follows a specific repetitive sequence. Or one prays every day at a specific time in a specific manner.

The term practice is highlighted as the above text also indicates the connection to **Practice Theory**. Praying is not a behavior; it is a practice. Mindfulness is not a behavior; it is a practice. More on that later. I have been doubting if a bottom-up approach to leverage points exists. Yoga provides an example of such a bottom-up approach. The practice (at least in Ashtanga) starts with the *parameter* cluster (see leverage points). One should only do the asana practice, no other practice. After some time, other practices such as pranayama or meditation can be added. This is as the system (the body and the mind, but also the day-to day life) needs to be ready for these other practices. By doing the practice feedback loops are changed and added. The simplest example is, doing the practice is rewarding. The body supplies endorphins, and one wants to repeat it. The practice becomes more and more important (I suppose due to the feedback loops), and the structure of the system changes. Not only the body changes due to the regular practice, the day-to-day life too. One may start to make more space (time) in one's life to accommodate the practice. Priorities shift. With a shift of priorities, the intent changes as well. In the beginning one did yoga to get in shape or to relax, etc. But once fully emersed this is no longer of prime relevance.

The mental aspect is part of the yoga practice right from the start, but one does not realize it. I suppose that is the trick. One is doing the same thing every day. It is a mediation in movement. The mind wanders, but at some point, self-reflection happens. Maybe it starts with thinking about one's own body as one is confronted with the bodily limitations and aspects that one may not like. But that disappears after some time and other thoughts become more prevalent. Thus, potentially there is a bottom-up way to change the mindset through action?

## 3.5 Change through social networks

*„[E]volutionary biology tells us also that people are inherently social animals, and that 'self-interest' is far more complex than once assumed. Under the right conditions, we excel at*

[Type here]

*cooperation, seek reciprocity, and act on the basis of social cues. And we have learned that our decision-making process is strongly influenced by the contextual environment in which we make decisions and the way choices are presented to us” (Williamson et al., 2018).*

Similarly, in a report by the Worldbank (2015) it is acknowledged that humans are social animals, that “[o]ur beliefs, desires, and behaviors are affected by social preferences, our relationships, and the social contexts in which we live and make decisions.” Further, it is indicated that humans consider group views as well as their own individual views when decisions are taken. Nielsen et al. (2021) highlight that behavioral change interventions often neglect the social aspect of individuals. Usually, the focus of studies is the individual, and behavioral change is still merely connected to values and attitudes. However, they argue that social and physical structures, social norms, and rules impact human behavior. Therefore, they suggest considering the social arena as well as different power structures, agency, and the different roles people take up within this social arena.

It needs to be highlighted that many theories which consider the social realm as part of human behavior still focus on individual behavior (Jackson, 2005). Thus, not group behavior is investigated, but how the group affects the individual and at times also vice versa. The figures presented below (Figure 34, Figure 35, Figure 38) place the individual at the center. The respective analytic approaches attempt to understand how the individual is affected by the (social) environment. Group behavior is yet another research field, which is not covered in this working paper.

A reason for the focus on the individual could be the history of behavioral science and its connection with neo-liberal economics and hence Newtonian thought. Another reason for the predominance of models and theories that focus on the individual could be that since the 21<sup>st</sup> century we are living in an individualistic society. According to **Cultural Theory**, there are only four different types of societies: fatalist, individualist, hierarchist and egalitarian. These four can be mapped on two axes; group and grid (see Figure 32). How we organize as society has major implications on, for example, our values. It might be a chicken and hen question, which is not discussed here. However, a society that can be characterized as individualist applies different values and norms than a society that can be characterized as egalitarian. This may even explain that analytical lens that is predominantly applied (Ward, Jackson, Russell, & Wilkinson, 2008). In that sense, a culture might fall prey to confirmation bias. Our culturally shared worldview is reproduced by the way we systematically analyze the world we live in. It may also relate to Bourdieu’s notion of **habitus** where we are not questioning the worldview we are having as this worldview is what is constantly reproduced, and which is thus understood to be the only right way to see the world.

**Cultural Theory** can also be applied to the individual in the sense that people prefer one type of organization over another one (Thompson, Ellis, & Wildavsky, 1990). Hence, these four types then represent four different individual psychological types present within a society. These types can be connected to different worldviews and respective values (egoistic, altruistic, biospheric) that people have. These worldviews and values can further be connected to, for example, how people perceive nature or which type of social organization they prefer. Implications for interventions and policies that **Cultural Theory** would suggest are non-trivial. For example, cultural theory questions whether interventions should be adapted to a specific cultural type or if a cultural type needs to be changed in order to change the behavior of individuals (Jackson, 2005).

[Type here]

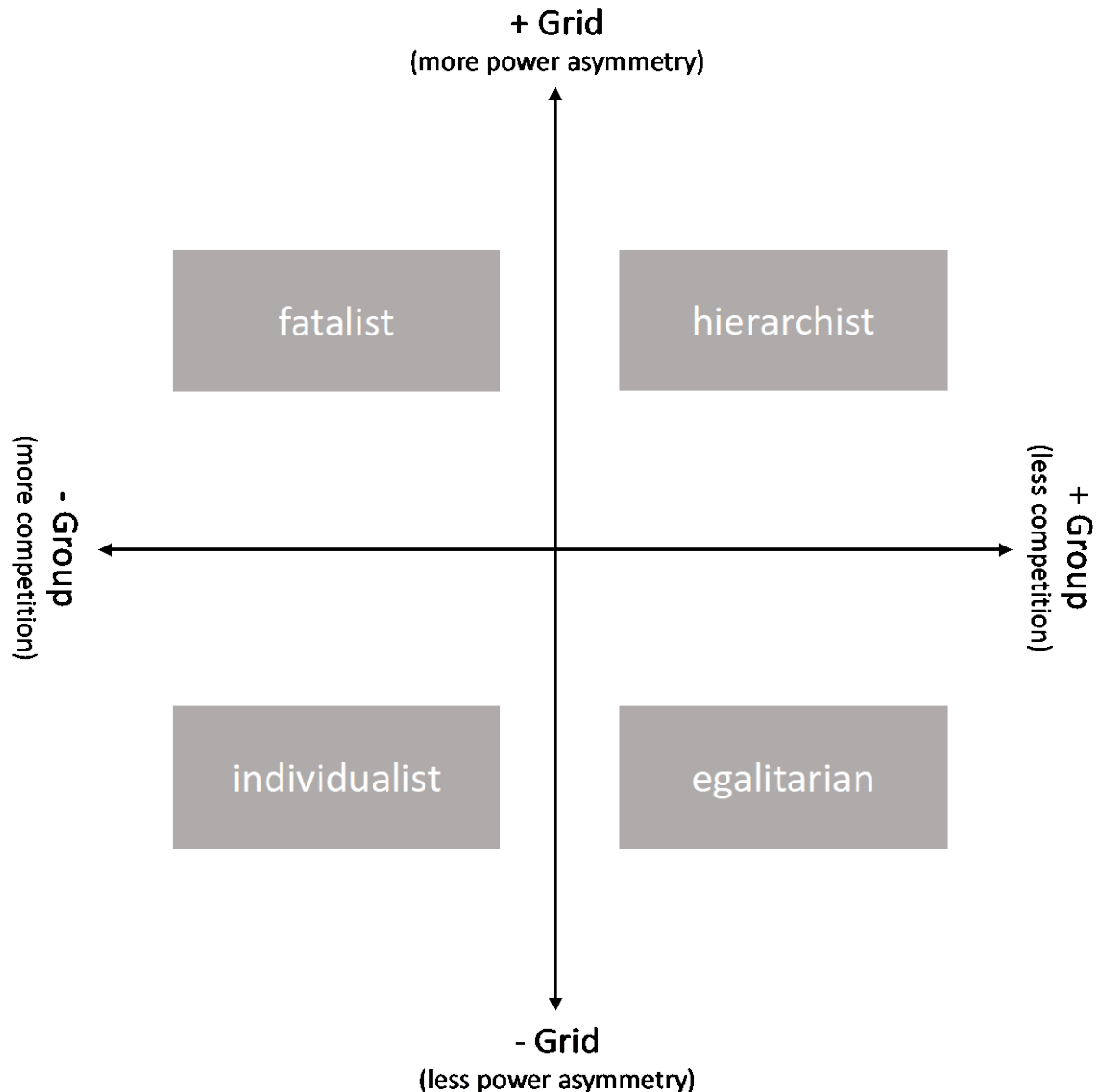


Figure 32: Cultural Theory's Typology of Social Organization and Cultural Type, compare with Jackson (2005) and Thompson et al. (1990)

Building on Bourdieu's concept of **habitus** Kasper (2009) develops the concept of ecological habitus. Bourdieu's work on habitus focuses on reproduction, rather than on change. Norbert Elias' conception of **habitus** is much more focused on change than on reproduction. That is even if the constant (re-)creation of **habitus** is also core to Elias' conception of **habitus** (Connolly, 2016). Kasper (2016) explains how the concept of **ecological habitus** can be used to understand change. She seems to combine a Bourdieuan and Elian approach to **habitus**, stating that change, as well as continuation, can be explained by the past, which was itself a product of habitus (see Figure 33). Past behavior does not only reproduce into the future it also builds the basis for future disruption (Connolly, 2016). "Because the conditions at any given moment are chronologically and otherwise dependent on the accumulated circumstances of past moments, social change does exhibit a kind of order, discernible in long-term trends" (Kasper, 2016). Kasper (2016) points out that since the formation of **habitus** needs context, if the context is altered (intentionally), the **habitus** can be influenced. Hence, similar as discussed in section 5.6 about habits, habitus is curse and cure at the same time.

[Type here]

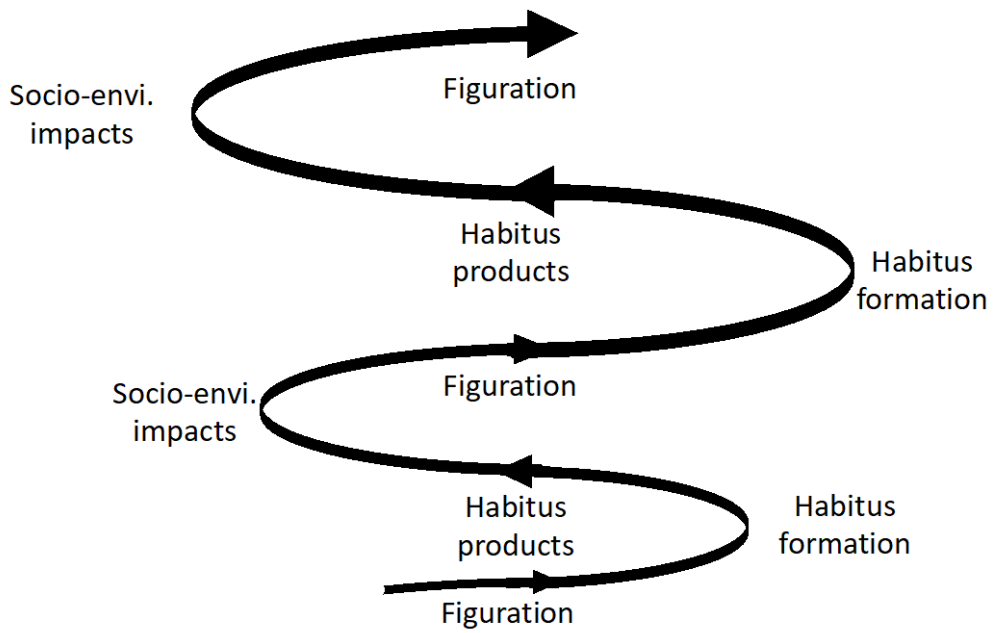


Figure 33: Socio-environmental processes over time, by Kasper (2016)

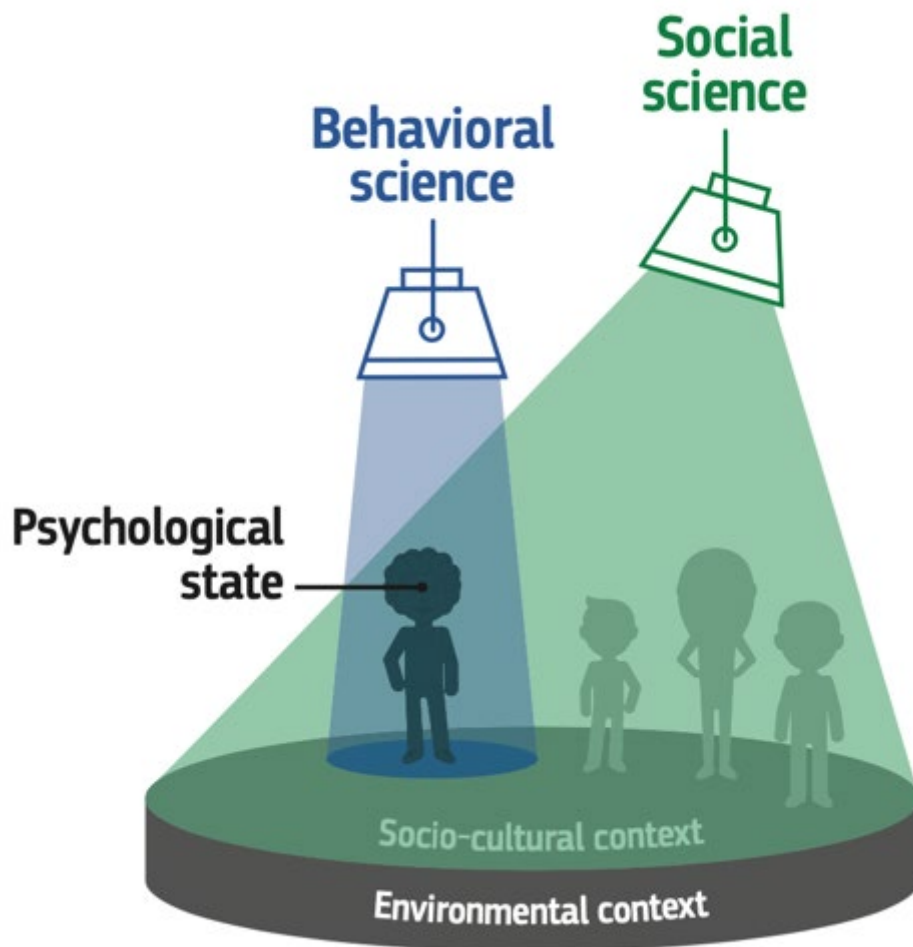


Figure 34: Combining psychology, behavioral science, and sociology, from Bujold, Williamson et al. (2020)

[Type here]

Bujold et al. (2020) provide Figure 34 to illustrate how the combination of psychology with social sciences enriches the analysis of human behavior. The social science perspective adds bidirectionality to the understanding and analysis of human behavior. Though, the illustration actually, indicates the difference between the psyche, the behavior, and the social context in which behavior and psyche are embedded.

A similar depiction is provided by Darnton and Evans (2013) see Figure 35. The illustration depicts the ISM tool, which is intended to be used by policymakers and other practitioners who want to influence behavior and bring about social change” (Darnton & Evans, 2013). The ISM tool expresses that to influence people’s behavior not only the individual sphere (I) needs to be considered. Additionally, the social environment (S), as well as the material context (M), needs to be considered. This approach has similarities with practice theory (see section 3.7) as it understands that the material context can facilitate or hinder a certain behavior. Furthermore, the tool combines behavioral economics (utilitarian perspective), social psychology (normative perspective), as well as sociology (practices).

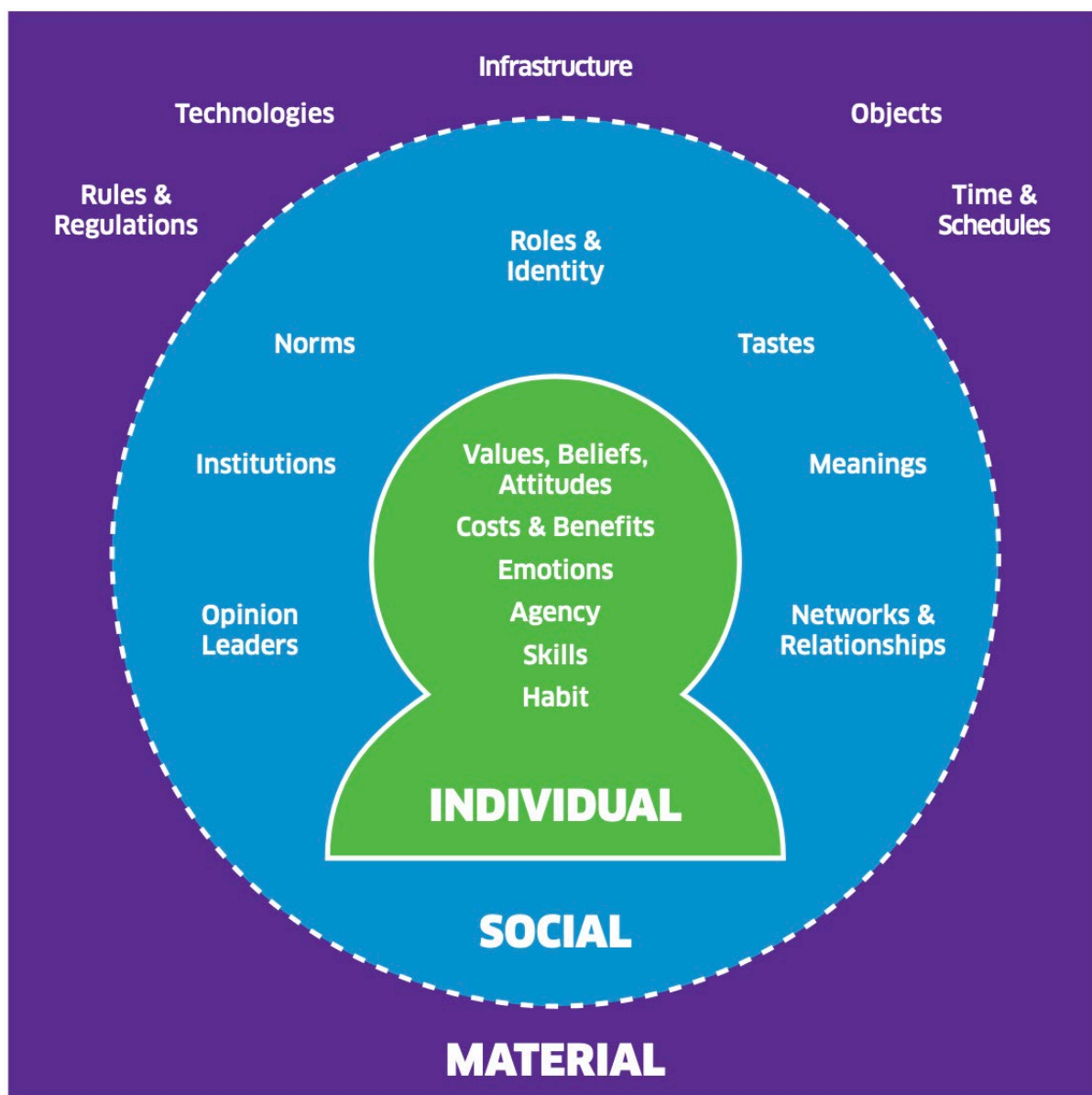


FIGURE 35: ISM MODEL BY DARNTON AND EVANS (2013)

In a report Darnton (2008), discusses and categorizes over 60 different socio-psychological models to understand human behavior. Describing different models he distinguishes between psychological

[Type here]

factors (which are of course not strictly disconnected from the environment), external factors, and social factors. Darnton (2008) points out that “[b]eing concerned with the psychological factors which influence behavior, most social-psychological models do not explicitly feature external factors. Like preferences in standard economic theory, external factors tend to be left ‘off the model’.” He further states that these external factors are often hidden in other variables such as agency. **Practice theory** will be discussed later, however, it can be highlighted that Darnton (2008) provides **Practice Theory** as an example of how socio-psychology can be combined with external factors. Nevertheless, standard interventions based on choice architecture might also take the social nature of humans into account. Nudges may make use of socio normative standards to push people into behaving *normal*, behaving in the socially accepted way (Heiskanen & Laakso, 2019).

A classic theory about individual behavior and the social group is **Social Identity Theory**, which is about an individual’s identification with an in-group. Hence the individual distinguished between those who are part of the group and those who are not. Specific characteristics and behaviors that are shared by the in-group members unite the group. Since humans are social animals, humans tend to exhibit behavior to become or remain part of a desired social group. This desire to belong to a group can then inhibit or support certain behaviors (Jackson, 2005). This relates to the concept of peer pressure, where for example, an adolescent may start smoking to become part of a specific group. Jackson (2005) points out that Bourdieu’s **Theory of Social Distinction** represents an example of how our behavior, and how we represent ourselves within the world is a marker of our belonging to a specific class. Then for example, if one wants to belong to the upper-class one may have to drive an SUV. Another connection to the social sphere and Bourdieu is provided by Kasper (2009) who discusses the notion of ecological habitus. Bourdieu does not present **habitus** as a stand-alone concept, he rather connects it to the concept of field and capital. Some understand social movements as a specific field in which a specific habitus can be expressed. This might be the reason why certain pro-environmental behaviors are easier to follow when one is embedded within a specific social movement.

To highlight the relevance of the social realm Darnton (2008) refers to the work of Lewin. Lewin’s rich work cannot only be viewed from a habit perspective (see section 3.6) but also from a social perspective. The group setting is key for behavioral change in **Lewin’s Change Theory**. The environment has not only the power to initiate habitual change, it is also vital for forming a new habit. If the conditions are not right, it might not be possible to form a new habit.

The world bank does underscore the usefulness of combining psychology with sociology as well. “The possibilities and limits of this approach – based on viewing people more fully and recognizing that a combination of psychological and social forces affects their perception, cognition, decisions, and behaviors – are not yet completely known” (Worldbank, 2015). Bujold et al. (2020) understand that humans are part of social networks and that humans shape and are shaped by these networks. Thus individuals are not only subject to the forces of social networks but have the power to influence and change these networks. The concepts of agency and power dynamics become relevant in this regard (Bujold et al., 2020). Bujold et al. (2020) point out that the social systems perspective allows seeing the dynamics between actors and social structures. This allows to integrate more complexity and provides a more comprehensive understanding of the environment in which humans act and take decisions. In a Worldbank (2015) report it is indicated that dynamics can be the result of the social nature of human beings. They state that “[s]ocial preferences and social influences can lead societies into self-reinforcing collective patterns of behavior” (Worldbank, 2015). Bujold et al. (2020) also highlight the importance of the structures in which behavior takes place. To support behavioral change, these structures need to be considered as they can enable or hinder change. Furthermore, they integrate the idea of tipping points, as well as, positive and negative feedback loops into their exploration of behavioral change.

If individuals are part of a societal environment, which is structured in a certain way, the question is whether the relationship between individuals and structure is uni- or bidirectional. Thus, do, for example, only individuals influence structures, or are individuals and structures influenced by each



[Type here]

other mutually? Williamson et al. (2020) make the following statement giving indications about the directionality of the relationship:

*“The actors we aim to influence do not exist in a vacuum. Their ability, as well as their interest in taking a target action, is not determined simply by their own mental processes: **it is just as significantly determined** by the wider cultural context that enables and limits these actors’ actions. An understanding of this wider cultural context goes beyond the generalities of how a group acts or what they believe. It involves identifying the systems of power, institutions, and structural forces **that shape actors’ identities and social roles**. This has implications for constructions of gender, race and ethnicity, socioeconomic status (SES), and religious affiliation – and that, in a given context [emphasize added].”*

This passage indicates that Williamson et al. (2020) ascribe the societal context more power over human behavior than the other way around. It needs to be noted that the authors focus on human behavior, and they may thus look for first-order (direct) influences, instead of for second-order (indirect) influences (see Figure 36). Accordingly, they might be more interested in how human behavior is influenced, rather than how behavior influences the environment (which then, in turn, may influence human behavior). If one would look for indirect influences, understanding how human behavior influences society might be relevant (see closed models). Though, it needs to be mentioned that this linear approach to human behavior is commonplace in social psychology. Burr and Dick (2017) for example, point out that some social psychologists understand “people as self-contained individuals who exist prior to social life.”

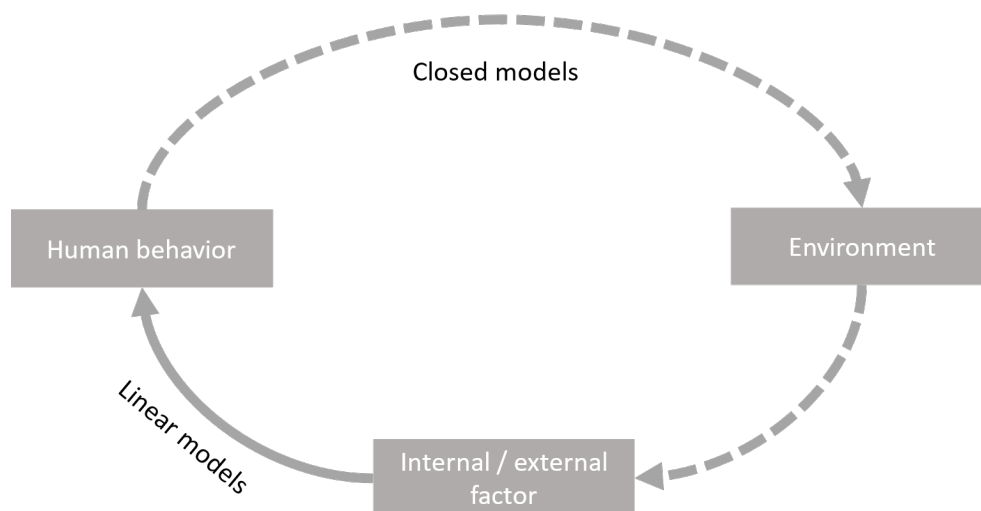


Figure 36: Linear versus closed models. Linear Models examine the relationship between the environment and human Behavior. Closed Models also investigate how behavior affects the environment, which in turn affects human behavior.

The unpredictable dynamics of social interactions on different levels is outlined by Schmidt and Stenger (2021). They argue that **Behavioral Design** can overcome shortcomings of behavioral science that focuses too much on static empirical experimentation to suggest behavioral interventions. Generally, “[d]esign means attempting to change existing situations into preferred ones” (Klotz et al., 2018). “[B]ehavioral planning can address behavioral science’s limitations by helping us speculate on how the presence of an intervention we’ve implemented will intervene in that system, and how the presence of other conditions within the system are likely to deform intervention effectiveness” (Schmidt & Stenger, 2021). Figure 37, illustrates the approach provided by Schmidt and Stenger (2021). It needs to be noted that ecosystem does not refer to the natural ecosystem, but to the general environment in which behavior takes place. What is interesting in their model, is the bidirectionality of their model; interventions as a result of environmental circumstances, and interventions changing environmental circumstances (which may then call for new interventions, etc.). It is this dynamic that calls for a continuous re-evaluation of interventions. In their model, they include the individual and

[Type here]

the larger environment, both of which can adapt to changing circumstances (which may have been caused by interventions). Further, they include two types of changing circumstances, those formally imposed by e.g., rules and regulations, and those naturally evolving (from the natural environment as well as from the social environment).

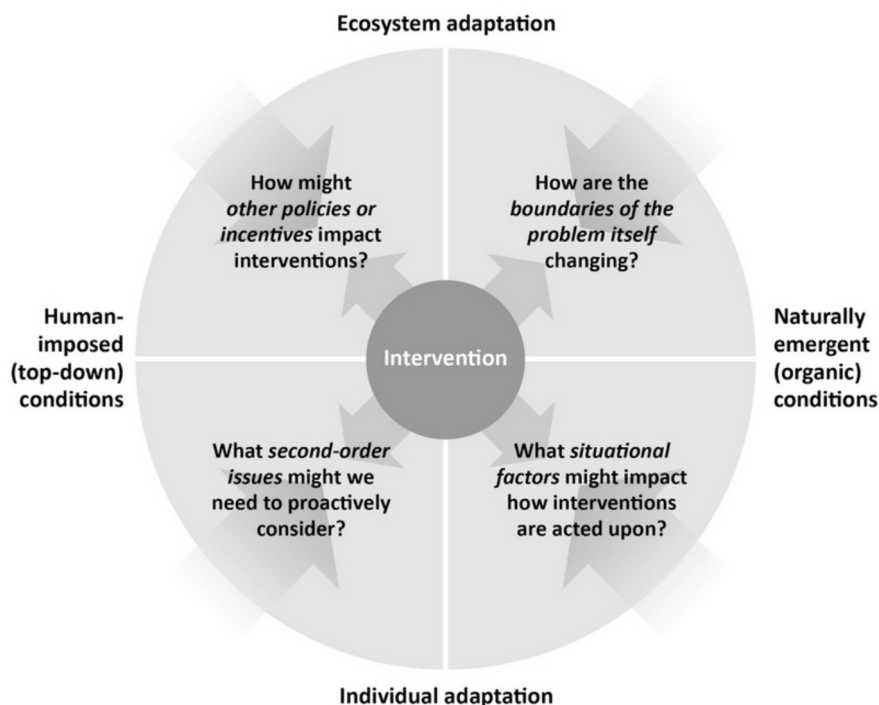


Figure 37: Intervention forces model for behavioral planning, from Schmidt and Stenger (2021)

Bujold et al. (2020) also apply a **Behavioral Design** perspective. They state that behavioral design is a blend of design as well behavioral and social sciences. They present it as a tool that does not only allow to target the individual, but also the larger system (RARE, 2021). Thorpe and Gamman (2011) also suggest societal co-creation or co-design to support societal change. Though, it needs to be stated that design for behavior change is a broad field that does not necessarily deal with the social sphere. For some design for behavior change is about overcoming unwanted habits and making people overcome, for example, the intention-action gap (Wendel, 2020). Similar to **nudging**, one could suspect that **Behavioral Design** is manipulative. Even if it could be used in that way Wendel (2020), highlights that it should only be used to, for example, close the gap between intention and action. Thus, behavioral design intends at helping people to execute intended behavior. Design for behavior change is often found in the area of product development, but it is also an emerging area in transition research<sup>8</sup> (Ceschin & Gaziulusoy, 2016; Design for Transition, 2022; Irwin, 2015; Tonkinwise, 2015).

Another approach that could help support behavioral change in context with the social realm is **Critical Social Psychology**. It is critical as it questions the constructivist and normative approach to psychology and knowledge production. Accordingly, it also questions the power structures that are (re-)constructed within our social reality (Adams, 2014; Burr & Dick, 2017; Gough, 2017). The acknowledgment of constructivism relates to the discussion above about self-reflection and questioning one's own worldview and values. However, the construction of one's own worldview is in critical social psychology understood to be related to the social environment one is embedded in. The

<sup>8</sup> The author of this working paper has participated in three workshops organized by DRIFT about design and transition. The question of how transition research and design research / thinking are connected or can be connected were discussed in these workshops. Thus the connection between those two is in an exploratory stage. See also: <https://rdsymposium.org/professor-dr-derk-loorbach/>

[Type here]

social environment provides discourses that influence or even determine one's personal worldview (Burr & Dick, 2017). Growing up in a certain environment, we get socialized in a certain way and learn what is *good* and *bad*. However, what is good and bad is not a fact, but a discourse. Thus, we may not only reflect on our own worldview, but also on the society's worldview. Burr and Dick (2017) refer to Foucault who suggested "that one of the most effective modes of modern governance is disciplinary power or, to grossly simplify, the desire of individuals to conform to norms in society. Discourses of personhood, for example, produce ideas about what 'normal' people should be like." This relates to heuristics, such as the descriptive norm (see section 5.4.14). Hence, people do not only need to overcome internal hurdles to change, they may also have to overcome or at least accommodate external hurdles to change (e.g., being ok with being odd, being abnormal, being an outsider).

*"One potentially troubling consequence of social constructionist philosophy is that it leads us to the position that there is no definitive 'truth' to the nature of the world or of people. Rather, what we take to be true at a given point in time cannot be divorced from the processes of power outlined above and their relationship to language. This means that if we are going to embrace a social constructionist philosophy, we also have to accept that there are multiple perspectives on any given event, person or object and that which perspective is currently accepted as correct is more a matter of politics and power than of some attribute of the perspective itself"* (Burr & Dick, 2017).

Adams (2014) states that in the past psychology sought the role of behavioral change in individuals' consumption. Individuals were seen in isolation and the barriers and drivers to behavioral change, or the uptake of certain behaviors was studied. He points out that critical social psychology could help to get a more nuanced view of human behavior. This is as critical social psychology understands the individual as part of the social, thus not in isolation (Burr & Dick, 2017; K. Day, Rickett, & Woolhouse, 2020). Adams (2014) uses the approach of social embeddedness of experience or "social reality as the product of social interaction, reflecting more explicitly a social constructionist and interactionist epistemology."

Baum and Gross (2017) explore behavioral change in their publication: "Sustainability policy as if people mattered: developing a framework for environmentally significant behavioral change." They address the shortcomings of bottom-up and top-down approaches and argue that a combination of both approaches is needed (compare with the discussion about bottom-up and top-down in section 3.4). Baum and Gross (2017) provide two examples for the relevance of studying the interaction between human behavior and the social system. First, humans may be locked in specific choices as the environment does not provide alternatives or makes change difficult. Second, the attitude-behavior gap indicates that people do not act according to their own pro-environmental behavior. The reason for the existence of this gap might be found in the societal system. Baum and Gross (2017) argue that a behavioral change might be easier to implement if such behavior is supported by the wider context within which a specific behavior is taking place. Worldbank (2015) similarly indicates the potential lever that society could have on an individual's behavior. "Sociality is also a lever for new types of development interventions that harness the tendencies of individuals to seek social status, to build and maintain social identities, and to cooperate with others under certain conditions" (Worldbank, 2015).

While Baum and Gross (2017) acknowledge that humans have the power to influence the wider context in which they are embedded, they also highlight the limits of such influence. This is illustrated in Figure 38. In reference to Figure 38 they argue that the greater the distance between context and the internal factor, the more difficult it becomes to influence the respective context. It is relevant to outline the limitations of individual behavior in changing the context in which behavior takes place. This does illustrate, that policies aiming at changing an individual's behavior are also limited in providing a deep transformation. Once more this connects to the question of top-down or bottom-up. This has also been discussed in section 3.4 in relation to **Systems Thinking** and leverage points. It will be again discussed in section 3.6.

[Type here]

I want to draw the reader's attention to the similarities between Figure 34, Figure 35, and Figure 38. In all figures psychology (internal factors) build the narrowest focus. Behavioral science in Figure 34 is the "individual-level context" in Figure 38. This area goes beyond the body and includes external circumstances. Social science in Figure 34, is the "socio-cultural context" in Figure 38 and encompasses the social environment in which individuals are embedded. Main differences between Figure 34 and Figure 38, are that the techno-economic context in Figure 38 does not exist in Figure 34, and the environmental context does not exist in Figure 38. However, the socio-technical context does exist in Figure 35. Remarkably the environmental context is depicted as the foundation of the societal and individual sphere in Figure 34. Thus, the environmental context is the cross-cutting base for human life. There is neither a reference to the environment in Figure 38 nor in Figure 35. Moreover, the way Figure 38 is illustrating different contexts, it seems as if the techno-economic context determines (because it encompasses) the socio-cultural context. Thus, technology and economy together are understood to shape culture and societies and not the other way around. Darnton and Evans (2013) (Figure 35) indicate that their illustration of the ISM tool is also the result of some pragmatic decisions. That is, as certain aspects of the illustration could have been depicted differently. They state:

*"[...] ISM should be understood as a pragmatic arrangement of diverse approaches to understanding behavior in order to create a practical tool that makes the most of the different thinking that the disciplines have to offer. For theoretical purists, it is understood that the tensions within the model may be insurmountable. However, the purpose of the tool is not to find a way of unifying the theories, but rather to cut across them to create something derived from multiple disciplines which practitioners can use to achieve new insights and ultimately maximize behavioral impacts" (Darnton & Evans, 2013).*

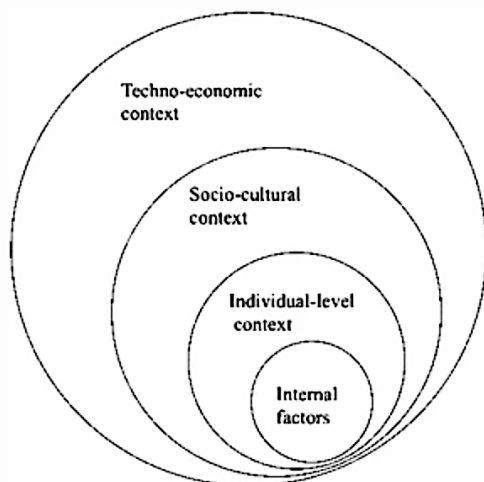


Figure 38: Internal and contextual factors of behavior, from Baum and Gross (2017). The layered understanding of internal and contextual factors that influence decision making outlines the complexity of each decision (see Table 6).

The work of Baum and Gross (2017) resonates with the work by Bouman et al. (2021) who write about the relation between individual and group values. "Making people aware that others also strongly value the environment could be a critical strategy to motivate climate action, particularly for individuals that are not strongly personally motivated" (Bouman et al., 2021). Similarly to Baum and Gross (2017), Bouman et al. (2021) understand the group to be key for influencing individual behavior. However, this is not the case for everyone, as Bouman et al. (2021) indicate. Bouman et al. (2021) argue that biospheric values are most important for climate actions and that people who do have such values self-identify in line with these values. Self-identification may be also built based on past actions. This idea connects to the relevance of habits, which are discussed below (see Figure 42, I act because I am). Bouman et al. (2021) suggest endorsing past pro-environmental behavior to strengthen people's

[Type here]

self-identification as environmentally friendly. This is an interesting conclusion since it would indicate that the relevance of the contextual layer may depend on someone’s values.

The limitations of human behavior and the connection to the wider context are also indicated by Newell, Daley, et al. (2021). While they highlight the relevance of human behavior to facilitate a sustainability transition, they also acknowledge that humans are locked-in certain structures (something similar is also stated by the Worldbank (2015)). Though they generally refer to the lock-in of societal dynamics, without the reference to structures). Thus, if the role of the individual level is overemphasized, individuals are pushed beyond their possibilities, a situation which may lead to frustration (compare agency, self-efficacy, and locus of control). The idea that different structures are easier or harder to influence by individuals is also shared by Newell, Daley, et al. (2021). They call the political economy the “critical context within which individuals operate, and therefore, behaviors is understood to be driven and circumscribed by social, political and physical structures, which are slower to evolve and harder to disrupt.”

CONTEXTUAL LAYER	BEHAVIORAL DETERMINANT	I WILL PROBABLY TAKE THE BIKE SINCE...
<b>INTERNAL FACTORS</b>	Preferences  Attitudes Intentions	...I prefer cycling over driving for a number of reasons (e.g. it is healthier, cheaper, and more friendly to the environment). ...I just like cycling. ...all the circumstances are right and that is what I had planned to do anyways.
<b>INDIVIDUAL-LEVEL CONTEXT</b>	Income Time  Knowledge  Habits Identity Values	...I cannot afford a car. ...I’m not in a hurry today. And often, during rush hour, cycling is even faster! ...I am aware of the health benefits of cycling. I also know that car driving is among the most environmentally impactful behaviors, so I attempt to drive less whenever possible. ...I cycle to work every day and therefore don’t even consider driving anymore. ...I consider myself an environmentally responsible person. ...I’m a person who generally cares a lot about society and nature. To me, the desire to have one’s own car is somewhat egotistical.
<b>SOCIO-CULTURAL CONTEXT</b>	Socio-demographic factors Social norms  Personal norms	...I do not live far from where I work.  ...all my neighbors cycle, which puts some pressure on me. ..., after observing other members of my family cycling and being encouraged to take the bike as well, I now feel somewhat obliged to do so—even if they occasionally are themselves too lazy to take the bike!

[Type here]

	Status	...Green is the new Black. In fact, I sometimes make a detour on my way to work to make sure others will see how environmentally responsible I am.
<b>TECHNO-ECONOMIC CONTEXT</b>	Policies and regulations	...it is becoming more difficult to drive to work given the greater incidence of car-free days and limitations on use of cars in the downtown area where I work.
	Institutional framework	...I sense a general trend towards sustainability. One day I might be glad that I started questioning my detrimental impact on the environment so early.
	Technology	...the invention of E-Bikes has made cycling much easier for an elderly person like me.
	Infrastructure	...there are nice and safe cycling paths that pass directly by where I work.
	(Relative) prices	...gas prices have increased so much that I only drive when there is really no other option.

Table 6: Should I cycle or drive to the office today? (Baum & Gross, 2017)

Chatterton and Wilson (2014) provide a framework for choosing relevant theories (see **Figure 51**). This framework contains four different dimensions: actor, domain, durability, and scope. Scope expresses whether an action is connected to other behaviors. In that sense, there is a practice theoretical connection. Durability is about the long-term impact of an action. The domain indicates if an action is connected to e.g., technology, or environmental aspects. Finally, the actor dimension distinguishes amongst others between an individual actor and group actions. Hence this framework also acknowledges the potential interconnectedness and complexity of behavior.

Several socio-psychological behavioral models include society to some extent, though mostly as some sort of benchmark to which an individual's own behavior is compared. For example, Darnton (2008) refers to work from Katy Hobson (2001) where she found that people participated in an initiative not because they wanted to reduce their environmental impact but because they wanted to compete with other participating households. The concept of descriptive norms also suggests that people act to comply with the norm (Bissing-Olson, Fielding, & Iyer, 2016; Gelfand & Harrington, 2015; J. R. Smith et al., 2012).

As outlined above, due to the linearity of many models, how behavior affects society is often omitted. It is also indicated that practice theory closes this gap. However, in his review of socio-psychological theories, Darnton (2008) does refer to another theory that explains how individual behavior affects society; **Diffusion of Innovations** by Everett Rogers E. M. Rogers (2004). The **Diffusion of Innovation Model** includes the idea of tipping points. The notion of tipping points refers to the idea that a transition accelerates once a critical mass has been reached. "The rate of adoption of an innovation in a society is determined by a combination of the nature of the network, and the attributes of the innovation." Apart from this whether or not an innovation is taken up, is decided in a 5 step process "comprising of 'knowledge of the idea', 'persuasion', 'decision', 'information' and 'confirmation'" (Darnton, 2008; E. R. Rogers, 1983). The **Diffusion of Innovation Model** is relevant for the social context, since

*"[...] diffusion occurs within a social system, because the social structure of the system affects the innovation's diffusion in several ways. The social system constitutes a boundary within which an innovation diffuses. [...] The structure of a social system can facilitate or impede the diffusion of innovations in the system. The impact of the social structure on diffusion is of special interest to sociologists and social psychologists, and the way in which the*

[Type here]

*communication structure of a system affects diffusion is a particularly interesting topic for communication scholars” (E. R. Rogers, 1983).*

Further, E. R. Rogers (1983) was aware of the role of norms, change agents and the role of leaders. He described norms as behavioral patterns adopted by the members of the social system.

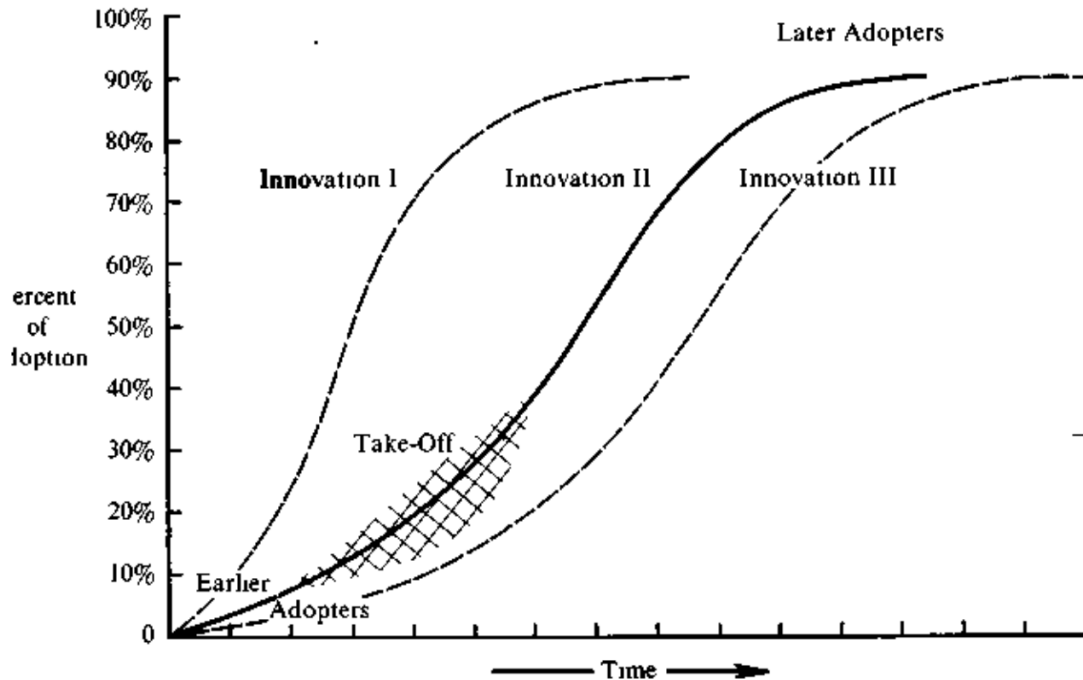


Figure 39: S-curve of the Diffusion of Innovation, from E. R. Rogers (1983)

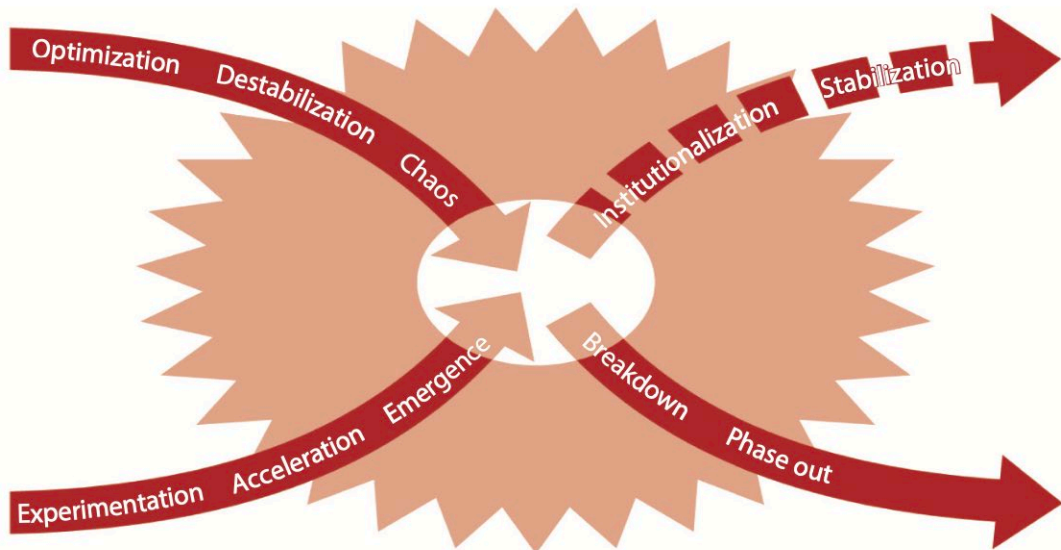


FIGURE 40 THE X CURVE BY LOORBACH, FRANTZESKAKI, AND AVELINO (2017).

Roger’s theory has mostly been applied to the uptake of technological innovations, though, Darnton (2008) states that Roger applied it also to behavioral science contexts (E. M. Rogers, 2002). The reason for the **Diffusion of Innovation Model** not being more widely applied to behavioral science contexts might be due to it being overly simplistic. Darnton (2008) criticizes the **Diffusion of Innovation Model** for being linear and based on a **Rational Choice Model**-like thinking. The **Diffusion of Innovation Model** is based on the simple idea of one technology substituting another one, without addressing resistance to such a substitution. “The fundamental point to note about the theory, which Rogers

[Type here]

acknowledges, is that it was developed to explain the adoption of new products and technologies by society. There is little evidence that it is appropriate for understanding how behaviors spread through a society” (Darnton, 2008).

The **Diffusion of Innovation Model** is depicted by the famous **S-curve** (see Figure 39). This **S-curve** has been taken up in transition (management) theory. A downward sloping **S-curve** is added to illustrate the decay of an incumbent industry or path (Hebinck et al., 2022; Loorbach et al., 2017). This means that one thing is replaced by another one, instead of the new and the old remaining in place at the same time (see Figure 40). The **Diffusion of Innovation Model** and the **X-Curve** provide a clear link with another prominent transition research field; **Socio-Technical Transition Theory** (Geels, 2004; Grin, Rotmans, & Schot, 2010; Loorbach et al., 2017; Turnheim & Geels, 2012). Even, if **Socio-Technical Transition Theory** has connections to sociology (Geels, 2004), it will not be further discussed in this working paper.

It might be worthwhile mentioning that there is a further relationship between the **X-Curve** and another transition theory; **Panarchy-Theory** (Gunderson & Holling, 2002), as shown in illustration Figure 41. Though, it needs to be highlighted that **Panarchy-Theory** belongs to the body of socio-ecological thinking (Gunderson & Holling, 2002), while the **X-Curve** belongs to socio-technical thinking. A comparison of transition theories not focusing on human behavior is, beyond the scope of this working paper. Though, it needs to be mentioned that there are parallels between certain transition theories and certain behavioral (change) models.

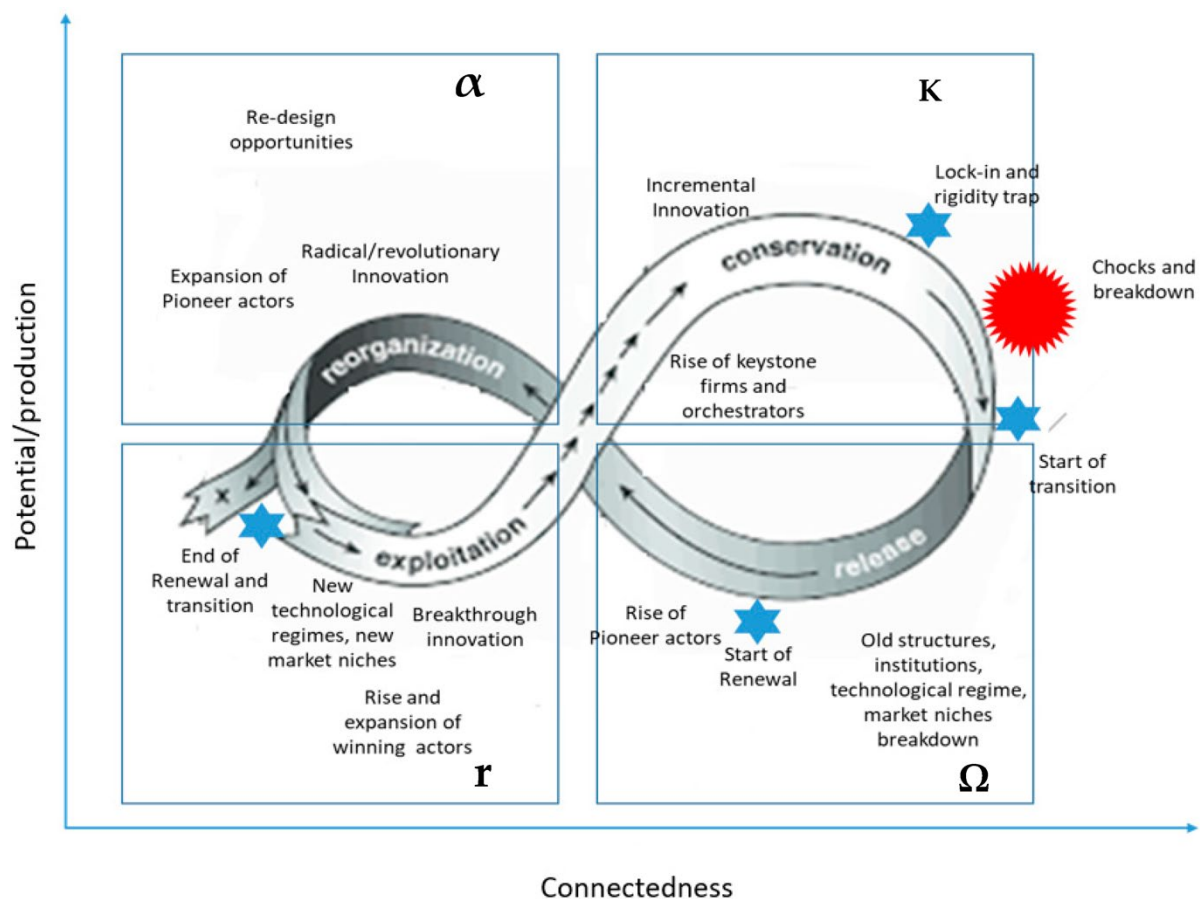


Figure 41: Panarchy applied to Innovation Ecosystem by Boyer (2020)



[Type here]

## Box 2: Science getting stuck in their bubble?

### Reflection of the author

It has been indicated that anyone can get stuck in one's own **mental model**. Anyone may replicate one's **mental model**. We see the world through our **mental model**, and we may surround ourselves with people and information that are in line with our **mental model**. Supposedly no one is safe from being biased by one's own **mental model**. Neither the author of this working paper. The author of this working paper has an interdisciplinary background, yet there is a tendency to, for example, apply **Systems Thinking**. This tendency can lead to certain biases. One's bias may of course provide entry points for legitimate criticism of any analysis. This bias has, for example, been discussed by Collet (2009).

However, the potential bias of the **X-Curve** will be outlined briefly. For sure, a thorough study would be needed. Reading about **Socio-Technical Transition Theory** and transition management one over and over stumbles upon the same names. Researchers in these fields refer to each other. This is naturally the case. As indicated, researchers become expert in one field and often researchers stay within this field. Echo chambers in social media have been criticized (Cinelli, Morales, Galeazzi, Quattrociocchi, & Starnini, 2021; Kahneman, 2011), but one can argue that the same also exists within research (Calver & Fleming, 2020; Kahneman, 2011; Unerman, 2020). If researchers remain in a bubble, they may replicate ideas and create a lock-in.

The **X-Curve** has a clear history. From the **S-Curve** to more detailed ideas about socio-technical transition to the **X-Curve**. The shape of the **X-Curve** illustrates its own history. To be clear, there is nothing wrong about an idea being further developed. I am though questioning whether this may not lead to a lock in, instead of providing truly innovative ideas? Hebinck et al. (2022) describe the **X-Curve**, stating that the emerging innovation is characterized by radical thinking. The **Diffusion of Innovation Model** was potentially this radical thinking. The idea may have trouble in the beginning until it becomes broadly accepted. Applied to the **Diffusion of Innovation Model** as well as the connected **Socio-Technical Transition Model**, this stage has supposedly been reached. **Socio-Technical Transition Theory** is one of the most, if not the most used, transition theory. Thus, it has become the new *normal*. From there the idea will be adapted and optimized. The **X-Curve** could be understood as such an optimization. The **S-Curve** and **Socio-Technical Transition Theory** have shown one part of transition. They have focused on the mainstreaming of the new, but they have paid less attention to the decay of the old. The **X-Curve** adds this latter part.

Not every scientific contribution needs to be or can be groundbreaking. It is necessary that scientific contributions elaborate on previous contributions. The potentially problematic aspect is, however, that the more contributions there are on one idea, the more the idea will become ossified. It will become the *norm*, the taken-for-granted, THE way to think about something, the **habitus**.

This has parallels to e.g., neoliberal economic thinking. This is THE way to think about economics. Alternative ideas are neglected. Student's learn neoliberal economics in universities and so this mental model becomes replicated. Hebinck et al. (2022) are aware of this and suggest an alternative econ course. However, the same can be stated about the **X-Curve** and related theories. When students learn about transition, they predominantly learn about socio-technical transition. That is problematic not only because the diversity of ideas becomes reduces, as we accept that this is the way to think about transition. It is also problematic as the **X-Curve** and related concepts are based on linear thinking. The same linear thinking that gave rise to the current economic system. While they criticize one-sided econ thinking they apply a transition logic that was born out of the same Newtonian worldview.

[Type here]

### 3.6 Change through habits

Darnton (2008) refers to the work of Lewis who understood habits to be the resistance to change. Darnton (2008) states that for Lewis a “habit is not measured by the consistency of behavior over time but in terms of the consistency of behavior in the face of changing circumstances.” It is further interesting that Darnton (2008) explicitly refers to the concept of resilience in reference to not changing habits. “This resistance is not willfulness, but a sign of the resilience of a group or social organization, which will adapt to keep its behavior constant.” I may remind the reader of the previously introduced definition of human behavior, which is the adaptation of an organism to its environment (Zimbardo & Gerrig, 2004). Thus, habits are the opposite of the intent of human behavior as habits block the adaptation of behavior to changing circumstances. This is relevant when we think about lock-ins or path dependencies (Sarigil, 2015). Habits lead to a lock-in as they often lead to a tunnel vision, where people have less interest in alternative information and thus stick to habituated choices (Verplanken & Whitmarsh, 2021).

It is logical that behavioral interventions aiming at behavioral change address those *undesired* behavioral and / or cognitive patterns and mechanisms that keep individuals stuck. Thus, these patterns and mechanisms are curse and cure and the same time (Verplanken & Whitmarsh, 2021). These patterns and mechanisms will be listed below (heuristics and biases see section 5.4).

The role of habits has been omitted by most socio-psychological models reviewed by Darnton (2008). The majority of models discussed by Darnton (2008) do not include the notion of habits. Similarly, Verplanken and Whitmarsh (2021) point out that socio-psychological models hardly address habits. However, Darnton (2008) refers to the **Theory of Interpersonal Behavior (TIB)** by Triandis (see Figure 18). This model does not only indicate the role of facilitating factors (external factors / structures), it does also indicate the role of past behavior on the expression of future behavior. Darnton (2008) connects this model to **Structuration Theory** and thus **Practice Theory**. In that sense, models acknowledging habits have a special position within the portfolio of behavioral theories. This special position is also discussed by Sarigil (2015) who makes a plea for singling out habitual lock-ins from utilitarian and normative lock-ins. To tackle climate change understanding habits is key, as many behaviors have a habitual character. The distinction between different behavioral types is not merely an analytical exercise but has practical implications. That is as certain interventions need to fit the type of behavior that they intend to address. For example, Verplanken and Whitmarsh (2021) suggest that the provision of information is not the right tool to break habits. Interventions based on legislation, incentives, or nudges may, however, be a better fit. Though, even with these tools Verplanken and Whitmarsh (2021) state:

*“It should be noted that while the use of legislation, monetary incentives and nudging techniques to tackle unsustainable behavior may have some traction, their impact should not be overestimated and cannot be expected to make people adopt sustainable lifestyles. Legislation takes long time to accomplish and requires political consensus. Effect size of financial reward are modest at best. Nudging techniques are limited to specific behaviors in well-defined contexts.”*

Sarigil (2015) and Wendel (2020) refer to habits as heuristics, as a shortcut to facilitate day-to-day life, without people getting stuck in uncountable lengthy decision-making processes. Wendel (2020) points out that there are two ways habits build. The basis is a repetition of single actions (see Figure 21). However, the repetition can either be connected to a certain trigger, or it can be supported by a reward. Whenever the trigger appears we are after some time automatically executing the habitual behavior (see also Verplanken & Whitmarsh, 2021). In contrast, the reward that supported the development of a certain habit might not be needed after some time anymore. Verplanken and Whitmarsh (2021) also point out that both, motivation, and habit need to be considered. That is as motivations can be the component that kicks off a new behavior that over time becomes a habit. Once

[Type here]

the habit is established motivation is no longer controlling the behavior. Rather cues are. However, if the habit is disrupted motivations become relevant again.

The lingo used by Sarigil (2015) has reference to **Practice Theory**, as the term “practice” to describe habitual behavior is used frequently. Furthermore, he builds on work that refers to Bourdieu, whose concept of **habitus** clearly connects behavior with the given environment. Sarigil (2015) is also referring to habits as institutions, which draws a connection to **Structuration Theory**. He outlines that habits become structure, which incorporates meaning, reasoning, and a context for action. Thus, habits form their own embedment. They are a form of creation, they (re-)create the structures that build the environment in which action takes place. Habits as path-dependency are discussed below (see section 5.6). In this section, change, rather than stagnancy is discussed. Sarigil (2015) states that a reflection process is crucial to break with habits and establish new ones. To instigate reflection on habits, the routine needs to be disrupted. Such a disruption can either be a bigger shock or many smaller shocks that lead to a kind of incremental shock. Wendel (2020) states that we only think about our habits „[...] when we have a good reason to do so: when something unusual catches our attention, when we really care about the outcome and try to improve our performance, and so on.“

According to Sarigil (2015), there are **two main ways to change**, abrupt or gradual. The abrupt change is triggered by a crisis, the gradual change is a slow incremental, evolutionary process. In both cases, reflection is can be key. Though the reflection about the own behavior is either forced upon someone by a life-altering event or by multiple, reoccurring, and reinforcing smaller events (see also Verplanken & Whitmarsh, 2021). Verplanken and Whitmarsh (2021) refer to **Habit Discontinuity Hypothesis** which highlights the opportunities provided by disruptions to break habits. Research (Bujold et al., 2020; Verplanken & Whitmarsh, 2021) indicates that disruptions are a potent tool to break with habits as people are forced to think about their actions. In such situations, people’s values and attitudes become more important since external cues that triggered a certain habit are existing not at all or to a lesser degree. Sarigil (2015) argues that the formation of habits can be contingent. In an event of change, it cannot be predicted which habit will emerge next. Whether the formation of a new habit is contingent or not may depend on the cognitive investment of an individuum. Verplanken and Whitmarsh (2021) argue that the more actions are planned out the higher the likelihood that intentions are executed. Thus, the plan defines the cues that lead to a specific behavior.

Above **Double, Triple, and Multi-Loop Learning** have been discussed. These concepts are also related to habits. Habits as a form of heuristic are single-loop learning. To achieve change, habits need to be broken. Breaking habits is however not an easy task. Verplanken and Whitmarsh (2021) indicate that even if a new habit is established the old habit still lingers, which increases the likelihood of relapse. It has been pointed out that a habit is triggered by external cues. Thus, one needs to be aware of the cues that trigger a behavior to not fall back into unwanted behavior. Furthermore, one needs to invest in building up the new habit. Both, omitting and fighting cues and building up a new habit, require cognitive processes which can be tiring.

Repetitive actions are also a key to developing and stabilizing new insights, attitudes, values, and worldviews. There are two ways habits can be connected to worldviews and values. **Triple-Loop Learning** leads to a change in one’s worldview. This change then needs to become manifest through daily practices (Peschl, 2007). New heuristics need to be established that lead to automated actions based on the new worldview. Alternatively, a bottom-up approach could be taken. Fahrenbach and Kragulj (2019) describe how repetitive actions could lead to a new worldview (Figure 42) (compare with the discussion about systems thinking and leverage points in section 3.4). If that is the case nudging could be a means to achieve deeper change. However, following double and triple-loop learning, a self-reflection process may still be needed. Otherwise, the new behavior is adopted without *correcting* a worldview that may have created the *negative* habit in the first place. Figure 42 illustrates

[Type here]

the subtle difference, between “I am because I act” (bottom-up learning), and “I act because I am” (top-down learning). The latter ties with cognitive dissonance theory, where we aim to align our behavior with our convictions. That our behavior can influence our attitude has been suggested by others before (Jackson, 2005). To a certain extent, the notion of changing our attitude through our behavior can be understood as some form of brainwashing, where we start believing we are what we are doing. This explains the accusation of nudging being manipulative (Nys & Engelen, 2017; Wilkinson, 2013). It needs to be indicated that Fahrenbach and Kragulj (2019) wanted to illustrate triple-loop learning. However, the model (also the original) does only show two loops. Triple-loop learning however would suggest (as the name tells) that there are three loops. Another loop surrounding “Identity” would be needed to illustrate triple-loop learning. This indicates that bottom-up learning itself will not lead to a reflection of the self. A revelatory event is needed that forces one to reflect on the self. Nevertheless, the strength of bottom-up learning needs to be emphasized. Single actions may over time lead to manifest structures (Adams, 2014; Sarigil, 2015). Furthermore, above it has been outlined that repetitive behavior not only (re-)creates institutions, it also strengthens our mental models (Worldbank, 2015). Thus, it can be hypothesized that by changing behavior our mental models can be changed (at least to some extent). The illustration by Fahrenbach and Kragulj (2019) does remind of the notion of spiral scaling, which is a combination of shallow and deep scaling (Newell, Daley, et al., 2021). Similarly, to the idea of single actions, being connected to deeper change in the long-run, spiral scaling proposes that change starts with shallow interventions that prepare for deeper ones. There one can refer back to the **U-Theory** and the notion of emotional and cognitive readiness for deep change. Thus, shallow changes could support the preparedness for deeper change.

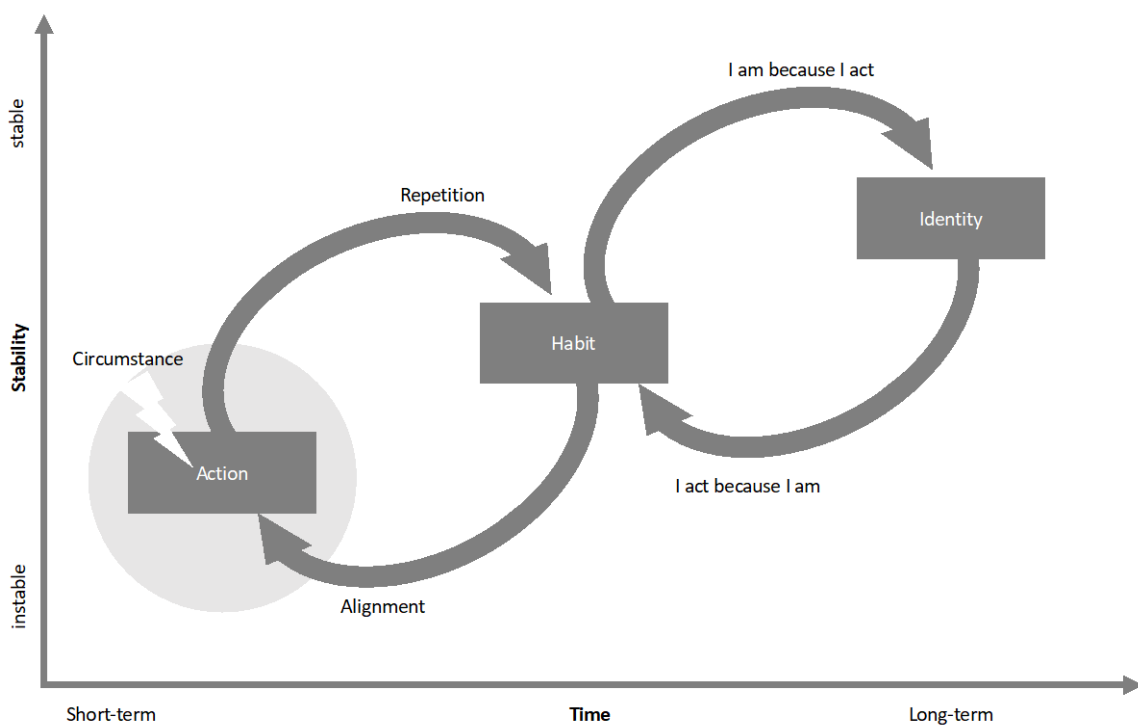


Figure 42: Action-Habit-Identity, adapted from Fahrenbach and Kragulj (2019)

The social realm is, indeed, as well relevant for the disruption, formation, and stabilization of habits. For Lewin, the formation of habits is linked to the social group. According to Lewin, individuals identify with groups and the behavior of individuals aligns with group norms and standards. For change to happen, group norms need to change. Behavior is then scrutinized by the new group standard and when the behavior is aligned it becomes a habit. The mechanisms for how habituated behavior becomes unstuck are different for Giddens (the father of **Structuration Theory**). For Giddens, a

[Type here]

cognitive process is necessary to bring about a change of habits. “[...] behaviors are lifted from practical to discursive consciousness, before being reconfigured and left to fall back into the routines of social activity” (Darnton, 2008).

Hampton and Adams (2018) refer to the ISM framework by Darnton and Evans (2013) (see Figure 35). Hampton and Adams (2018) highlight that “[Darnton’s] ‘Individual-Social-Material Tool (ISM)’ integrates – without assimilating – insights from both behavioral science and practice theory. It emphasizes the relationships between *individuals’* values, beliefs, skills and habits; the *social* context, including norms and meanings, institutions and networks; and the *material* environment including technologies, infrastructure and rules and regulations.” **Practice Theory** connects the social, the structures, with so-called practices. These are strictly speaking not the same as habits or behavior. **Practice Theory** will be discussed next.

### 3.7 Change through practice

This section is about the **Practice Theory** which is closely linked to habits. According to Heiskanen and Laakso (2019), social **Practice Theory** is the newest theory assisting in understanding sustainability issues related to consumption. This newness may also be one of the major downsides of **Practice Theory**. So far insights from **Practice Theory** could not be translated into policy recommendations. At least not in the same way as other theories have done. That might be because **Practice Theory** embraces the complexity of behavior. Furthermore, results might not be transferrable to other contexts, since **Practice Theory** understands that behavior is context-specific (Heiskanen & Laakso, 2019). Interventions based on nudging can be criticized for their lack of scalability. However, the same is true for interventions based on practice theory. So far, mostly small-scale research has been conducted, and even if they provided promising results it is unclear how these interventions can be upscaled (Heiskanen & Laakso, 2019). One approach could be to address shared practices that are influenced by collective rules and structures (Heiskanen & Laakso, 2019; Worldbank, 2015).

Above the role of learning for change has been discussed. A definition of learning provided by Parente (2011) illustrates the connection between learning and *practice*. “Learning is the cognitive process of acquiring a skill or knowledge. It can also be defined as a relatively permanent *change in performance that results from practice*” (Parente, 2011). Though, **Practice Theory** is not only about the repetition of a specific behavior. In **Practice Theory**, practices are the unit of analysis, and practices are understood to be consistent behavioral patterns that are socially organized and embedded within social and material structures. These structures are understood to support as well as hamper certain practices (Adams, 2014; Darnton & Evans, 2013; Heiskanen & Laakso, 2019; Spaargaren, 2003). Not focusing on the individual but on the practice (see Figure 43) represents a major distinction between **Practice Theory** and classic linear behavioral theories (Spaargaren, 2003). Heiskanen and Laakso (2019) state that **Practice Theory** “[...] investigates how daily practices are shaped by established services and technologies, by shared norms, conventions and capabilities, as well as by organizational, institutional and political rules”. (Heiskanen & Laakso, 2019). Heiskanen and Laakso (2019) also highlight that **Practice Theory** does not focus on the individual as classic behavioral models do. Instead, behavior is understood through the lens of “socially shared practices, that is, embodied habits, institutionalized or otherwise shared knowledge, meanings and engagements, and materials and technologies” (Heiskanen & Laakso, 2019).

[Type here]

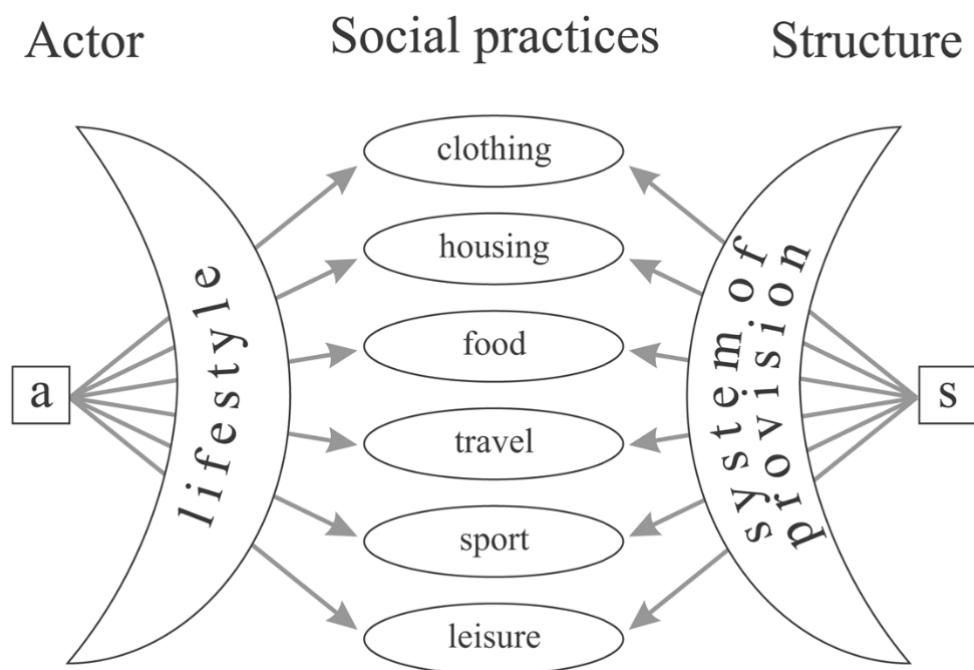


Figure 43: Theory of Consumption as Social Practices form Spaargaren (2003)

The reviews of behavioral (change) models by Darnton (2008) and Jackson (2005) also include **Practice Theory**. Darnton (2008) discussed **Practice Theory** in the context of socio-psychological models, commonly not including external factors in the analysis of human behavior. “At their most basic level of internal/external opposition, the theories outlined above recognize that there are factors beyond an individual’s control which determine their behavior. Yet theory goes beyond this binary distinction to reveal behavior as a social practice based on interactions between ourselves and the world, which both provide for and constrain our behavior, and through which we create both the external world and our self-identity. These recursive models of behavior have an element of change built into them, in the form of the flow of feedback between inputs and outputs. At their most complex, these models break down the internal/external dichotomy, and so pull away from linear (albeit multilinear) social-psychological models” (Darnton, 2008).

Likewise, Jackson (2005) discusses **Structuration Theory** and **Practice Theory** as sociologists’ responses to the internal-external dichotomy. That is, as outlined above, there are models that understand human behavior as an internal process and there are models that understand human behavior as a result of external forces and circumstances. Jackson (2005) summarizes the quest of **Structuration Theory**: “The basic dilemma in the agency-structure debate can be expressed in the question: are humans capable of autonomous, directed social action; or are they rather locked into historical and social processes over which there is no possibility of individual or collective control?” A similar discussion can be found in the work of Kasper (2009) who, though focuses on Bourdieu’s habitus.

The most prominent formulation of **Structuration Theory** may be from Giddens. The dichotomy of internal-external is overcome by illustrating human behavior as a mutual relationship between both. The means of expressing and understanding the world is provided by society and individuals who make use of these means to express themselves within society. Thus, there is reciprocity between the individual and society. Society needs the individual to be reproduced and the individual needs society to produce (act) (Jackson, 2005; Kasper, 2009; Morrison, 2005). “Thus, Giddens model portrays social structure as both the medium and the outcome of people’s ordinary social practices” (Jackson, 2005). There is a connection between **Structuration Theory**, biases as well as heuristics, and the

[Type here]

concept of thinking fast and slow (see section 2.2). That is as Giddens distinguished between practical and discursive consciousness. The former is thinking fast (habits, heuristics), the latter is thinking slow (conscious cognitive deliberation). Giddens suggests that most activity is in the realm of practice consciousness, routinized, patterned, habitual behavior (Jackson, 2005; Morrison, 2005).

The connection between **Structuration Theory** and practice theory is obvious. **Structuration Theory** provides an understanding of the interplay between actors and structure (Whittington, 2015). **Practice Theory** focuses on how this interplay manifests through practices. Spaargaren (2003) who developed the **Theory of Consumption as Social Practices** refers to **Structuration Theory** by Giddens as a starting point.

Darnton (2008), as well as Jackson (2005), refer to the **Theory of Consumption as Social Practices** by Spaargaren (2003). Darnton (2008) states that “[t]he concept of behavior as social practice reflects this interrelation between internal and external forces in determining our behavior” (Darnton, 2008). Further, he notes that Figure 43 is “[...] showing behavior as produced between lifestyles and systems of provision. It is important to note that neither of these factors is wholly internal or external, but each is shaped in response to the social practices it helps to determine.”

Though **Practice Theory** is not only connected to **Structuration Theory**. It is also connected to Bourdieu’s notion of **habitus**. Both Giddens, as well as Bourdieu, attempted to overcome the dichotomy between structure and agent. While Giddens focused on the reciprocal relationship between actor and structure, Bourdieu provides with the concept of **habitus** a way to understand the individual in a reciprocal relationship with its’s environment (see section 3.5). The habitus can be observed through the expression of one’s preferences and practices (Kasper, 2009; Morrison, 2005).

It seems that **Practice Theory** is a theory that aims to respond to shortcomings of classic behavioral (change) models. In section 3.5 the contributions of sociologists to behavioral science have been discussed. The contextual aspects, the concepts of agency and structure were already discussed there. **Practice Theory** is similar to some of the approaches and concepts introduced in section 3.5. However, **Practice Theory** focuses on practices instead of on independent, observable behavior. A definition of practice connects the practice with know-how, social meaning, and material (Jaeger-Erben & Offenberger, 2014). This combination reminds of the ISM tool developed by Darnton and Evans (2013). One needs to know how to do something, one may do something because of it’s meaning, and one may need resources to do something. A practice is understood as a combination of these three factors.

There is a parallel between **Practice Theory** presented by Spaargaren (2003) and habits discussed by Sarigil (2015). Both concepts, habit and practice, are characterized by repetition or routine. However, the focus when framing something as habit versus as a practice is different. For **Practice Theory** the structure and the societal component are key. These factors might be neglected when habit is rather understood as a repeated behavior as a mere heuristic triggered by a cue. Thus, two different epistemological perspectives can be applied to repetitive behavior; a sociological and a psychological (Darnton & Evans, 2013).

Spaargaren (2003) intends to “[...] attach greater importance to the role of citizen-consumers in shaping and reproducing some of the core institutions of production and consumption.” The reproduction of institutions through the repetitive execution of practices is also indicated by Jaeger-Erben and Offenberger (2014). Similarly, Sarigil (2015), who looks at habits, indicates a connection between habits and institutions. He outlines that habits are a means to re-create institutions through agency and the embodiment of existing institutions. Furthermore, habits are a form of practice. Though, habits are not necessarily observable behavior, they can also merely be a propensity or tendency to act in a certain manner (Verplanken & Whitmarsh, 2021). Another parallel between these two texts is the motivation to act. Sarigil (2015) highlights the difference between actions motivated by utility (*homo economicus*) and by norm (*homo sociologicus*). Similarly, Reckwitz (2002), writing about social practices from a **Cultural Theory** perspective, also discusses the common distinction between the *homo economics* and *homo sociologicus*. A **Cultural Theory** perspective may be

[Type here]

appropriate when engaging with **Practice Theory** since “[c]ultural conventions define appropriate ways of consumption [...]” (Heiskanen & Laakso, 2019). However, from distinguishing between *homo economics* and *homo sociologicus*, Sarigil (2015) elaborates that habit is a third distinct motivation. Though, it can be argued that habits evolved out of individual actions that were based on utility and / or norms (Verplanken & Whitmarsh, 2021). Spaargaren (2003) indicates this by looking at **Practice Theory** through the lens of the consumer, where a routine (consuming) is established through the motivation to maximize utility<sup>9</sup>. There is a clear overlap between *homo economics* and *homo sociologicus* thinking. Not least because Adam Smith postulated that utility maximization by each individual would lead to an increase of the overall societal welfare (A. Smith, 1776). Whether or not this holds true is another discussion. However, the societal legitimation allows everyone to act selfishly as an individual (utility maximization).

Similar to Spaargaren (2003), Jaeger-Erben and Offenberger (2014) apply practice theory to consumer behavior outlining that consumption is more than a simple behavior. They refer to recycling or buying organic produce which might lead to more changes in a person’s life that are connected with the ostensibly simple behavior change. Recycling may require the acquisition of multiple bins and bringing the waste to a recycling center. Buying organic produce may require one to change supermarket or to go to a farmers’ market. For this, habits may need to be adapted to go to the recycling center or to the farmers’ market at a specific time. In their analysis, they differentiate between practices as entities and practices as performances, which allows delineating between long-lasting, structural aspects of a practice, and the day-to-day reproduction of a practice. “Both sides co-constitute each other and can only be separated on the basis of analytical means” (Jaeger-Erben & Offenberger, 2014). This differentiation helps to understand that a consumer’s choice cannot be understood in separation from structural or habitual aspects. A consumer might not be able to buy organic produce if it is not offered or if it is too inconvenient to make that choice.

In contrast to Adams (2014), Sarigil (2015) argues that a habit becomes meaning at some point. That is as habits are not simply a heuristic (see section 5.6) that simplifies our lives (utility perspective). They also become the norm as we do things because they ought to be done this way, because they have always been done this way, and thus it is *good* to do it this way. Here the connection between habit and **habitus** becomes evident (see also mental models in section 2.4). Adams (2014) provides another twist to understanding practices as a rational action. He uses a **Critical Social Psychology** (see section 3.5) perspective in which the individual is understood as being part of the social. Advocating critical social psychology Adams (2014) states that:

*„[critical social psychology] can tell us a great deal about the productive and performative dynamics of social interaction, and contribute, for example, to an understanding of the way human responsibility for ecological degradation is communicated, constructed, distributed and avoided; or how human – nonhuman nature relationships are permitted, rationalized or marginalized in discursive formations that provide parameters for meaningful social life.“*

On practices, he argues that human practices have wrongly been framed as rational and that the social context has often been omitted. Adams (2014) states that **Critical Social Psychology** helps “to address the role of social context and interaction in shaping individual experience, behavior and the collective production of reality.”

These two views on the nature of and the emergence of practices (and habit) may indicate a shortcoming of **Practice Theory** that can be mitigated by complementing it with ideas from other approaches. Others have suggested that **Practice Theory** neglects the role of actors and does, thus, not shed light on (self-)reflection processes (Adams, 2014; Nielsen et al., 2021). That would mean that change can only be instigated by changing external structures. While that is a relevant and necessary

---

<sup>9</sup> Indeed, consumption can also be motivated by norms, and as outlined below, utility can be understood as a norm as well.



[Type here]

step, it has also been indicated in this document that self-reflection is key to achieving a deep transition. By overly focusing on how external structures shape our practices, the role of individuals is neglected. It might be an unavoidable consequence of any approach or theory that some aspects are neglected<sup>10</sup>. No theory is complete, and necessarily one aspect will be in the limelight while another one will remain in the shadow (Jackson, 2005). However, it could be argued that adding the notion of mental maps (see section 2.4, double, triple, or multi-loop learning (see section 3.3 and 3.4), or even classic planned behavior ideas (see section 2.2 and 2.3) to **Practice Theory** could be a fruitful endeavor. Further, connecting practice to habit could be insightful. The similarities and connections between habit and practice have been outlined above. However, habit is usually approached from an individualistic perspective, while practice is more about the social context. The mentioned potential connections with **Practice Theory** would bring the agent more into the limelight. One could not only look at how external structures form practices, but also how internal or mental processes may lead to certain lifestyles and practices. A similar point has been made by Adams (2014), who states that a problem of **Practice Theory** is that it neglects the role of self-reflection. By combining **Practice Theory** with **Critical Social Psychology**, this problem can be overcome, permitting the inclusion of the individual psyche. It sheds light on why we prefer to deny our contribution to environmental destruction, or our connection to nature. While the combination of different approaches and theories might be helpful, it may also lead to certain problems. Darnton and Evans (2013) combined behavioral economics, social psychology, and sociology in their ISM tool and noted that „ [...] the disciplinary understandings are fundamentally different. For instance, behavior and practice are two alternative and incommensurate understandings of human conduct.“ Though, they do not intend to provide a consistent theory but rather highlight that an issue can and, maybe, should be analyzed through different lenses.

While **Practice Theory**, as presented in Figure 43 illustrates behavior or rather practices as the result of structures (lifestyle as self-created structure and societal structures as external structures), the illustration does not include a feedback mechanism. Thus, while the role of the social realm is underscored, how practices (re-)produce structures is not illustrated. This is potentially an addition that can be taken from Sarigil (2015) describing the relation between habits and institutions. However, Darnton (2008) specifically highlights the non-linearity of models that are based on **Structuration Theory**, where behavior is in a reciprocal relationship between the actor (agent) and the environment (structure). **Practice Theory** is a further development of **Structuration Theory** that looks at practices as an expression of the dynamic relationship between actor and environment. Such models rather fit a circular illustration. Though, this circularity, which is often expressed by a feedback mechanism, is not present in Figure 43. This is not to say that **Practice Theory** does not have feedback mechanisms; it is rather that Figure 43 does not reflect them. Spaargaren (2003) (who developed Figure 43) describes the lifestyle as a result of different practices. That would indicate that arrows need to point from practices towards lifestyle. At the same time, a specific lifestyle is a composition of a set of practices. Thus, there is a feedback loop between practices and lifestyle. On the other side of things are the external structures, such as market structures. Existing structures may support or hinder certain practices. For example, the availability of eco-products influences whether people can introduce these products in their practices. At the same time, the more people are using a certain product for example, the more this product will be provided by the market. This provides a connection to the **Diffusion of Innovation Model**, the **X-Curve** as well as **Socio-Technical Transition Theory** (see section 3.5 Change through social networks).

---

<sup>10</sup> Like Heisenberg's uncertainty principle shows an object can be a particle and a wave. Yet each observation needs the right measurement tool to capture one of these behaviors. Both behaviors cannot be captured at the same time.

[Type here]

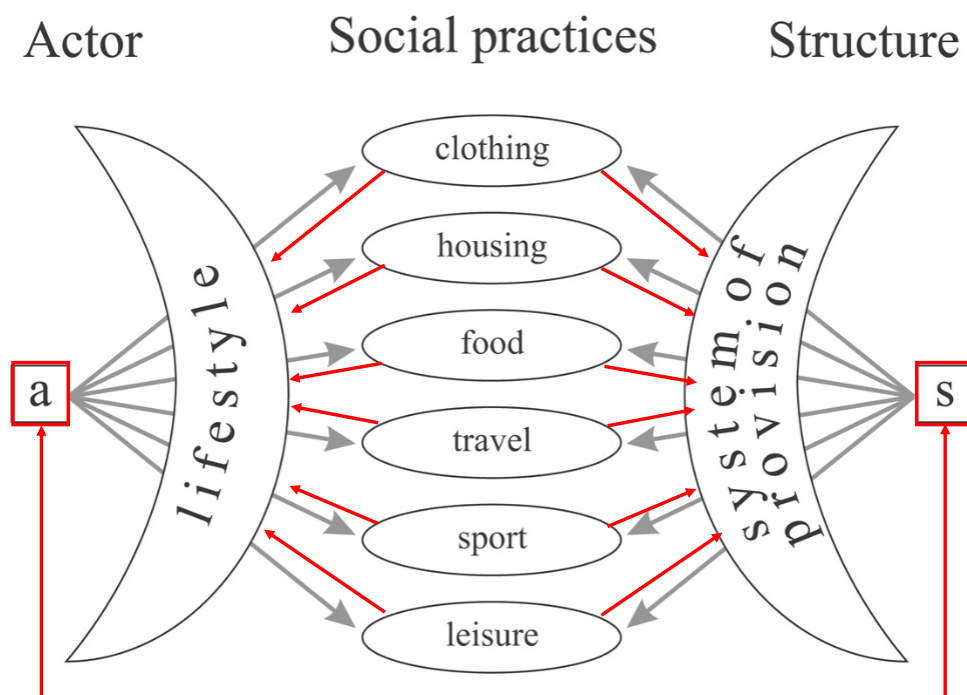


Figure 44: Adapted Theory of Consumption as Social Practices. Original from Spaargaren (2003)

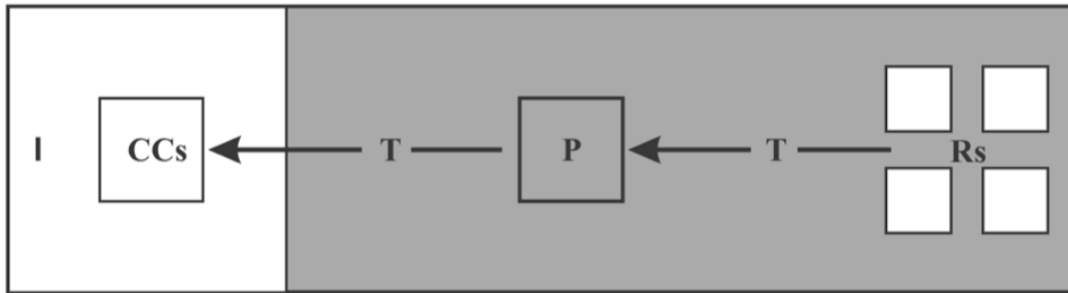
Figure 44 is a simple adaption of the schematic illustration of **Practice Theory** provided by Spaargaren (2003). On the one hand, it aims at showing that there is a feedback loop between practices and lifestyle as well as between practices and external structures. Furthermore, another double-sided arrow has been added directly between actor and structure. That is to illustrate that not all influence happens in the field of practice. The process of observation and self-reflection could for sure also be framed as practice. However, to schematically illustrate a distinction between a practice that is dominated by an internal cognitive process that may not be visible to outsiders at all, and practices that have a more outward-oriented character, a direct connection was added.

The feedback between practices and structures is provided by a concrete example discussed by Spaargaren (2003). The differentiation of the energy market is characterized by different resources (renewables, non-renewables), by different providers that potentially focus on one type of resources, and by different consumers who prefer one resource over another one. Figure 45 illustrates this differentiation in three different stages. Only the last stage includes a double-sided arrow between consumers and providers. Though, it can be stated that some consumers may demand alternatives even before they are offered. However, it indicates that there is a mutual relationship between lifestyles (the green energy consumer), practices, and structures. This stepwise differentiation also indicates the acknowledgment of real-life dynamics. On the one hand, repetitive practices provide stability to structures (personal and external). On the other hand, a change somewhere in this dynamic interplay may affect the whole system. For example, offering energy from different sources, may start a new discourse or change an existing discourse, which may start a reflection process, which may lead to the establishment of new lifestyles and practices.

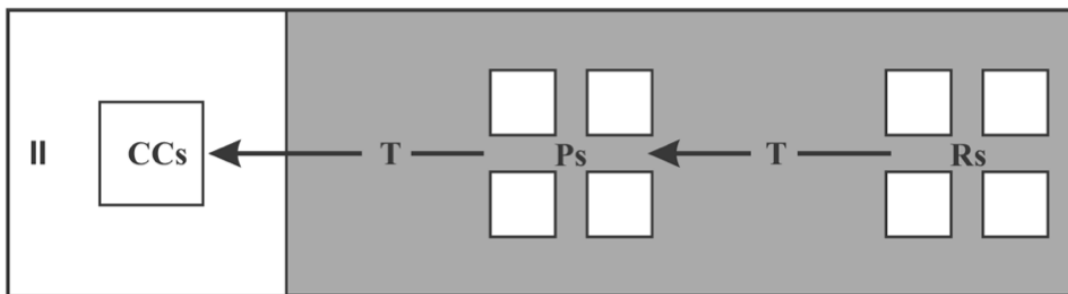
Due to the connectivity of factors and the need to understand practices embedded within a system, **Systems Thinking** is a natural alley of **Practice Theory**. That is even more so since **Practice Theory** understands that “daily practices create complex systems” (Heiskanen & Laakso, 2019). When one applies Systems Thinking terminology to **Practice Theory**, both seem to be synergistic. The behavior, the practice, is the output of a system that is structured in a certain way. In **Systems Thinking**, too, the structure dictates the behavior of the system. However, a difference is that in **Practice Theory**, behavior can change structures, while in **Systems Thinking** behavior cannot be changed without

[Type here]

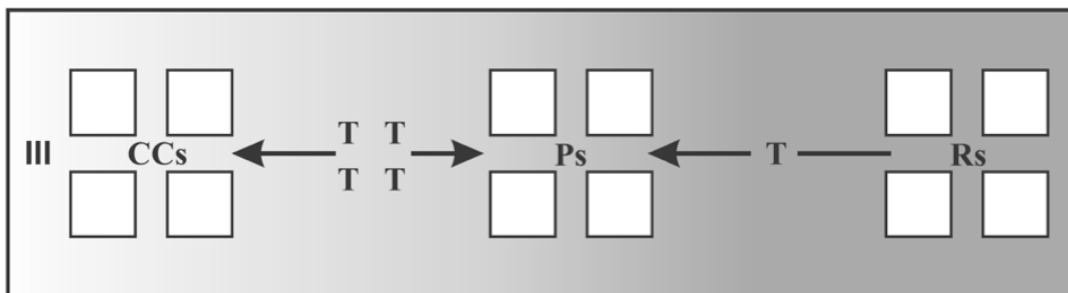
changing the structure or some flow variable<sup>11</sup>. As a side note, there is some discussion about the superiority of one concept over the other. Caldwell (2012) discusses the superiority of **Practice Theory** compared to **Systems Thinking** for organizational learning. Morrison (2005) outlines what **Complexity Theory** could add to the notion of **Habitus** and to **Structuration Theory**.



**Step 1: resource-differentiation**



**Step 2: (also) providers-differentiation**



**Step 3: (also) consumers-differentiation**

Figure 45: Resource, provision, and consumer differentiation, by Spaargaren (2003)

It has already been pointed out that **Practice Theory** does not focus on the individual but on practices. This is a significant difference from linear behavioral models. “The agent stands at the center of classical theories of action. Here he presents himself either as the self-interested figure of the homo economicus, or as the norm-following and role-playing actor of the homo sociologicus. In the former case, the social world seems first and foremost to be populated by independent individuals who confront one another with their decisions” (Reckwitz, 2002). When the agent is no longer at the center

<sup>11</sup> Though a change of a flow variable, e.g., the speed of throughput, does not change the behavior. It changes amplitudes of behavior, which can change for example how fast, or whether a system collapse or restores.

[Type here]

of attention, at least two significant differences are the consequence: 1) the unit is the practice, not the individual, 2) the focus is on compositions of practices, rather than on one specific behavior. This leads to entirely different research questions. The question is not how to get a person to recycle, but how people pick up sustainable lifestyles (including recycling). The lifestyle becomes relevant in **Practice Theory** because it is understood that the lifestyle is the internally created structure that facilitates or hinders certain practices (Spaargaren, 2003; Verplanken & Whitmarsh, 2021). This ties in with the notion of mental models (see section 2.4) and identity (I act because I am, see Figure 42). Thus, the actor aims at aligning actions (practices) with one's paradigm, worldview, identity, and by acting according to one's convictions, these convictions are strengthened (circularity). The observation that one environmental behavior may predict another environmental behavior of the same person is sometimes called spill-over effect. This spill-over effect is related to cognitive dissonance (see section 5.3), a concept that expresses people's tendency to align their actions with their attitudes (Jackson, 2005).

According to Spaargaren (2003), a lifestyle view also allows understanding why people seem to care about the environment in some parts of their lives but not in others. **People can have a compartmentalized lifestyle.** This means that certain lifestyles only find application in certain circumstances. This is not necessarily the same as **moral licensing**, where one action is traded off with another one. This trading-off may not occur when people compartmentalize their lifestyles (think of wearing different hats depending on the situation). One such example of different approaches to practices has been mentioned above. Humans are not either *homo economics* or *homo sociologicus*; humans are both. Which rationale is predominant will depend on the receptive circumstance. Another example might be the everyday logic versus the holiday logic.

Another distinction between a psychological and a sociological approach to practice is that the sociological approach (practice theory) is not so much interested in **nudging** or persuading someone into some behavior (Darnton & Evans, 2013). That is, as a practice is understood to be a more complex construct than a merely routinized behavior (a heuristic) (Collet, 2009). The structural and cultural aspects that enable or hinder certain practices need to be considered if a change in practices is aimed at. A nudge may not be able to change these structural and cultural factors and may thus not be successful in changing a *practice*.

Behavioral interventions based on linear models have been framed as catching low-hanging fruits. That is particularly the case if these interventions do not aim at changing mental models. To use the same analogy, **Practice Theory** may aim for higher hanging fruits. However, it has been indicated that the agent's role and self-reflection are not in the limelight. Thus, while **Practice Theory** aims at changing structures that enable or hinder practices, **Practice Theory** does not necessarily aim at changing mental models. **Practice Theory** aims at identifying the structural aspects that shape certain practices. For example, investigating recycling behavior **Practice Theory** may query what (structural) factors hinder or support recycling. Thus, it is not only about how to get people to do a certain thing; it is about asking why people behave in a certain way in the first place. Furthermore, since **Practice Theory** understands behavior as being embedded, facilitated as well as constrained by structures, it also investigates how a change in structures could change a specific behavior (Heiskanen & Laakso, 2019). This illustrates a gap that **Practice Theory** is closing. It has been outlined above that many classic behavioral models exclude or neglect environmental factors, such as culture structure, society, etc. Including these factors provide some explanation for the attitude-behavior gap, for example. People might want to do something, but might be restricted by the market, social expectations, cultural norms, or other structural circumstances (Heiskanen & Laakso, 2019).

**Practice Theory** in conjunction with **Structuration Theory** and the concept of **habitus** may provide new insights on how to support change. Kasper (2009) attempts to provide a way to understand human behavior (change) by employing an environmental habitus lens. Her starting point was to investigate how paradigms change. Researching ecovillages, she states that her "[...] observations suggest that the communities most successful in fostering this alternative worldview employ

[Type here]

strategies that simultaneously span the psychological, social, physical, spiritual, and ecological dimensions of everyday life” (Kasper, 2009). She reports how ecovillages provide circumstances that penetrate many aspects of life and thus support a particular lifestyle and a specific paradigm. Though, for Kasper (2009), ecological habitus is not limited to pro-environmental practices. Rather it encompasses all practices that are relevant for environmental considerations. Thus, it includes all practices within the spectrum of pro- or counter-environmental practices. It needs to be reminded that **habitus** is not necessarily describing someone’s conscious decision to exhibit some practice. Hence, some individuals may show pro-environmental practices without being aware of them. One example might be biking in the Netherlands, which might be a typical means of transportation due to cultural and structural reasons, rather than a means chosen for environmental reasons (Gilderbloom, Hanka, & Lasley, 2009; Jones, Harms, & Heinen, 2016).

If the focus of **Practice Theory** is not the actor but the practice, it might be difficult to come up with interventions for change (Nielsen et al., 2021). Despite the difficulty of providing policy recommendations, Heiskanen and Laakso (2019) provide some insights that can be of use for policymakers. One insight is to work conjointly on several factors that influence behavior (e.g., information, norms, and structures). Another one is to pay attention to competing practices. Heiskanen and Laakso (2019) provide the example of heating space versus heating people. Both practices should lead to the same result (human not being cold), but they have completely different implications, also pertaining to emissions. A further point is to consider how practices interlock. That is, one practice may need another practice. These knock-on effects among practices can either increase or reduce sustainability or nullify certain endeavors. Finally, Heiskanen and Laakso (2019) indicate that certain (un)sustainable practices might be triggered by policies (e.g., taxes, standards) that, at first sight, are unrelated to these practices.

A lifestyle perspective does not only have implications for research but also for policies. Spaargaren (2003) endorses that structures in which practices take place specifically need to be taken into account. Taking such a perspective may reveal that some environmentally friendly practices may not be practical for certain people. Then, the question is how can structures be changed to better accommodate these practices, or how can practices be tweaked to better fit existing structures (e.g., daily routines). Spaargaren (2003) suggests the use of environmental heuristics, shortcuts that reduce the mental burden of behavior change or the repetition of certain behavior. In this respect, he may acknowledge the heuristic character of some practices (daily routines). If those should change, easily applicable tools (heuristics) could be helpful.

**Structuration Theory** does also provide a possible avenue for intervention. This type of intervention is very much related to concepts that have already been outlined. The distinction between practical and discursive consciousness indicates that in order to break with a practice that is based on practical consciousness, discursive consciousness for that practice needs to be established (Jackson, 2005). Thus, once more, a self-reflection process is required.

### Box 3: Reflection on practices from daily-life

#### Reflection of the author

In Box 1 I have reflected about the yoga practice and how this **practice** might be an example of practical behavior changing the mind. I have also indicated that the regularity of the yoga practice is crucial. I am calling it a yoga **practice**, not a yoga routine or habit. Those who regularly do yoga are called practitioners. Thus, yoga may be a practice, rather than a habit. A yoga practice might be a great example to illustrate what a practice is. The yoga practice is not just doing some exercises. In Ashtanga yoga the **practice** is a set sequence from which one should not deviate. Even in other yoga styles there is some sort of logic behind the sequence. Thus, the **practice** in the strict sense of exercise is not random. The setting in which the practice takes place is neither random. Although

[Type here]

adaptions are made to accommodate for people's day-to-day life, Ashtanga is usually practiced early in the morning on an empty stomach. If one wants to practice later, the empty stomach still needs to be considered. That has an effect on planning one's day. One needs to think about when to eat so that the stomach is (almost) empty. With any activity one needs to figure out how to integrate it in the day. Planning is needed. If one needs a teacher, the **practice** and the planning of the **practice** is bound to the structures provided by the teacher (e.g., teaching schedule of a Shala). These examples show that it is not just some activity. It is a **practice** that is embedded in a structure and by doing the **practice**, structure is (re-)created.

In Box 1 I have also indicated that Ashtanga yoga is a **practice** for which many practical steps are provided. When it comes to the **practice** itself, no thinking is needed in terms of planning on which asana to do when. Also, with the integration into the daily life, the yoga teacher will provide guidance. I have stated that my yoga teachers have said that it is important to just unroll the mat. Thus, they do not overwhelm one with a 1,5-hour commitment, but provide simple, small steps that maybe lead to more. Verplanken and Whitmarsh (2021) indicate that having a practice plan increases chances to act on intentions. Hence, the way in which the yoga **practice** is offered, may provide what is necessary to establish a **practice**.

Maybe instinctively, I personally try to adopt this "having a plan" to my life whenever I aim at establishing a routine or performing a specific action. Biking to work might be such an example. It is not just about going to work by bike. It is about the structures around biking that need to be considered to make the **practice** work. This includes, knowing the way, knowing the time I need, knowing how to deal with bad weather, how to transport everything I need for the workday (laptop, charger, food, clothes to change, etc.). It not only affects the work environment, it also affects the rest of the day and life. Biking takes me longer, so I have to make tradeoffs or organize things differently. It adds to my sport program, so I may have to cut back on other activities. It also greatly affects logistics. With a car for example, valuables can be left in the car and more can be transported. Thus, more can be done without stopping at home. So, when I want to go climbing after work, I have to go home first. This example shows how a simple activity such as biking to work affects the whole day (week), how structures need to be created and how one needs to make use of existing structures. If I am just **nudged** into biking, all these factors that are influenced by biking are not addressed. Though, it is clear that there needs to be commitment to make certain changes and to get engaged in certain **practices** that may take more effort. The provision of information, for example, may still help. Particularly in the beginning when a **practice** is being build, one needs a lot of information to execute the **practice**. Hence the more information and support is accessible the higher the chance that one does not give up along the way.

[Type here]

## 4 Connecting levels

This chapter is a humble attempt to connect some of the dots discussed in Chapters 2 and 3. Many more conclusions and connections can be drawn than will be discussed in this chapter. Connecting levels could apply to connecting the individual (micro) to some group or administrative organization such as nation-states (macro). Connecting levels could also be about different sectors such as economics, technology, politics with human behavior. It could also be about connecting different interventions such as shallow and deep interventions. The chapters above have shown that analyzing and understanding human behavior is a complex matter. This has been shown although the chapters above do not provide a complete overview of behavioral science approaches. The complexity of human behavior is for sure acknowledged by many. For example, Nielsen et al. (2021) state:

*“In general, limiting climate change requires interventions at multiple levels and time scales: technology change and policy change are necessary, but do not obviate the importance of individual and household behavior, especially where these have the potential to push forward such systemic change; likewise, individual responses to climate change are necessary but must be supported and enabled by policy and structural change. Moreover, behavioral, cultural, technological, economic, and policy changes interact: none can be fully assessed without considering the others. For example, policies shifting energy supply away from fossil fuels to renewables may require changes in when and how energy is used.”*

The Working Group II contribution to the IPCC Sixth Assessment Report also indicates the need to connect different levels. Within the IPCC report section 18.3.1.5 expands on societal systems and a definition of (societal) transformation is provided: “A profound and often deliberate shift initiated by communities toward sustainability, facilitated by changes in individual and collective values and behaviors, and a fairer balance of political, cultural, and institutional power in society” (Pörtner et al., 2022). It is also highlighted that a “[...] societal transition requires changes in individual behaviors, but also in the broader conditions that shape these behaviors. These broader conditions are largely related to questions of power, in enforcing dominant political economies and social-technological mindsets” (Pörtner et al., 2022). Thus, the need to connect levels is a reoccurring theme within scientific literature. Though, there are many different ways to connect different levels.

In the following, a short review of some approaches and connections among levels is provided. Then a model is provided that attempts to capture some of the approaches that have been discussed in this working paper.

Sarigil (2015) discusses behavioral lock-ins. His analysis does not only shed light on why individuals may not change their behavior, or rather their habits (see section 5.6), it also provides insights on how individuals are connected with higher-order organizational levels (larger scales). This way of thinking about behavior (in terms of Sarigil’s habitual lock-in) is not limited to individual behavior but can be extrapolated to other levels. Our day-to-day lives are connected through structures that connect individuals but are beyond the individual (Grin et al., 2010) (e.g., page 42). The insights from **Structuration** and **Practice Theory** discuss this connection as well (see section 3.7). Individuals create institutions that support actions, which were based on decisions taken that are understood to be *good* and *logic*. Whereat what is *good* and *logic* might have been communicated by society (structure). Clearly, the concept of **habitus** is relevant in such an analysis as well. **Habitus** allows us to understand that humans are likely not aware of their own biases, which have been created by past experiences, by the exposure to society, its structures, and institutions. Through institutionalization, habituation (and a specific **habitus**) is supported. This is not only because doing something becomes easier, but also because doing this appears to be the *norm* and thus the *logic* thing to do (**habitus**). The alignment of one’s behavior with social norms cannot only be explained using sociological ideas, but also psychological ideas. Mechanisms that support individuals’ alignment with social norms are for example herd behavior or psychology of compliance.

[Type here]

The **Norm-Activation Model** is an approach that suggests that individual values are derived from social values (Williamson et al., 2018). This means that the model suggests that society has power over the individual, rather than the other way around. This and other theories from social sciences seem to place structures over actors in terms of relevance for behavior change. “By identifying the key structural elements that perpetuate unsustainable behaviors, social theorists believe we can actively shape these elements to enable more sustainable behavior across varying social and cultural contexts” (Williamson et al., 2018). Whatever view an analyst may have, from the reviewed literature it can be seen that the power of leverages is an ongoing debate. Does the structure (or context) have more power to change the individual compared to the power of the individual to change the structure? Or are these equally powerful. Such questions are relevant as they guide potential interventions. Should interventions target structures or the individual, or both?

When thinking of different scales one can also focus on stakeholders that represent different scales, such as the individual to represent citizens; the CEO to represent businesses, the politician to represent politics; the judge to represent jurisdiction; the teacher to represent schools, etc. Williamson et al. (2020) write about “Engag[ing] a range of relevant stakeholders at different scales of the behavioral system.” However, they do neither explain what different scales are nor what the behavioral system is. They state that all relevant stakeholders need to be considered. Relevant is related to the behavior that one intends to change, and the specific actions that need to be taken to change that behavior. They furthermore indicate that actors that are not directly contributing to the intervention also need to be considered. Supposedly this is due to indirect links that could influence the success of an intervention. This suggests that any intervention could quickly become a time-consuming task due to the complexity of human behavior and the subsequent amount of stakeholders that need to be involved.

According to Williamson et al. (2020), working on a larger scale can be difficult. That is as more stakeholders are involved and there might be too many contextual factors to consider. Therefore, they argue for operationalizing interventions on a smaller scale. Though, it is not clear what scale that is. It needs to be highlighted that they apply a rather mechanistic approach to behavioral change, as they suggest that an intervention can be reapplied in other parts of the system. Hence, they apply a copy-paste approach to behavioral interventions. Though, if contexts and stakeholders change, a behavioral intervention that suited one situation may not fit another one.

The embeddedness of the individual within structures has been discussed in the different sections above. The work by Baum and Gross (2017), Darnton and Evans (2013), and Bujold et al. (2020) outlines how the individual connects with the context in which behavior takes place. The focus in these approaches is on the individual. That contrasts with **Practice Theory**, where the practice, as well as the structures that shape and that are shaped by practices, are in focus. A mutual relationship between practice and structure is advocated, which clearly allows connecting different scales. The **Innovation Diffusion Model** by E. R. Rogers (1983), as well as the transition management and socio-technical transition literature, try to provide an understanding of how change is upscaled, from niche to regime. Upscaling is also discussed by Newell, Daley, et al. (2021). However, their concept of spiral scaling is not about reaching more people, but rather reaching more impactful leverage points. Thus, how to get from shallow change to deeper change, a change of paradigms, mindsets, or mental models? Clearly, this connects to **Systems Thinking** and the insights that leverage points provide in this field. Furthermore, it connects to the literature about double and triple-loop learning.

Looking at all of these approaches, one remains stuck in the question between top-down or bottom-up. And as has been shown, this question is not only about individuals versus groups or contexts; it is also about shallow versus deep interventions. However, some of the literature studied for this working paper highlight the relevance of understanding the mutual relationship between scales. Thus, the question might not be about either-or, but about how to combine top-down and bottom-up interventions (Londakova et al., 2021).



[Type here]

This short section, as well as the sections above about change through social networks (see section 3.5) and change through practices (see section 3.7), show that individual behavior needs to be understood in the context in which it takes place. **Practice Theory** focuses on the practice and how structures can facilitate or hinder the execution of certain practices. The role of the agent might be pushed in the background. Other theories focus more on the actor, but then neglect the structures. It will be impossible to develop a model or approach that covers everything (Kasper, 2009; Kollmuss & Agyeman, 2002).

Despite the likely impossibility of creating a model that captures everything, Figure 46 is an attempt to do just that. This is a thought experiment to combine different approaches and to understand how they could be connected. It needs to be emphasized once more that this model is for sure not complete. It is a reflection on the approaches that have been discussed in this working paper. Though, certain aspects of behavior change have not been addressed in this working paper. That applies for example to group behavior where the focus is on the group, rather than on the individual.

In Figure 46, the top area describes that, just like in **Practice Theory**, there is an interplay between the external and the internal structure. These structures mutually influence each other. The individual sits in between these structures, being part of the social structures but having adopted individual structures as well. The societal structures are also influenced by different actors or actor groups. These groups have been divided into three different levels (political, business, community). Though, this is a bit arbitrary as other groups could be selected. The illustration does not intend to put a hierarchical order on different levels. Thus, the political level being at the top does not indicate that the political level is most influential. The hierarchies among levels would call for an analysis related to power structures which is beyond the scope of this working paper. The arrows between the levels indicate that they all mutually impact each other. The arrows between the three levels and the individual level indicate that individuals influence each of the three levels, but also that individuals are part of these levels. For example, an individual might have voting rights, but may also be politically active. Or an individual is a citizen but can also be a CEO or the head of the workers unit within a company.

On the individual structure side, the agent is put in focus. Individual structures are coined by specific values, attitudes, emotions, etc., and form the motivation to act (see Figure 53). Motivation is of course also shaped by the societal structures since the societal structures influence the individual structure. The motivation triangle is extended by the heuristics and biases triangle. This aims at illustrating that even rational thinking that is based on motivation is biased and influenced by heuristics. In previous sections, it has been discussed that our judgment on what is the *right* thing to do is influenced by society. But also, this judgment is influenced by, for example, previous experiences and judgments (**habitus**). If I intend to buy tomato sauce in the supermarket, but the brand I usually take is not available, I may go for one that is similar. For example, my usual brand might be Italian, thus I may go for the Italian alternative as well even if other characteristics (e.g., price) would usually not make me choose that sauce.

As discussed by Verplanken and Whitmarsh (2021) (see section 3.6), prior to the establishment of a habit, action is rather triggered by motivations, than by heuristics. Thus, first actions are characterized by the slow path, by thinking about values, beliefs, agency, self-efficacy, etc. For sure, that is not always the case, as certain heuristics and biases might be preexisting. Kahneman (2011) describes that the fast path is the first path through which a section is evaluated. Only if necessary, the slow path kicks in. He compares it with a situation where one is confronted with solving 2x2 compared to solving 47x35. For the first calculation, the brain has the answer ready, and the slow path does not need to work. For the second calculation, the fast path cannot help, and thus the slow path needs to take over. The communication between the fast and the slow path is illustrated by a double-ended arrow in Figure 46. In the first draft of this Figure, the slow action preceded the fast action, that is as prior to the formation of a habit, one needs to invest cognitive energy to set the habit up. Though, as just discussed whether the fast or the slow track operate depends on the situation. Therefore, the fast and the slow path are on the same level. Out of a slow action eventually, a habit might form. A double-

[Type here]

ended arrow is also used between fast action and habits. That is as habits are a heuristic that inform fast action.

The habit box is depicted with more boxes in the background. This aims at indicating that individuals have sets of habits. Hence this intends to illustrate that one action, should not be understood as disconnected from other actions. This in turn leads to practices, which are actions that are embedded within the social structure and the individual structure. At least **Practice Theory** focuses more on the embeddedness in and mutual relationship between structure and practice. To illustrate the embeddedness within structure a thick arrow between the social realm and the individual realm has been added. Practices influence structures and structures influence practices. The social realm distinguishes between tangible and non-tangible structures. Between those is a mutual relationship. Once more the intention is not to engage in a discussion about the leverage either of these spheres has. For simplicity reasons, it is here only indicated that a mutual relationship between those two spheres exists. This relationship has been indicated in the discussion about mental models, as well as about habits. We (re-)create the world the way we perceive it. Thus, based on our social norms and values we create tangible structures (such as institutions or infrastructure). This tangible structure (re-)creates non-tangible structures. Our values, for example, influence the political system that is put in place. The political system, in turn, influences the values society has. This mutual relationship happens on individual, as well as on societal level. It has already been explained that our motivation, such as our values, influences our actions. Thus, the invisible, mental sphere is translated into something observable, which in turn influences the mental sphere again.

On the individual level practices form a lifestyle. A lifestyle is a tangible (observable) structure that in turn influences the intangible aspects. Thus, in the societal as well as in the individual realm there is a circular relationship between structures that recreate each other. Since individuals are part of the societal realm and since the societal realm is part of the individual these two circles re-enforce each other as well (see Figure 47). As Figure 47 illustrates the infinity symbol might be a good representation of this interconnectedness. The continuation of interaction in processes of change is also highlighted by the illustration of **Panarchy-Theory**, mentioned in section 3.5.

It needs to be highlighted that Figure 46 does not intend to illustrate that every action is becoming a habit. Some actions happen only once or every now and then. If one is analyzing such an activity, the analysis stops at that point. Still a person's lifestyle and motivation, thus the internal as well as the external structures will influence this one point in time action. The distinction between routinized and *random* actions is key when thinking about behavioral interventions. For the former case, a habit needs to be broken, for the latter this is not the case. Thus, it might be easier to trigger a specific action that one has never done before than changing an action. However, the one point in time action is not purely *random* and is influenced by internal and external structures.

[Type here]

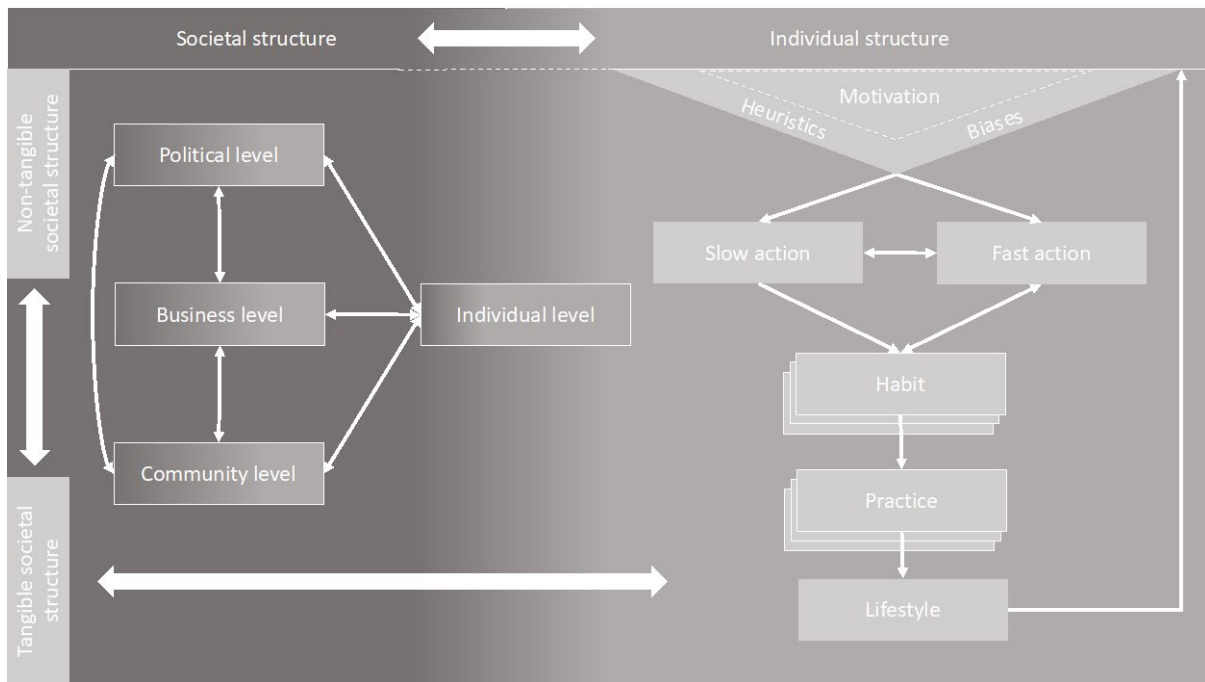


Figure 46: Connecting levels

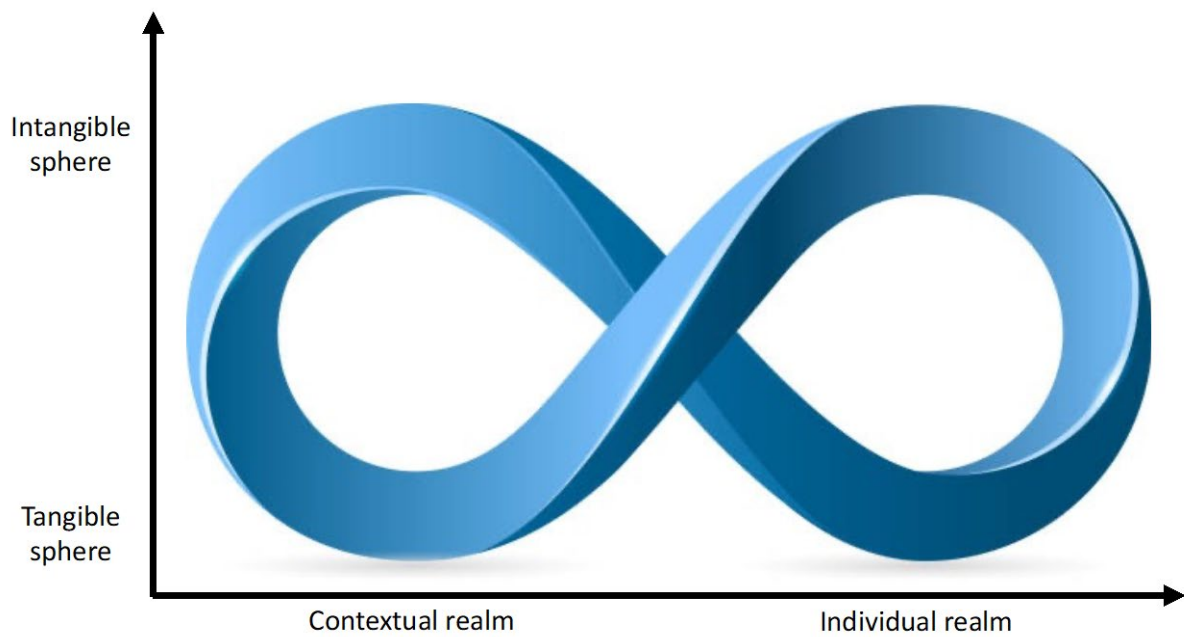


Figure 47: Interconnection between the social and the individual, the tangible and the intangible.

[Type here]

## 5 Behavioral levers

In the previous chapters, it has been outlined that interventions aiming at triggering a specific behavior or changing existing behavior, may use different leverages. There are interventions that provide information to change people's attitudes and thus change their behavior. There are interventions that focus on heuristics to reduce the cognitive burden of taking a specific action. There are incentives that target people's mindsets and thus call for cognitive activity to reflect on one's own perceptions. There are incentives that focus on the interplay between the individual and the context in which behavior takes place. The question is which intervention to apply when?

Above it has been indicated that not every intervention fits to every behavior. Verplanken and Whitmarsh (2021) indicates that information is not sufficient to change / break with habits, but that nudges, legislations, and incentives might be better tools. That could lead one to the conclusion that the intervention needs to fit the type of behavior. The type of behavior / practice needs to be analyzed first and then one can decide which type of intervention would fit. Verplanken and Whitmarsh (2021) outline that motivation is relevant to setting up a habit, but then the cues take over. Once cues have taken over the motivation to act in a certain way is less relevant. Though that does not mean that it is not necessary to work on people's motivations. It only means that motivations are outperformed by the cues at some point. Depending on the behavior a sequence of interventions may be needed. For example, first information may have to be provided to change attitudes, then cues need to be disrupted so that people cannot tap into old habitual behavior. That may need to be accompanied by interventions that support the formation of new behavior. Hence a suite of interventions might be necessary.

A similar conclusion could be drawn from a report provided by the UK's Behavioral Insights Team that suggests drastic behavioral changes in order to meet the Net Zero target. Within this report, it is suggested to combine upstream and downstream approaches (see Figure 48). This is not so much about sequencing interventions, but rather about the need to place several interventions at the same time (Londakova et al., 2021). The combination of approaches or rather of scales has also been suggested by Newell, Daley, et al. (2021). However, the idea of sequencing interventions along with behavior change has hardly been found in the reviewed literature.

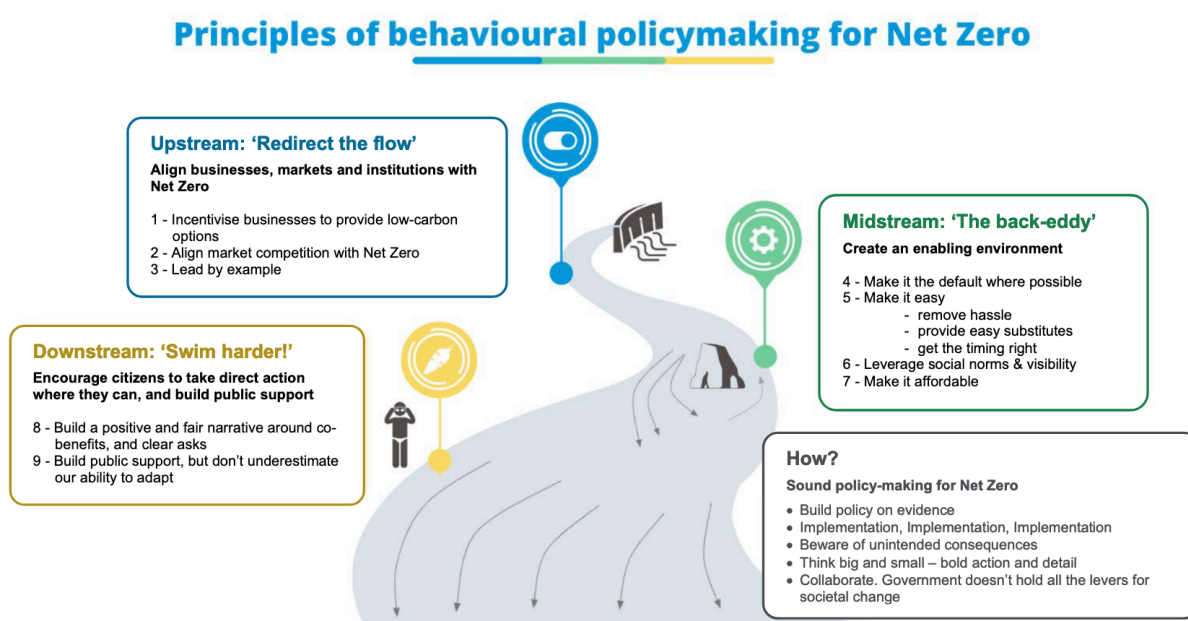


Figure 48: Upstream, downstream model of Behavioral Change, by Londakova, Park et al. (2021)

[Type here]

Bujold et al. (2020) provide a literature review about “The Science of Changing Behavior for Environmental Outcomes”. They provide six different behavioral levers (Figure 49) as an entry point to change human behavior. These **levers** indicate that human behavior is not operating in isolation, but is embedded in a social structure and regulatory frameworks. Bujold et al. (2020) highlight that behavioral science does consider the broader environment in which individuals and thus their decisions are embedded.

*„In summary, the behavioral science perspective has studied how individuals make decisions, concentrating on the ways human behavior deviates from the predictions of rational choice models. The field has documented various biases that result from people relying on cognitive heuristics for making decisions, many of which are the result of quick, implicit, and sometimes emotional processes rather than slow deliberation. While this work analyzes decisions from the perspective of the individual, it also investigates social influences, showing how people process their social environment and then apply it to their choices.“ (Bujold et al., 2020)*



Figure 49: Behavioral levers (Bujold et al., 2020)

[Type here]

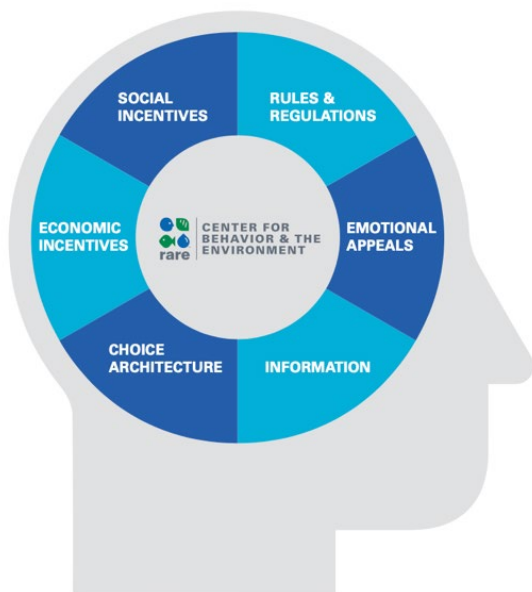


Figure 50: Behavioral Levers, from Williamson, Satre-Meloy et al. (2018)

In an earlier RARE report (Williamson et al., 2018), the six behavioral levers were already presented (see Figure 49). There, Williamson et al. (2018) differentiate between those levers that are commonly (light blue) and those that are not commonly (dark blue) applied to behavioral interventions (see Figure 50). The history of behavioral science becomes visible in this illustration since those levers commonly applied rather belong to the Rational Choice Theory category (see also Sanders, Snijders, and Hallsworth (2018)). Kollmuss and Agyeman (2002) for example argue that although information deficit models have proven to be wrong, they are still used by many Non-Governmental Organizations (NGOs) and some Governments campaigning for behavior change (see also Heiskanen & Laakso, 2019). Hampton and Adams (2018) investigate the popularity of behavioral economics. They compare the application of commonly used behavioral science with less commonly used **Practice Theory**. According to their research, the popularity of behavioral science seems to be based on accessibility, co-option, evidence and applicability. Similarly, Chatterton and Wilson (2014) state: “This positioning of individuals at the centre of the problem stems from the historical foundation of policy-relevant ‘behavioural science’ in economics and psychology.” Darnton (2008) states: „Standard economic theory represents the starting point for modelling many aspects of human behaviour.“ Even if it might be due to the historic rooting of behavioral interventions in Rational Choice Theory, Kollmuss and Agyeman (2002) point out that everyone intuitively knows that behavior change is not that easy. This is as literally everyone knows how hard it is to change. The predominance of the individual perspective is also acknowledge in **Cultural Theory**, which categorizes the dominant cultural model since 21<sup>st</sup> century as individualistic<sup>12</sup> (Jackson, 2005).

To account for the complexity of human behavior, Williamson et al. (2020), suggest to use a **Psycho-Social Theory of Change** (PS-ToC). Williamson et al. (2020) state:

*“Many program intervention elements aim to change behavior through the beliefs and preferences of their target actors. In traditional [Theory of Change] ToCs, these changes are often implicit, directly linking the intervention elements to the behavioral output. However, a PS-ToC makes explicit the intermediary step of belief and preference shift. By including this step, the PS-ToC acknowledges that even if the intervention element is delivered as directed,*

<sup>12</sup> There are four types of cultural models; fatalist, hierarchical, individualist/entrepreneurial and egalitarian

[Type here]

*it may fail to change the necessary beliefs or preferences, and, therefore, fail to change behavior.”*

This approach indicates limitations of interventions based on **Rational Choice Theory**, or more generally of linear behavioral models. Williamson et al. (2020) seem to indicate a hierarchy among factors that are relevant for change, where a deeper or long-lasting change is acquired through a change of mindset (see also Kollmuss and Agyeman (2002) and see discussion above in sections 3.3, 3.4, 3.6). However, the **Psycho-Social Theory of Change** does still focus on beliefs or mindsets to achieve long-term behavioral change. While beliefs, values, perceptions, etc., are all relevant for behavioral change, it seems like none of these factors are sufficient to achieve behavioral change.

Table 7 provides behavioral principles used in different behavior design projects, compared by Williamson et al. (2020). “Behavioral principles serve as the behavioral and social science framework through which designers understand and analyze the motivations and barriers that their target actors have relative to behavior change. They also help to design effective interventions” (Williamson et al., 2020). If all principles are compared with each other one can see that they can be reduced to several levers: human nature (cognitive and emotional), choice architecture, information (information), social context, and incentive scheme. Behavioral principles with a focus on “incentive schemes” encompass rules, regulations as well as sanctions and rewards. The lever “norms” is covering perceptions and world views. Behavioral principles focusing on the “choice architecture” are about the simplification of choices. Indeed, “choice architecture” may overlap with “norms,” the social context or “human nature”. “Human nature” is a broad category that encompasses emotional aspects, as well as cognitive processes or identity. Interventions that aim at changing human behavior should combine several foci. “To get people to change, we need to design innovative solutions that meet them where they are, using the power of emotional appeals, social incentives, and choice architecture as expertly as we apply economics and policy,, (Williamson et al., 2018).

The five levers identified based on the behavioral principles provided in Table 7 differ from the levers Williamson et al. (2018) have identified. They have identified economic choices, rules, and regulations, information, social incentives, emotional appeals as well as choice architecture. Even if levers are called differently, both cover the same issues, though structured differently. “Incentive schemes” cover their “economic choices” lever. Additionally, this lever contains “rules and regulations”. This is as supposedly there is some form of sanction or support connected to rules and regulations. “Human nature” is not only “emotional appeal”, but encompasses all other (rational and irrational) mechanisms that affect decision making.

Behavioral Principle	Focus
Choice Architecture: Changing the context in which choices are made	choice architecture
Choice overload: When faced with a huge range of options, many people fail to choose the best option or fail to choose altogether. Having more options often leads to less realized choices.	choice architecture
Choice: People are influenced by the framing of choices as well as their social and situational context	choice architecture
Cognitive depletion & decision fatigue: Being tired and hungry can deplete our cognitive resources and significantly affect our decision-making.	choice architecture
Defaults: We “go with the flow” of pre-set options	choice architecture
Easy: Harness the power of defaults; Reduce the ‘hassle factor’ of taking up a service; Simplify messages	choice architecture

[Type here]

Enablement: Increasing means/reducing barriers to increase capability or opportunity	choice architecture
Hassle factors: Sometimes we do not act in accordance with our intentions because of seemingly minor inconveniences.	choice architecture
Incentivization: Creating an expectation of reward	choice architecture
Material Incentives: Increasing or decreasing real or perceived costs, time, or effort for doing a behavior	choice architecture
Persuasion: Using communication to induce positive or negative feelings, or to stimulate action	choice architecture
Primacy bias: The bias toward the information that is presented first.	choice architecture
Timely: Prompt people when they are likely to be most receptive; Consider the immediate costs and benefits; Help people plan their response to events	choice architecture
Affect: Our emotional associations can powerfully shape our actions	human nature
Attention: People's attention is limited and easily distracted	human nature
Belief formation: People rely on mental shortcuts and often over/underestimate outcomes and probabilities	human nature
Commitments: We seek to be consistent with our public promises, and reciprocate acts	human nature
Determination: People's willpower is limited and subject to psychological biases	human nature
Ego: We act in ways that make us feel better about ourselves	human nature
Emotional Appeals: Using emotional messages to drive behavior	human nature
Identity: Many of our choices are impacted by the perception we have of ourselves and our social roles.	human nature
Incentives: Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses	human nature
Limited attention: Our ability to pay attention to several things at once is much more limited than we might think.	human nature
Loss aversion: People hate losses more than they love wins.	human nature
Procrastination: We put off for tomorrow what we could (and often should) do today.	human nature
Salience: Our attention is drawn to what is novel and seems relevant to us	human nature
Status quo bias: People prefer to stick with the status quo, even if other options are available.	human nature
The availability heuristic: People judge probabilities based on how easily examples come to mind.	human nature
The planning fallacy: People tend to be overly optimistic about their ability to finish tasks on time. They consistently believe the future will	human nature



[Type here]

unfold as planned, and they rarely leave sufficient time to meet key deadlines.	
Thinking automatically: Much of our thinking is automatic, not deliberative. It is based on what effortlessly comes to mind.	human nature
Thinking Socially: Humans are not autonomous thinkers or decision-makers, and we are deeply social animals. We have innate preferences for altruism, cooperation, and reciprocity, and we are strongly affected by the social norms and networks in our communities.	human nature
Thinking with mental models: Individuals respond not to objective experiences but to mental representations of experience constructed from culturally-available mental models. Human decision making, therefore, is shaped by the powerful pull of both contextual cues and the past experiences of individuals and societies.	human nature
Attractive: Attract attention, Design rewards and sanctions for maximum effect	incentive scheme
Coercion: Creating an expectation of punishment or cost	incentive scheme
Restrictions: Using rules to reduce the opportunity to engage in the target behavior (or to increase the likelihood of engaging in the target behavior by reducing the opportunity to engage in competing ones)	incentive scheme
Rules and Regulations: Enacting rules that promote or restrict a behavior	incentive scheme
Education: Increasing knowledge or understanding	Information
Information: Providing information about what the target behavior is, why it matters, and how to do it	Information
Priming: Our acts are often influenced by sub-conscious cues	Information
Training: Imparting skills	information
Environmental restructuring: Changing the physical or social context	social context
Messenger: We are heavily influenced by who communicates information	social context
Modeling: Providing an example for people to aspire to or imitate	social context
Norms: We are strongly influenced by what others do	social context
Social Influences: Leveraging the behaviors, beliefs, and expectations of others	social context
Social norms: All of us are heavily influenced by our perception of what others are doing.	social context
Social: Show that most people perform the target behavior; Use the power of networks; Encourage people to make a commitment to others	social context

Table 7: Behavioral principles, adapted from Williamson, Bujold et al. (2020)

[Type here]

Due to the high number of different behavioral models, it might be difficult to choose the right one to understand a specific behavior. Guidance might be needed to select the most relevant models and theories to be used in an analysis. Chatterton and Wilson (2014) provide such a tool.

Figure 51 by Chatterton and Wilson (2014) indicates the complexity of human behavior. It illustrates that the actor may not only be an individual, but it can be understood as the whole population. In this respect, it needs to be mentioned once more that behavior (change) models discussed in this working paper are only looking at individual behavior. Group behavior is not discussed. Even if sections in this working paper include the role of the society for human behavior and for behavior change, these sections are not about group behavior. Rather they indicate how society influences individual's behavior and vice versa. Back to Figure 51 and the scope dimension. This is an interesting dimension pertaining behavioral interventions, as it indicates that behavior is not necessarily self-contained. Hence, one specific behavior might be connected to other behaviors. The domain dimension refers to other illustrations such as the context provided by Baum and Gross (2017). Figure 52 illustrates how the framework by Chatterton and Wilson (2014) is implemented. It is interesting to note that Chatterton and Wilson (2014) developed this framework to overcome the divide within behavioral science. In the beginning of their paper, they report about the discussion of psychological, social, economic, institutional, and structural aspects influencing or determining behavior. Their framework provides a combination, a way to identify which of these aspects are relevant for a specific behavior.

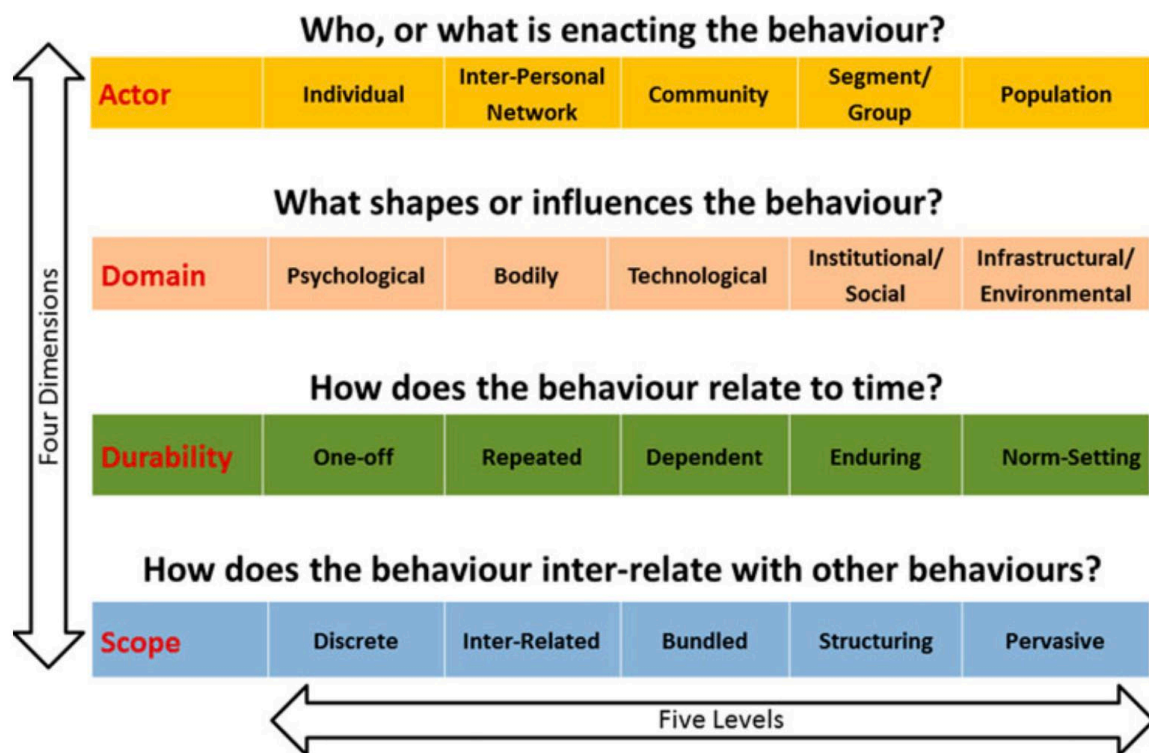


Figure 51: The Four Dimensions of Behaviour, from Chatterton and Wilson (2014)

[Type here]

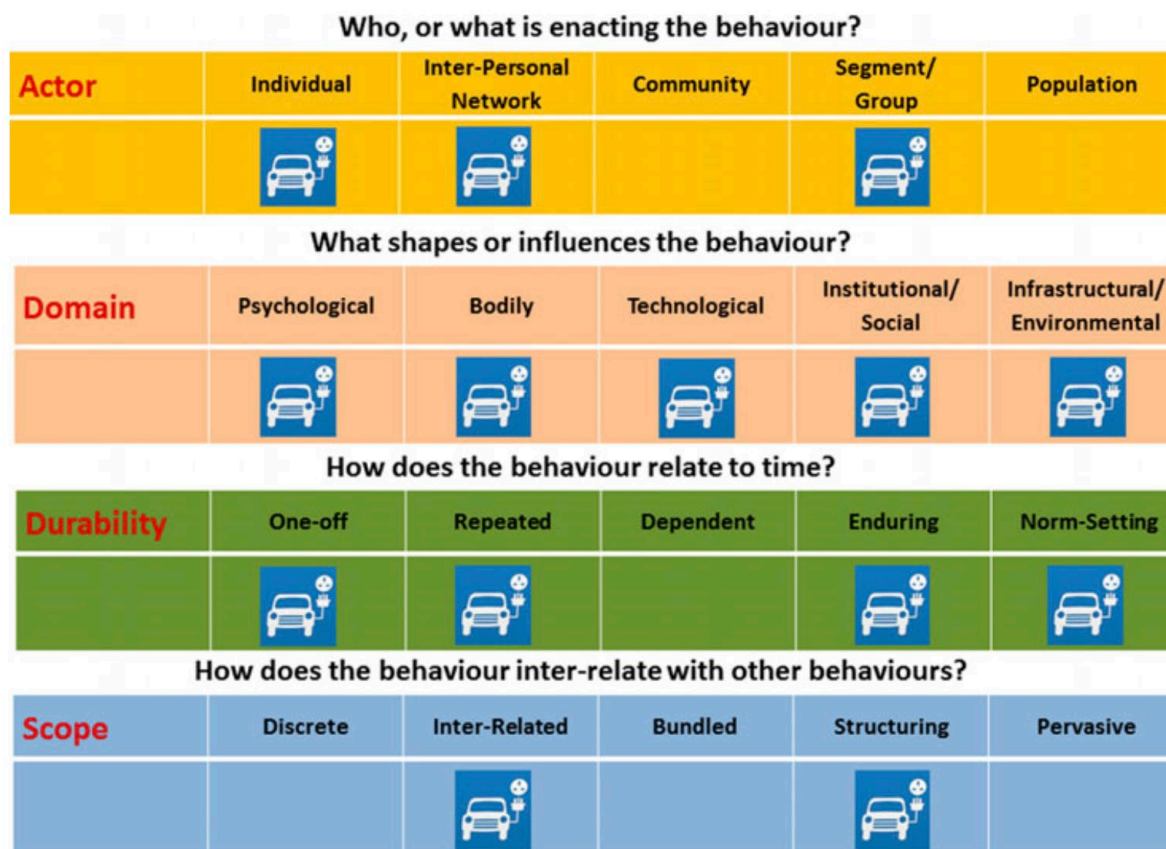


Figure 52: The Four Dimensions of Behaviour applied to a case From Chatterton and Wilson (2014)

The notion of different behavioral levers indicates that successful behavioral change interventions need to consider more than just one lever. It also connects with the idea of leverage points in **Systems Thinking**, where leverage points have a hierarchy based on their ability to change the whole system (Abson et al., 2017; Meadows, 1999). It further connects to the idea of **Double, Triple, or Multi-Loop Learning** (Fahrenbach & Kragulj, 2019; Pahl-Wostl, 2009; Peschl, 2007), as well as to **spiral scaling** (Newell, Daley, et al., 2021).

Due to the complexity of human behavior, it is suggested to not only approach behavior change from one angle. Instead, human behavior needs to be addressed using different angles. Bujold et al. (2020) suggest combining social science and behavioral science to support sustainability transitions. This approach is also supported by Newell, Daley, et al. (2021) who integrate four different approaches; nudge theory, psychology, sociology, and political science. The approach presented by Newell, Daley, et al. (2021) does also highlight the importance to combine low-hanging fruits with goals that are harder to achieve. This combination is called **spiral scaling**. In a sense **Systems Thinking** does also differentiate between low-hanging fruits and goals that harder to achieve, through the notion of leverage points (Meadows, 1999).

Studying and understanding the embeddedness of humans within an environment does not only allow to understand why individuals act, but also why they do not act. The concept of lock-in or path dependency describe such instances. Above, habits have been discussed already, and it has been indicated that heuristics are curse and cure at the same time. The discussion of habits being curse and cure at the same time could be extended to the concept of **habitus** or **Structuration Theory**. However, it will remain limited to habits as a form of heuristics. In this section heuristics and biases are listed to

[Type here]

provide an (incomplete<sup>13</sup>) overview on how behavior (change) can be inhibited. Specifically, targeting these heuristics and biases can be a way to support a specific behavior. Further, values, attitudes, preferences, and worldviews are briefly discussed.

## 5.1 Values, preferences, world view paradigm

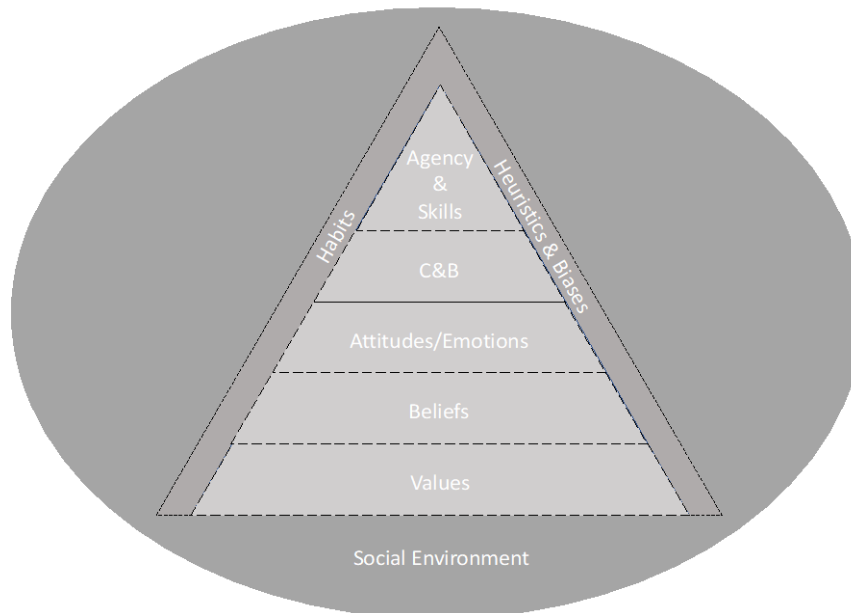


Figure 53: Iceberg model of Human behavior

Values, beliefs, and attitudes can be presented in a hierarchical manner (see Figure 53) (Darnton & Evans, 2013). According to Darnton and Evans (2013) values are “[p]art of the basic elements of an individual’s motivational system [...]” They state that in psychology values are what underpins motivations, they are **guiding principles** that individuals use to evaluate a situation and to decide on which actions to take (see also Cieciuch & Schwartz, 2020). While they apply to many different actions, the effect they have on all actions are limited, since other factors matter too. This is described by the **value-action gap**. Values are also described as the foundation of one’s personality (Cieciuch & Schwartz, 2020). Beliefs are a step lower, so to say, and describe a person’s **worldview**. Attitudes are once more a level lower and describe people’s **views**. Values, beliefs, and attitudes constitute a person’s motivation to act in a specific way. In Figure 53 emotions are added to attitudes. However, Darnton and Evans (2013) indicate that there is no congruence where to put emotions. For example, Bernard and Terjesen (2020) use the distinction between hot and cold attitudes (see Figure 54). Cold attitudes describe purely rational cognitive processes, while hot refers to cognitive processes that are influenced by emotions. See (2020) provides a discussion about the differentiation between cognitive and emotional aspects of individual attitudes.

While beliefs and attitudes are connected it does not necessarily mean that one believes in something that someone likes. Carlitz and Rios (2020) provide the example of people not believing in superpowers but linking the hypothetical idea of having superpowers. Carlitz and Rios (2020) explain that “[...] beliefs help us predict and make sense of phenomena such as attitudes, choices, behaviors, and cause-and-effect relationships, whereas attitudes influence our choices and behaviors.”

<sup>13</sup> A Wikipedia page list provides a more complete list: [https://en.wikipedia.org/wiki/List\\_of\\_cognitive\\_biases](https://en.wikipedia.org/wiki/List_of_cognitive_biases)

[Type here]

Cost and benefit (C&B) assessments are slow-track thinking that leads up to a certain decision. Pros and cons are assessed, and actions are taken accordingly. Though, it needs to be stated that a C&B assessment is at the fringe between fast and slow. Weighing off costs and benefits can happen fast, or it may need more through considerations. Nevertheless, what is understood to be a cost and a benefit depends on someone's values, beliefs attitudes, and emotions. Another aspect of decision making is whether one can really take a certain action. The possibility to implement of any action also depends on someone's agency (having a say) and someone's skills (ability to do it). Thus, even if an action has been decided to be favorable, one may not be able to do it because of the lack of skills (Darnton & Evans, 2013).

The center triangle in Figure 53 is extended by habits, heuristics, and biases. Darnton and Evans (2013) mention some heuristics regarding cost and benefit assessments, such as loss aversion or present bias (discounting). While such heuristics can be part of a conscious decision process, heuristics are also often part of an unconscious decision process. Thus, the extension of the core triangle describes the thinking fast path of decision making. This also contains habits. Of course, the borders between thinking fast and slow are permeable (dashed lines). For example, Darnton and Evans (2013) indicates that skills need to be acquired at some point. This only happens through repetition. Hence, the role of habits for having a skill is obvious. They also refer to the relevance of Practice Theory in this regard, as a practice is a regularly executed behavior. To also highlight the relevance of the society for the formation of values, for example, the triangle has been embedded in a circle that represents society. The relation between individual behavior and society is bi-directional. Therefore, the border of the outer triangle is dashed as well. It needs to be mentioned that society includes structures in which behavior is embedded.

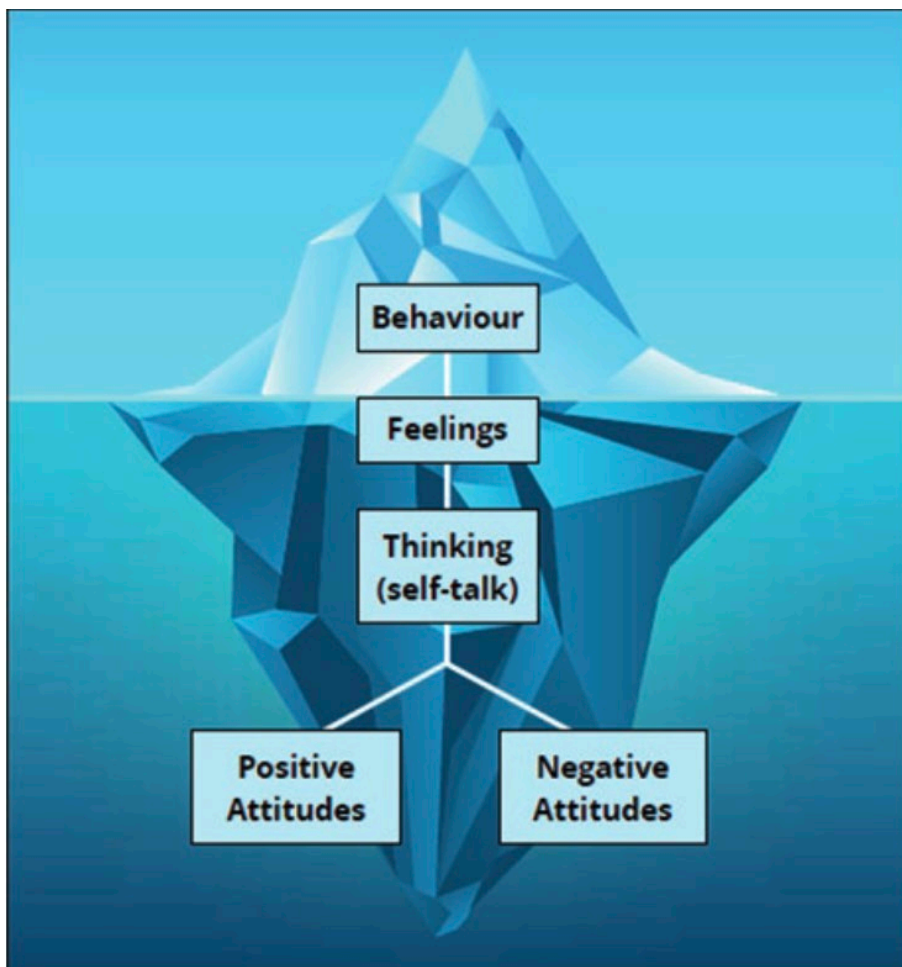


Figure 54: Iceberg model From Bernard and Terjesen (2020)

[Type here]

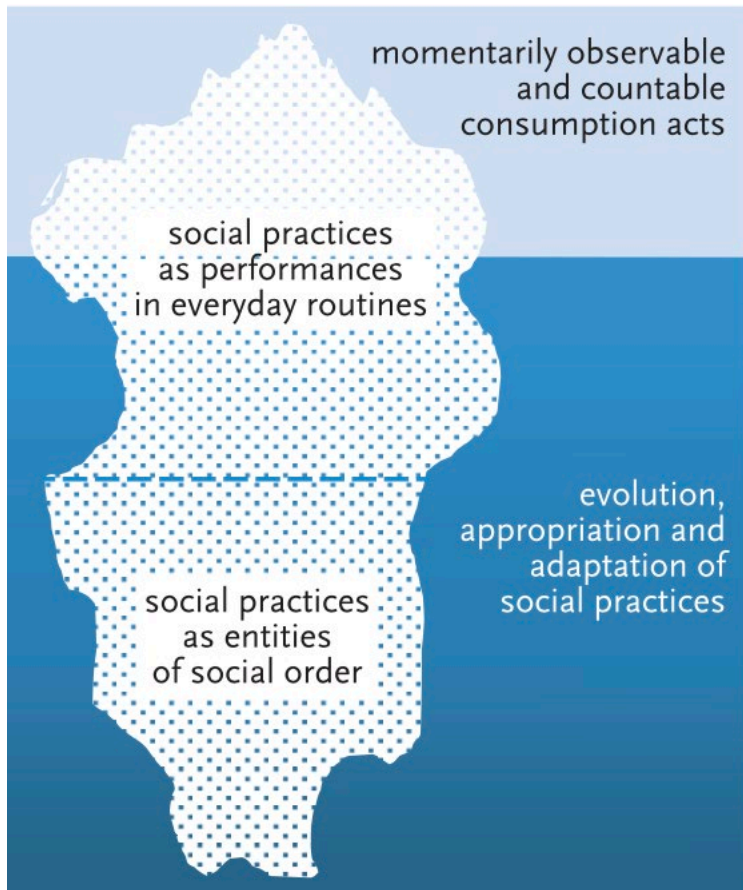


Figure 55: Iceberg model applied to Practice Theory, By Jaeger-Erben and Offenberger (2014)

A similar illustration of the connection between behavior and attitudes is the iceberg model (see Figure 54 and Figure 55). The model distinguishes between observable, semi-observable, and non-observable aspects of human behavior. Only the actual behavior is observable, feelings are semi-observable, and attitudes, beliefs, as well as values, are non-observable. It is indeed the task of research to investigate what non-observables lead to a certain observable behavior (Bernard & Terjesen, 2020). Jaeger-Erben and Offenberger (2014) apply the iceberg model to Practice Theory to also distinguish among visible, partly visible, and invisible parts of practices. Similarly to the model by Bernard and Terjesen (2020) there is a visible behavior / practice. The semi-visible or invisible part that explains the respective practice within the model by Jaeger-Erben and Offenberger (2014) is though not explained through individual motivations, but through the (social) context.

The aspect of observable behavior is critically discussed by Nielsen et al. (2021). They argue that scientists aim at proofing certain behavioral models and do so via easily observable behaviors. However, in terms of behavior relevant for mitigating climate change, for example, easily observable behavior may not be the most important behavior to reduce emissions. Thus, the connection of harder to observe behaviors and their connection to for example motivations or non-observable structural aspects might be understudied.

#### 5.1.1 Values

Cieciuch and Schwartz (2020) provide three different takes on value. One is framing values predominantly as motivation, one takes more a cognitive angle to values, and finally, one interpretation of values combines these two. Those who understand values as a motivational factor to behavior see values as personality traits, which are hard to change. Those who understand values from a cognitive angle view values as socio-cognitive constructs which are more changeable. When both views are combined values are understood as guiding principle that motivates actions but also provides rationality to these actions.

[Type here]

In this view “[...] individuals’ values are a product of the interaction between biologically based dynamic dispositions (located at the first level) and social circumstances and experiences. Values are transformations of motivations into socially acceptable goals defined by one’s culture. In the process of socialization, people shape their mental representations of the goals and learn how to fulfill their basic motivations by pursuing these goals” (Cieciuch & Schwartz, 2020).

Schwartz (1992) developed a way to structure values along the axes “protection versus growth and focus on self versus focus on other people or groups” (Cieciuch & Schwartz, 2020). Following these axes four main values result: “conservation values, which express a protection motivation and a social focus; self-enhancement values, which express a protection motivation and self-focus; openness to change values, which express a growth motivation and self-focus; and self-transcendence values, which express a growth motivation and social focus” (Cieciuch & Schwartz, 2020). These four categories can be further subdivided (see Table 8). That some values are incommensurate is described in Figure 56. Opposing values are incommensurate while adjacent ones can be combined (Cieciuch & Schwartz, 2020).

Investigating behavior change the value circle is insightful since openness to change is in opposition to conservation. Thus, behavior change may rather be difficult for individuals who mostly identify through conservation values.

Higher-order values	More narrowly defined values
Self-transcendence	Benevolence-dependability – being a reliable and trustworthy member of the in-group
	Benevolence-caring – devotion to the welfare of in-group members
	Universalism-tolerance – acceptance and understanding of those who are different from oneself
	Universalism-concern – commitment to equality, justice, and protection for all people
	Universalism-nature – preservation of the natural environment
	Humility – recognizing one’s insignificance in the larger scheme of things
Conservation	Humility – recognizing one’s insignificance in the larger scheme of things
	Conformity-interpersonal – avoidance of upsetting or harming other people
	Conformity-rules – compliance with rules, laws, and formal obligations
	Tradition – maintaining and preserving cultural, family, or religious traditions
	Security-societal – safety and stability in the wider society
	Security-personal – safety in one’s immediate environment
	Face – security and power through maintaining one’s public image and avoiding humiliation
Self-enhancement	Face – security and power through maintaining one’s public image and avoiding humiliation
	Power-resources – power through control of material and social resources
	Power-dominance – power through exercising control over people
	Achievement – personal success through demonstrating competence according to social standards
	Hedonism – pleasure and sensuous gratification for oneself
	Hedonism – pleasure and sensuous gratification for oneself

[Type here]

Openness to change	Stimulation – excitement, novelty, and challenge in life
	Self-direction-action – the freedom to determine one’s own actions
	Self-direction-thought – the freedom to cultivate one’s own ideas and abilities

Table 8: Values, From Cieciuch and Schwartz (2020)

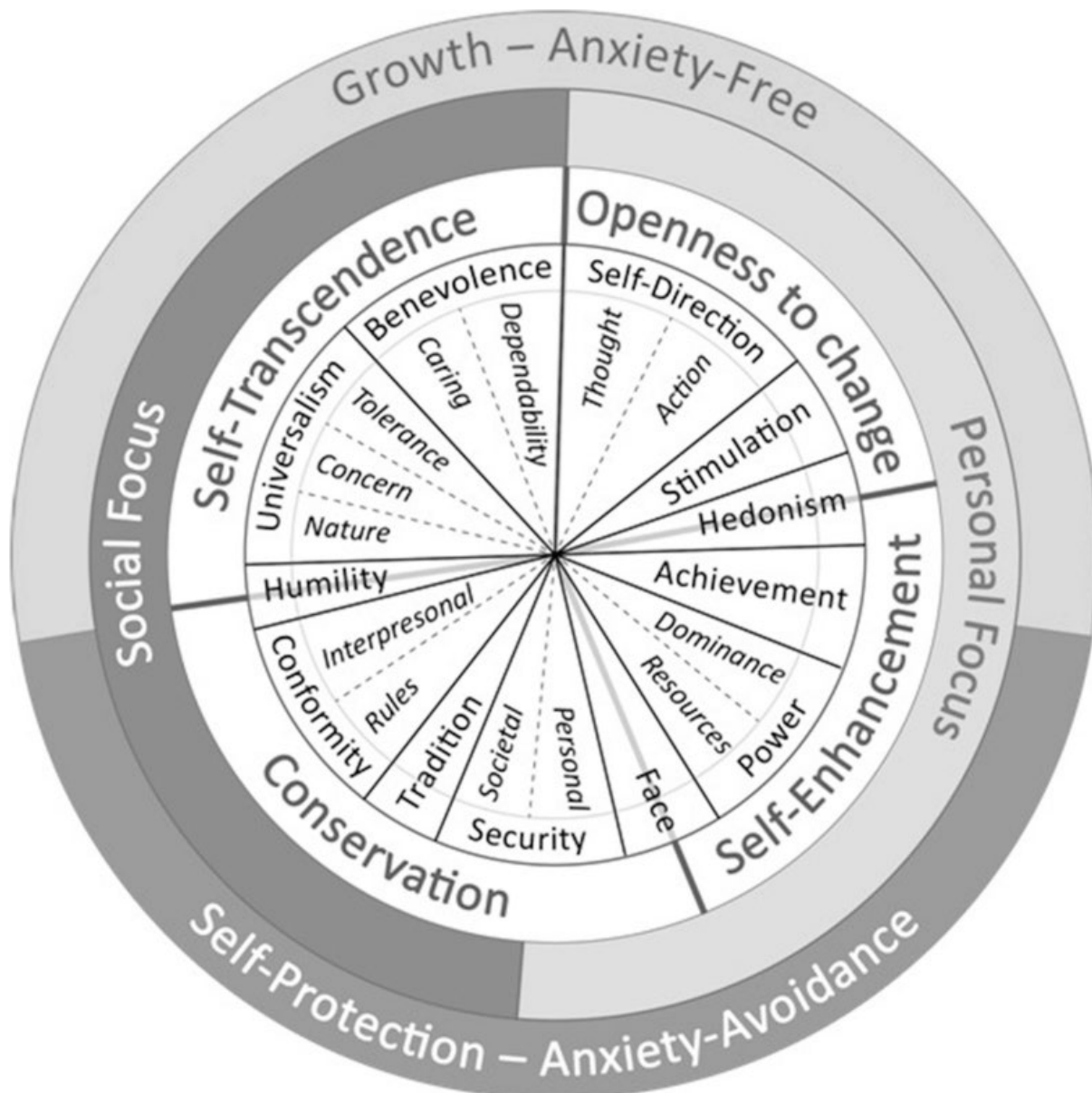


Figure 56: Value Circle from Cieciuch and Schwartz (2020)

### 5.1.2 Beliefs

“Beliefs are defined in psychology as a person’s views of a particular aspect of life” (Darnton & Evans, 2013). “[P]sychologists define “beliefs” as fundamental units of thought (i.e., subjective judgments of what is true or false) upon which attitudes are often built” (Carlitz & Rios, 2020). Some distinguish between different types of beliefs. For example, one can distinguish between automatic thoughts, which are surface level and easy to change, and core beliefs that are deep-sitting and difficult to change. Core beliefs are more general than surface level automatic thinking, which rather applies to



[Type here]

specific situations. Beliefs are crucial for the **Attitudes, Behavior, Context (ABC) model**. “A” is not limited to attitudes, but includes beliefs, norms, and values which then trigger a certain behavior. Though the behavior might be moderated by the context (e.g., social structures). It might still be difficult to identify what a specific behavior was triggered by. For example, there are thoughts and beliefs individuals are aware of, beliefs and thoughts one is not instantly aware of and those beliefs and thoughts one may not be aware of (Bernard & Terjesen, 2020).

*“Before forming new and modifying existing beliefs, three important cognitive operations take place: sensation (i.e., detecting stimuli via eyes, ears, nose, skin, and tongue), perception (i.e., decoding and interpreting sensory information), and evaluation (i.e., determining the veracity of the information). However, what we perceive is not necessarily reality; beliefs and knowledge are thus distinct” (Carlitz & Rios, 2020).*

The three conditions listed by Carlitz and Rios (2020) remind of the discussion in section 3.3 about the readiness to change. Furthermore, the distinction between reality and perceptions could be understood as a parallel to the concept of **habitus**. According to Carlitz and Rios (2020), beliefs are more related to fast rather than slow thinking. The formation of beliefs relies on heuristics rather than on thorough thought processes. For example, confirmation bias may come into play when forming new beliefs. Information might already be filtered to fit to already held beliefs. Above it was stated that perception and evolution of information are part of how beliefs are formed. Though the evaluation and perception of information depend on preexisting beliefs (mental models).

Thus, it is difficult to change beliefs, particularly foundational beliefs which are the foundation to other beliefs one holds. Beliefs may however be challenged if they are undermined. One such instance is cognitive dissonance, where one is confronted with two opposing beliefs that one agrees to. Another circumstance is when beliefs are no longer able to explain the world. This may lead to a loss of sense of something and to anxiety. In order to restore stability, a new belief needs to be taken up (Carlitz & Rios, 2020).

### 5.1.3 Emotions

In psychology, emotions are separated from cognitive processes, whereat emotion and cognition are understood different aspects of attitudes (See, 2020). Emotions are also part of what motivates people to act in a certain way. Thus emotions are an important factor in decision-making processes (Williamson et al., 2018). However, there are people whose attitudes are predominantly formed by emotions or by cognition. This has implications for behavior intervention. People who are more steered by cognitive processes have to be targeted differently than people who are more steered by their emotions (See, 2020). Emotions are influenced by many things. For example, Darnton (2008) refers to research that indicates a link between emotions and agency, where agency and emotions work together to trigger pro-environmental behavior.

In sociology, emotions are studied in the context of culture and interaction with other individuals. Emotions are understood to differ depending on the cultural context. For example, the adequate way to emotionally respond to death depends on the cultural context (Grills, 2014).

### 5.1.4 Attitudes

Attitudes are tendencies towards things which have been informed by beliefs, emotions as well as past experiences (Richardson et al., 2020). Carlitz and Rios (2020) describe attitudes as “global evaluations – liking or disliking – toward an object (e.g., person, thing, event, idea).” If beliefs, emotions, and past experiences do not line up people may express “mixed” feelings towards something (Richardson et al., 2020). Attitudes are to some extent relevant for human behavior. However, humans may not be able to report on their attitudes. That is as some distinguish between implicit and explicit attitudes. Implicit attitudes are unconscious and automatic, explicit attitudes are formed through cognitive process (e.g., thinking about past experiences). People can report on explicit attitudes but not on implicit ones. This instance relates to the attitude behavior gap. Research indicates that people who rely more on explicit attitudes are more consistent in their behavior. Also,

[Type here]

personality traits, such as the need for consistency, the need for self-monitoring or self-awareness seem to matter (Richardson et al., 2020).

Since attitudes are understood to be relevant for behavior, much research has been conducted to investigate how attitudes can be changed. Most of this research focuses on persuasion. However, the successfulness of persuasion seems to depend on personality traits. To a certain extent framing can support persuasive interventions to reach those who are harder to persuade. Further the existence of preexisting attitudes that can be applied to a certain circumstance also matters. If no preexisting attitude can be applied, it is easier to suggest a new one. Similar to beliefs, if a new attitude is opposing a preexisting one the result is cognitive dissonance, which in turn may lead to the adaptation of the old attitude (Richardson et al., 2020).

## 5.2 Defense mechanisms

Above it has been indicated that for deep change to happen an individual needs to be cognitively and emotionally ready for that change. If a person is not ready for change, psychological defense mechanisms kick in. "In short, (i) scientific understanding advances rapidly, but (ii) avoidance, denial, and recrimination characterize the overall societal response, therefore (iii) there is relatively little behavioral change, until (iv) evidence of damage becomes plain" (Dyson, 2005). This statement leads Dickinson (2009) to wonder "why the connection is so flimsy between what we know, what we value, and how we behave." This again shows that the link between attitudes, information, values and actual behavior is weak. Kollmuss and Agyeman (2002) also argue that direct experiences are more triggering than indirect ones. They indicate that in order to deal with distress experienced, secondary psychological responses, such as denial, rational distancing, apathy, and delegation, are triggered.

Denial means that an individual is living in a dream world and does not accept reality. Information that may not fit one's worldview is either ignored or reinterpreted. In contrast to denial, rational distancing describes a strategy where a person is aware of the problem but does no longer have emotions connected to that issue. Kollmuss and Agyeman (2002) state that this mechanism is particularly common among scientists and environmentalists. It is a mode to protect from further bad news about a known problem. A defense mechanism where a person may no longer seek information about the issue is apathy and resignation. The situation has become hopeless, the person has lost the feeling of having agency and thus retracts attention from the issue. Another possibility is to delegate responsibility. With this defense mechanism, a person will blame others for the issue at hand (Kollmuss & Agyeman, 2002). The **Norm Activation Theory** features emotional aspects that are relevant for defense mechanisms. The theory includes the notion of feeling morally obliged as well as the denial of responsibility (Darnton, 2008). Adams (2017) provides an infographic (Figure 57) to illustrate the diversity of defense mechanisms individuals have to overcome to actually act in line with e.g., scientific evidence. The infographic does not only indicate the variety of defense mechanisms, it also shows that the first step to overcoming them is reflection. The need for reflection has been discussed above (see change as learning section 3.3, change in systems in section 3.4).

[Type here]

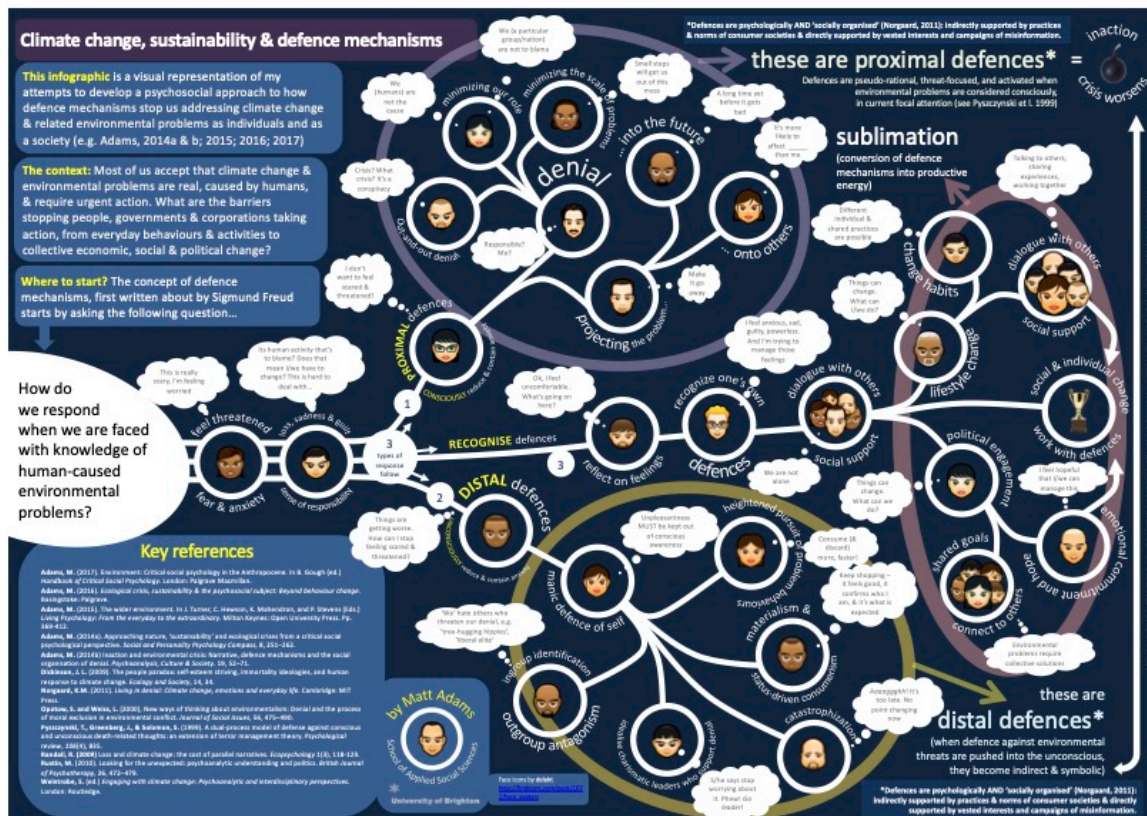


Figure 57: Defense mechanisms, infographic from Adams (2017)

Dickinson (2009) reviews the work of Ernest Becker, who contributed to **Terror Management Theory**. This theory is about the avoidance of death thoughts. Humans avoid such thoughts as we fear death, and we intend to avoid what we fear. The avoidance of death thoughts or rather the attempt to negate our own mortality has the effect that we either try to build something that makes us immortal or that we praise others who have a godlike character and are thus immortal. Thus, it is suggested that humans worship something immortal to avoid thoughts about one's transience. This concept is called transference and was coined by Sigmund Freud. It needs to be noted that the **Terror Management Theory** is not limited to thoughts about physical death but does also include the death of the ego and the identity.

Dickinson (2009) applies this theory to climate change to understand whether the death threat of climate change could explain why we are not acting the way we should. Dickinson states that he focuses on the proximate defense mechanisms of death thoughts. Generally, two different defense mechanisms can be distinguished, proximal and distal. "Proximal defenses are launched when death thoughts rise to consciousness, whereas distal defenses are responsible for keeping death thoughts unconscious." (Dickinson, 2009)

Proximal defense mechanisms to climate change death threats are: "(1) denial of climate change, i.e., climate skeptics; (2) denial that humans are the cause of climate change; and (3) a tendency to minimize or project the impacts of climate change far into the future" (Dickinson, 2009). So, either people deny climate change altogether, or they push needed action into the far future. If then the adverse effects of climate change become more and more apparent, people may apply distal defense mechanisms. Distal defense mechanisms aim to strengthen the self. Interestingly distal defense mechanisms applied to the climate change death threat lead to counterintuitive behaviors.

[Type here]

*“If primes related to global climate change increase the accessibility of death thoughts, exposure should lead to (1) transference idealization in the form of blind following and a reduction in the rational criticism of public figures, particularly charismatic leaders; (2) increased striving for self-esteem, which in Western society could mean counterintuitive increases in status-driven consumerism, materialism, and other behaviors that increase carbon emissions; (3) increased outgroup antagonism, not just between environmentalists and anti-environmentalists, but among religious groups, gangs, and other ideological groups; and (4) a tendency to bolster the existing world view even if it is not sustainable” (Dickinson, 2009).*

Thus, if people get their self-esteem from consumerism, a threat to consumerism will lead to more consumerism. To fight climate change consumption will have to be reduced. People may translate this into an attack on their own person (identity) and defend it by consuming even more. Dickinson (2009) refers to a study that supports the idea that consumerism is increased by thoughts about death (Kasser & Sheldon, 2000; Solomon, Greenberg, & Pyszczynski, 2004). The connection between consumption and identity to some extent contradicts the idea of Fahrenbach and Kragulj (2019) who propose that identity can be formed through actions, such as consumption (see Figure 42). If these actions are not in line with someone’s identity, that person may not adopt the action and may rather act in a way that supports their own identity. Thus, only smaller changes, which do not fundamentally attack someone’s identity, might be feasible. Another possibility might be the merging of values. The result may be environmental consumerism, or conscious consumerism. Consumption as such is not questioned but adapted to fit both values (caring for the environment and consumption). We identify with saving the planet, but we also identify with consumerism. The identity of the conscious consumer is born (Haws, Winterich, & Naylor, 2014; Lin & Huang, 2012; Naderi & Van Steenburg, 2018). This kind of adaption fits to the first loop of **Double-Loop Learning** described by Fahrenbach and Kragulj (2019) where underlying values are not changed.

Another way to escape the threat is through technology.

*„Technocracy itself is an immortality ideology that, although it is coupled with materialism, has as part of its makeup an element of the magical and a belief that new tools and innovations provide solutions to both the small day-to-day problems of life and the larger problems of human happiness and mortality” (Dickinson, 2009).*

Similarly, to people who get their self-esteem through consumerism, those who praise technologies, will support technologies even more when climate change threatens the physical life or the ego. While technologies do have the ability to reduce emissions in relative terms, these reductions can be nullified by the rebound effect (Haberl et al., 2020; Hickel & Kallis, 2020). The narrative around technology provides a basis for defense mechanisms. Technology myopia can feed proximal defense mechanisms such as: “future technologies will solve the problem.”

The role of science can be mentioned here as well. Dickinson (2009) indicates that **Terror Management Theory** suggests that more resources are used to investigate adaptation and mitigation, instead of halting climate change (Dyson, 2005). Even when looking at mitigation one could question whether some approaches to mitigation are not overly optimistic. For example, Warszawski et al. (2021) question scrutinize the 1,5°C scenarios provided in the 2021 IPCC (2021) report.

Anyhow, Dickinson (2009) suggests that people need to identify with nature or environmental protection to not exhibit defensive behavior when confronted with climate change or other environmental problems. If people identified with nature, a threat to nature would be a threat to their own ego and hence it would be more likely that people protect nature. In contrast, if people define themselves through consumerism, climate change is a threat to one’s (consumer) identity and thus one opposes the idea of climate change by consuming even more.

[Type here]

### 5.3 Cognitive dissonance

Defense mechanisms, as mentioned above may lead to confirmation bias. However, the aim to avoid cognitive dissonance may too. Individuals “[...] unconsciously seek consistency in our beliefs and mental frameworks and selectively perceive information. Information that supports our existing values and mental frameworks is readily accepted whereas information that contradicts or undermines our beliefs is avoided or not perceived at all” (Kollmuss & Agyeman, 2002). The **Theory of Cognitive Dissonance** was developed by Festinger and implies that humans tend to avoid information about environmental problems because they contradict or threaten some of our basic assumption of quality of life, economic prosperity, and material needs. On the other hand, cognitive dissonance can also lead to the adaptation of values, beliefs, and attitudes (Carlitz & Rios, 2020; Darnton, 2008). Similarly, in a Worldbank (2015) report it is stated that behavioral economics models would expect a person to adapt beliefs if incoming information does not match reality. However, the information that someone receives and how this information is interpreted depends on someone’s mental map (worldview) (Carlitz & Rios, 2020). Hence, the incoming information may already be filtered to reflect someone’s perceived reality. A situation which is very poignantly referred to as the “equilibrium fiction,” a concept developed by Hoff and Stiglitz (2010).

The idea that values can be changed through incoming information would be in support of the notion of bottom-up learning proposed by Fahrenbach and Kragulj (2019) (see Figure 42). Based on this assumption Darnton (2008) states “[...] interventions do not always have to work through social-psychological factors, although they do need them to be in line for behavior change to be sustained.” This is as values, attitudes, and beliefs provide stability to an individual’s actions since they are factors that are difficult to change. Cognitive dissonance can lead to changes of foundational beliefs if for example one is confronted with two oppositional beliefs that one is agreeing to (Carlitz & Rios, 2020).

A related concept is **Self-discrepancy Theory**, which describes the comparison with what is and what ought to be. Though, what ought to be, can be one’s own expectation or a societal expectation. Not meeting these expectations can lead to negative emotions, which individuals usually intend to avoid. This can be used to trigger wished behavior (Jackson, 2005). Though this approach needs to be taken with caution as research shows that shame and guilt may not be the best means to trigger environmental friendly behavior (Bissing-Olson et al., 2016). Norgaard (2006), for example, showed that keeping unsettling information at bay is a mechanism to avoid negative emotions (such as guilt) evoked by not adopting a behavior that supports sustainability. Other studies show that the feeling of guilt can trigger collective pro-environmental behavior (Stollberg & Jonas, 2021) or support eco-friendly consumer decisions (Habib, White, Hardisty, & Zhao, 2021). Yet again, other research suggest to focus on positive approaches such as environmental friendly lifestyles (Harth, 2021).

### 5.4 Heuristics – shortcuts

Behavioral models try to explain why we behave in a certain way. In Chapter 1 it has been outlined, that there are many different behavioral models, that all take different factors into account. In this section, the emphasis is on the intuitive path of action, the thinking fast path. It has been explained that intuitive action is based on heuristics, biases, and habits. These concepts are listed, though, the aim is not to discuss how they can be overcome. This is, however, a relevant question for transition research (Klotz et al., 2018). It needs to be highlighted that not only citizens, users, or consumers fall prey to heuristics and biases. Planners, designers, and decision-makers do too (Klotz et al., 2018). This essentially means that those who design change may design solutions that are born out of the same thinking (heuristics) that lead up to the sustainability problems humanity is facing.

Wendel (2020) points out that there are more than 100 heuristics and biases that scientists could identify. Addressing how each of them could be overcome, goes beyond the aim of this working paper. However, there are suggestions on how to overcome unwanted intuitive patterns. Wendel (2020) states that 6 factors need to simultaneously be in place for a conscious action to take place. These six factors are; cue, reaction, evaluation, timing, experience (CREATE). “You can think about replacing a

[Type here]

habit or stopping a mental shortcut as CREATE in reverse: removing one or more of the key factors that leads to the negative decision or behavior. In particular, we'll avoid the *Cue*, replace the *Reaction*, rethink the *Evaluation*, or remove the *Ability*" (Wendel, 2020). Imagine you want to stop smoking: you avoid situations in which you usually smoke, have an alternative strategy to keep you busy in case you are in a situation you would normally smoke, be mindful of the side effects of smoking and why you want to quit, and don't have cigarettes around you.

Arguably, the key factor in CREATE is evaluation. Some active deliberation needs to happen, to even allow a change to happen. Thus, someone first needs to think about a certain behavior. This has been outlined above. Reflection and learning are key to changing someone's behavior. Someone needs to become aware of the negative effects of some behavior and someone needs to care about these negative side effects. The other factors in reverse, call for considerable planning. How do I avoid the cue, what can I do instead, how do I keep myself motivated, etc. The mental aspect is crucial. In the end, though, one heuristic is exchanged with another one. If one uses smoking to deal with stressful situations, one may have to develop a new habit (a healthier one) to deal with stress.

#### Box 4 Stopping to smoke as an example to overcome an addictive habit

##### Researcher's self-reflection on the experience to stop smoking

I have been a chain smoker throughout my adolescence. The first thing in the morning was a cigarette, when I woke up in the middle of the night, I would smoke. After some time, the side effects became apparent. Yellow fingers, bad health, shortness of breath, high costs as well as the mental occupation that come along with addiction. I tried to stop smoking several times. I had been aware of the potential side effects for a long time. Yet I started to smoke. Even if I started feeling the side effects I did not care enough to stop. I used different methods to stop smoking. I tried to just not buy cigarettes, I used nicotine patches, I read books, I removed myself from social environments. Nothing helped. In the end, it was a combination of factors; the long fight to quit, ever-increasing costs, and a strong will that made me stop from one day to the next. The mental factor was key. All the negative aspects of smoking and all the positive aspects of being a non-smoker needed to be present whenever I had the urge to smoke. This is very much what is described by Verplanken and Whitmarsh (2021) (see section 3.6). I also want to connect it to Figure 42 and the discussion about behavior changing identity. Today I am a non-smoker. That is my identity. However, I would argue that I have already identified with this before I stopped smoking. Wanting to get rid of being a smoker was one strong incentive for me to break the habit. This would be in line with research stating the odds of **nudges** working are higher if an individual already had the intention to do something or already identified with what the **nudge** aims for. Hence, potentially behavior can lead to a change of identity, but maybe the seed of that new identity needs to already be planted. Thus, this needs to be compared with the reflection within Box 1.

Further, I can report that a behavior change might not be long-lasting. I had been non-smoker for several years when I was triggered to smoke again being confronted with a traumatizing situation. It seems like the stress coping strategy "smoking" was still stored in my brain and in an extreme situation the newer behavior was overridden by the older behavior. Though, in my case it did not lead to me becoming a chain smoker again. In my case, I was not at all identifying anymore with the idea of being a smoker. There was a mismatch between my identity and my actions which lead to a mental struggle. This struggle still took some years until I once more became smoke-free. Thus, this experience is an example of how one can fall back into old behavior when the old behavior is triggered, and no alternative behavior is available.

Heuristics are shortcuts, that simplify our life as we do not have to consciously think about every decision we make. Heuristics save time and free up mental space. Without heuristics, we would constantly be exhausted due to the heavy cognitive load of the decisions we have to make every day.

[Type here]

Though the downside is that these heuristics can keep us stuck in unwanted behavior or lead to wrong decisions (Wendel, 2020; Worldbank, 2015). A limited list of heuristics and biases is provided below. Figure 58 indicates when we make use of heuristics. Note that habits are a form of shortcuts as well. In Figure 58 habits are the main heuristic we rely on in our day-to-day life. A similar categorial ranking is also provided by Jackson (2005) who locates heuristics somewhere between completely automatic behavior and behavior based on rational consideration. It might be interesting to note that Wendel (2020) is not referring to heuristics when individuals undertake cost-benefit assessments. This is in contrast to the description of Darnton and Evans (2013). They do list loss aversion, as well as present bias (discounting) as part of cost-benefit considerations. Accordingly, some heuristics might be used in cost-benefit assessments as well. Jackson (2005) notes that every action is a composition of both automatism and control. Though, depending on the situation and what is at stake one of both prevails. This is in line with the description of the workings of system one and system two by Kahneman (2011). He also states that both systems are always working, but that system one (the fast system) undertakes a first check to figure out if intuition suffices to respond to a given situation.

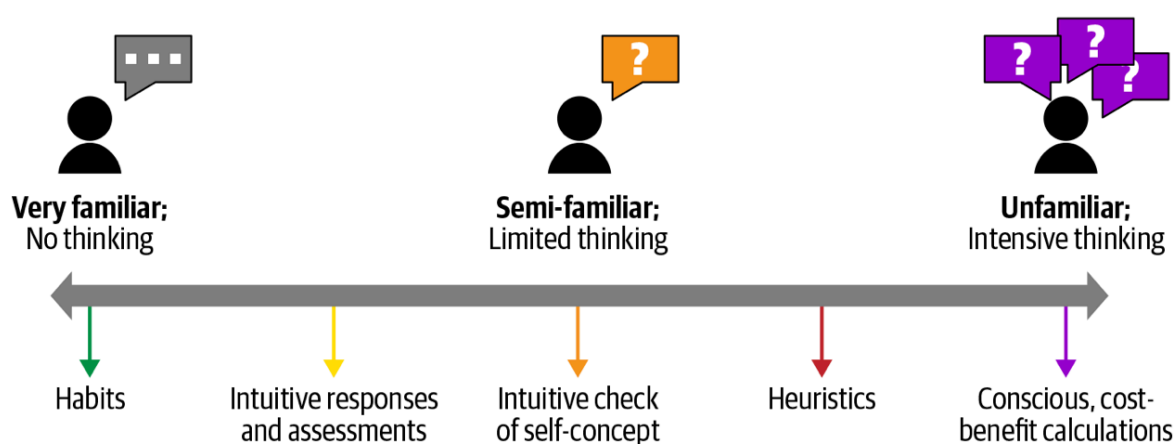


Figure 58: How we take decisions depending on the familiarity with the respective choice. From Wendel (2020)

#### 5.4.1 Framing

The concept of framing refers to the phenomenon that decisions are not so much based on logic as on how a certain choice is presented. For example, if something is framed as a loss or as a gain, in face of uncertainty, such a difference in framing may influence one's decision more than the actual statistical probability of the negative or positive event to happen (Darnton, 2008; Darnton & Evans, 2013; Kahneman, 2011; Wendel, 2020). Loss aversion may be part of the reason of that effect. Thus, not only the way information is presented matters but also how this information is perceived. The latter is called mental editing, which describes the interpretation and editing of the received information. The more complex a situation is the more the brain may rely on pre-existing mental models, thus, on heuristics (Worldbank, 2015). Hence, all kinds of heuristics such as confirmation bias or status quo bias influence our decision in tandem with how the choice is framed.

*"[...] the way in which facts are presented has a great influence on whether they are absorbed and how judgments are reached. What matters is not only the entire set of available information and how each piece might be logically weighed, but also the sequencing of information and the psychological salience of different types of information"* (Worldbank, 2015).

Accordingly, framing can make use of biases and heuristics to present a choice in a way that increases the chance for a decision taken in a certain way.

[Type here]

#### 5.4.2 Anchoring

Anchoring is a powerful heuristic. It describes the phenomenon that a decision depends on the initial reference point (Furnham & Boo, 2011; Kahneman, 2011). The anchor can have an effect on responses in for example surveys, which is why the survey design needs to be considered thoroughly (Zavala-Rojas, 2014). An anchor can also be relevant when evaluating the likelihood of an event taking place. People may perceive a higher likelihood of a specific situation to happen if that situation just happened (Worldbank, 2015). For example, if someone just experienced a flooding, one may perceive a higher likelihood for floorings to happen, compared to a person who never experienced a flooding. The anchor can have an effect on assessments. Even if feedback is provided the final assessment might not have been adjusted sufficiently and remain closer to the initial anchor (Wendel, 2020). However, anchoring can also be used to support pro-environmental behavior, by setting an anchor that supports a pro-environmental behavior (Klotz et al., 2018). Furnham and Boo (2011) provide a literature review of anchoring the anchoring effect.

#### 5.4.3 Attitude-behavior gap – Value-action gap – intention-behavior gap

Strictly speaking the attitude-behavior gap, the value-action gap and the intention-behavior gap are not the same. However, they all describe that we are not doing what we intended to do, what was in line with our values or attitudes. They all state that a certain attitude, certain values, or certain intentions are not sufficient to trigger a certain behavior (Wendel, 2020). The reasons for why there is a value-action gap are manifold. For example, there may not be a value-action gap, since people only reported their values inaccurately. That might be due to people's unawareness of their own values or because they do not want to reveal their real values. On the other side of the spectrum, people may not know how to or are unable to express their values. That might be due to costs, structures, conflicting interests, or simply the lack of opportunity (Cieciuch & Schwartz, 2020). Heiskanen and Laakso (2019) report that meta-studies on attitude-behavior gaps show that awareness only explains 4-5% and attitude only 13-18% of human behavior.

Above the societal context for behavior change has been discussed. Critical social psychology underscores the relevance of the social sphere for forming our behavior, our values, and attitudes. Some may think that e.g., the intention-behavior gap is only created by an internal process. However, Baum and Gross (2017) provide an alternative explanation. They state that the attitude-behavior gap might be created by societal conditions. Accordingly, Baum and Gross (2017) argue that a behavioral change might be easier to implement if a specific behavior is supported by the wider societal context.

The relevance of the external factors is even more pronounced as Baum and Gross (2017) indicate the limitations of individuals to change their context. Baum and Gross (2017) acknowledge that humans have the power to influence the wider context in which they are embedded. However, they also highlight the limits of such influence. This is illustrated in Figure 38. Kollmuss and Agyeman (2002) also report on several factors that influence the attitude-behavior gap: 1) direct versus indirect experience, 2) temporal discrepancy, 3) normative influences, 4) attitude-behavior measurements. Direct experiences are understood to be more potent in changing behavior, greater temporal distance between an event and the behavior can reduce the effect of the event on behavioral change (see present bias and availability bias), social norms can counterbalance information provided, and the way attitudes and behaviors are measured are not always congruent.

The value-action gap stands in contrast to linear behavioral models suggesting that information would have a direct linear impact on behavior. Some research indicates the limitations of simplistic assumptions, which do not necessarily reflect reality (Darnton, 2008; Kollmuss & Agyeman, 2002). Figure 59 illustrates factors that stand in between an intention and an actual action.



[Type here]

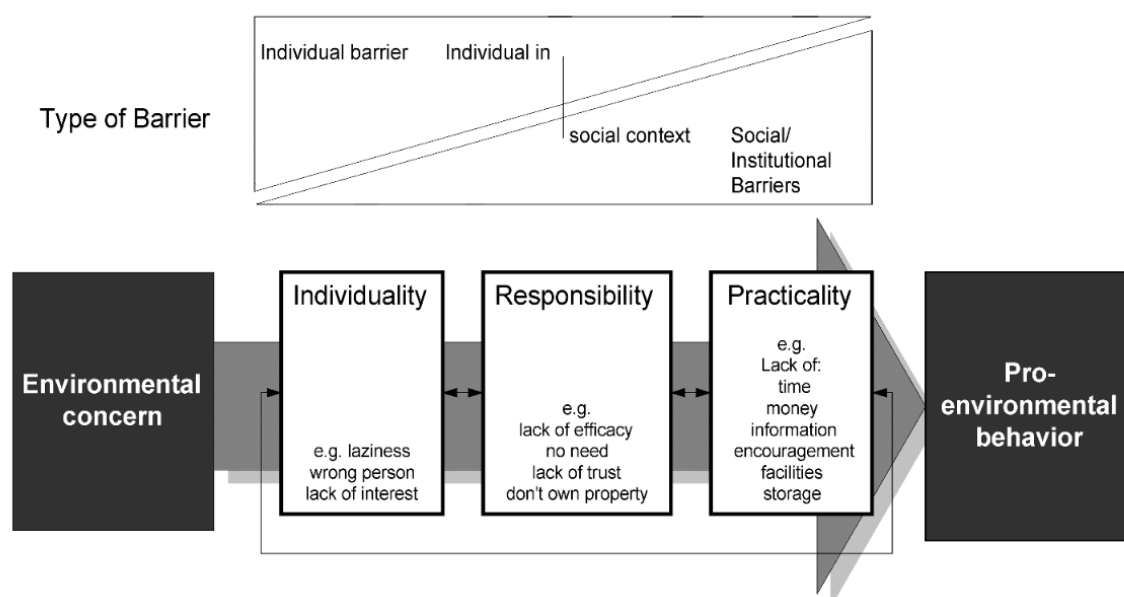


Figure 59: Barriers between attitude and action from Blake 1999

#### 5.4.4 Confirmation bias

Confirmation bias describes an individual's preference to only search for, notice, and remember information that confirms one's perception. Though, it also includes the interpretation of received information to match one's worldview (Wendel, 2020; Worldbank, 2015). It needs to be highlighted that there is a vicious circle. On the one hand, one only searches for information that fits one's worldview, which of course strengthens that worldview. On the other hand, the worldview serves as a filter, or translator of received information to make the information fit the respective worldview (Carlitz & Rios, 2020).

#### 5.4.5 Closed-minded

Closed-mindedness is connected to confirmation bias and equilibrium fiction, and it helps one to stay locked in a certain mindset. For (deep) learning to take place open-mindedness needs to be supported. However, open-mindedness can also have a downside. As too much open-mindedness reduces stability and may inhibit action as well. One may no longer have convictions and guiding principles which may lead to hesitation (Mobus & Kalton, 2015).

#### 5.4.6 Loss aversion

Loss aversion describes an individual's tendency to avoid losses. This is related to risk and ambiguity aversion. Thus, if the odds are too big to lose out one will avoid that option. The same applies to options where the outcome is not known compared to options where the outcome is known. The known outcome is preferred even if this will lead to a loss (Bujold et al., 2020). Thus, individuals prefer to avoid losses, but also want to reduce insecurity as much as possible.

The anchor is relevant for loss aversion since the loss is compared to a benchmark. Furthermore, framing comes into play as something portrayed as a loss is evaluated differently than the same thing being portrayed as a (relative) gain (Kahneman, 2011; Wendel, 2020; Worldbank, 2015).

#### 5.4.7 Status quo bias

People tend to do what they are used to doing. A deviation from what one is used to doing is connected to possible losses. As humans also have a loss aversion, humans tend to stick to what we know, even if this may knowingly have adverse effects on us (Bujold et al., 2020; Wendel, 2020).

[Type here]

#### 5.4.8 Present bias

Present bias can lead to inaction or procrastination. That is as individuals may place more importance on the present than on the future, and thus individuals postpone action into the future (Wendel, 2020; Worldbank, 2015). In economics, this concept is also called discounting (Darnton & Evans, 2013).

#### 5.4.9 Moral licensing

When individuals rectify some *bad* behavior with the argument that they have already done their fair share, we call it moral licensing. An example would be legitimizing a short-distance flight by not using a private car (Newell, Daley, et al., 2021).

#### 5.4.10 Self-serving bias

Related to moral licensing is the idea of self-serving bias. It describes that one ascribes to principles that serve the own agenda and interests, while omitting those that do not (Worldbank, 2015).

#### 5.4.11 Projection bias

The projection bias refers to the concept that individuals think that their current preferences are similar to their future preferences. An example is the difficulty to buy healthy food when doing groceries while being hungry (Oren & Sklar, 2022). Clot, Grolleau, and Ibanez (2022) tested the projection bias with respect to environmental-friendly behavior. They showed that the weather influences people's responses on a survey about solar panels and the use of eco-friendly transportation means. Thus, they concluded that it is advisable to sell solar panels on sunny days.

#### 5.4.12 Availability bias

The availability bias describes the impression that something is more likely to occur if it just recently occurred. The occurrence is fresh in our mind, it is available, and thus we think it is more likely to happen again (Wendel, 2020). This relates to the projection bias.

#### 5.4.13 Limited cognitive ability

The existence of heuristics generally illustrates human's limited ability to compute all available information. In reference to sustainability issues, human's limited ability to compute information might be a problematic factor (Klotz et al., 2018). Kollmuss and Agyeman (2002) highlight that awareness about environmental problems is mediated through the characteristics of many environmental problems. These characteristics are complexity, graduality, and non-immediacy. Complexity refers to the fact that sustainability issues are multilayered and that humans are often unable to grasp all connections among these layers. Graduality refers to environmental destruction being a slow process and the inability of many humans to grasp the severity of environmental destruction due to the slow pace of that destruction. Finally, non-immediacy is related to the graduality of environmental problems. The problems are understood to be non-urgent, as they will only come to full effect at a later stage.

#### 5.4.14 Descriptive norms

Humans tend to adopt the behavior that is assumed to be the norm. The descriptive norms heuristics refers to the circumstance of people relying on what they observe in their environment (Wendel, 2020).

#### 5.4.15 Environmental heuristics

Shortcuts that provide a rule of thumb for environmentally friendly behavior. It is a concept suggested by Spaargaren (2003) and refers to e.g. "waste prevention and separation ("keep them apart"), the use of eco-labels ("buy green"), and the use of the modal-shift notion in transport ("park and travel")."

[Type here]

#### 5.4.16 IKEA Effect

This effect describes that humans tend to value something higher if they have invested work into it (Wendel, 2020). Think of a plant you have cultivated yourself and a plant that you have bought. You may care more for the plant that you have raised yourself.

#### 5.4.17 Halo effect

The halo effect refers to the incidence of people valuing someone's skills or actions higher if they have a good overall impression of that respective person (Wendel, 2020). Though, the halo-effect is not limited to people. Products such as green products can also create a halo-effect (Sörqvist et al., 2015).

#### 5.4.18 Locus of control – efficacy

Locus control describes the perceived efficacy of a potential action. Whether individuals act or not is related to the extent the action is believed to be effective (Darnton, 2008). Several socio-psychological models, such as the **Theory of Planned Behavior**, include locus control. Kollmuss and Agyeman (2002) state that individuals with a strong internal locus control belief in their actions, while those with an external locus control, place higher efficacy of actions of others.

#### 5.4.19 Agency

According to Darnton (2008) many behavioral theories about agency assume that an agent only acts if the action is perceived to be effective and meaningful (see also Williamson et al., 2018). Self-efficacy a term coined by Bandura is at times used as a synonym for agency (Darnton, 2008; Darnton & Evans, 2013). If an agent does not feel to have agency, there will be a lack of action. Above the connection between emotions and agency has already been indicated. Further, there is a connection between habits and agency. Sarigil (2015) states that routinized behavior can be understood as a form of agency. Thus, it is not just an accident that some behavior is repeated, and other behavior is not. That is as the maintenance of a path can be guided or at least influenced by agency. Though, he also states that habitual behavior is not strategic and non-deliberative (see Table 9). However, some understand agency to be primarily habitual (Sarigil, 2015). Furthermore, agency is related to **Structuration Theory**. That is as structures need to be in place for someone to have agency (Darnton, 2008; Darnton & Evans, 2013; Jackson, 2005).

Model	Logic of action	Prevailing conception of agency	Mechanism of reproduction
I: Utilitarian	Consequentiality	Deliberative, teleological, reflective, sentient, strategic	Increasing returns (utilitarian lock-in)
II Normative	Appropriateness	Deliberative, teleological, reflective, sentient	Legitimation (ideational, normative lock-in)
III Habitual	Habit/practicality	Unreflective, non-deliberative, non-strategic, insentient, dispositional	Habituation (habitual lock-in)

Table 9: A comparison of habitual path dependence with utilitarian and normative models, from Sarigil (2015)

[Type here]

## 5.5 Choice architecture - nudging

Since it has been acknowledged that humans do not always think rationally, the way choices are designed has received more attention. One problem of rational thinking is that humans only have limited capacity to digest all available information. Therefore, simplifying choice options is vital to facilitating decision-making processes. Choice architecture deals with questions of how choices can best be designed and presented to support the decision-making process (Heiskanen & Laakso, 2019; Klotz et al., 2018).

*“A choice architect is someone who organizes the context in which people make decisions. [...] A component of choice architecture is simplicity. Too many options or too much complexity may lead individuals to avoid thinking through a decision, to postpone indefinitely making an active decision, or to make error-ridden decisions” (Worldbank, 2015).*

Hampton and Adams (2018) state that **nudging** has become synonymous with Behavioral Economics to express how influential this idea has become. Heiskanen and Laakso (2019) state that Behavioral Economics owes its breakthrough to the success of the books *Nudge* (Thaler, 2011) and *Thinking Fast and Slow* (Kahneman, 2011). Furthermore, they state that **choice architecture** has become a prevalent tool because it is based on neoliberal economics which enjoys an influential position within the political arena (Heiskanen & Laakso, 2019).

**Choice architecture** makes use of heuristics and biases. Thus, choice architecture takes framing, anchoring, or norms into account (Klotz et al., 2018; Worldbank, 2015). Choice architecture also makes use of **default choices** and **choice editing**. Default choices applied to sustainability set the sustainable choice as default. Choice editing is the reduction of choices (O'Rourke & Lollo, 2015). Choice architecture aims at nudging people to choose a certain option (Heiskanen & Laakso, 2019; Newell, Twena, et al., 2021).

**Nudging** describes the idea that a person can gently be pushed to take a certain decision. Thus, options are not necessarily reduced, but the way they are presented aims at influencing individuals to favor one of them (Heiskanen & Laakso, 2019). This is done through, **default choices**, **choice editing**, **framing**, and **anchoring** (Heiskanen & Laakso, 2019; Newell, Twena, et al., 2021). For example, given several food options, one option might be framed as the healthy option (Worldbank, 2015). On the positive end of things, nudging thus leaves the choice to individuals (Hampton & Adams, 2018; Newell, Twena, et al., 2021). This is also why it is called *liberal paternalism*. On the negative end, nudging is accused of being manipulative. While individuals still have free choices, their autonomy is to a certain extent curtailed, if individuals do not know that they are nudged in a certain direction (Bujold et al., 2020; Heiskanen & Laakso, 2019). Having said that, Heiskanen and Laakso (2019), also indicate that the use of nudges might be legitimate to solve social dilemmas.

Some nudges have proven to be effective. However, the effectiveness has been proven in rather small-scale experiments. The implementation of these nudges on larger scales can potentially be a barrier to effectively changing the behavior of a larger portion of society (Heiskanen & Laakso, 2019).

Nudging does not always work. The likelihood of nudging to work increases if the intrinsic motivation to act in a certain way is already prevalent (Hampton & Adams, 2018; Klotz et al., 2018). Taking the food example again. If one does not have the intention to eat healthy the nudge will likely not work. Chatterton and Wilson (2014) also indicated that nudging was found to not work for complex problems such as energy consumption. Bujold et al. (2020) stated that nudges are for subtle changes and that they rarely address the root structures that created the unwanted behavior. Hence, nudging may be a tool to reach low-hanging fruits. Nudging can include the provision of information, however, “nudges typically attempt to bypass higher-order information processing” (Heiskanen & Laakso, 2019). Hence, a reflection process may not be achieved through nudging. Thus, it might not be possible to nudge people into a deep transition.

[Type here]

Newell, Daley, et al. (2021) similarly refer to nudges as a strategy of shallow scaling. For a substantial change deep scaling would be needed. Shallow scaling does not address the root causes of an issue (see also Heiskanen & Laakso, 2019). Though even catching low-hanging fruits may come with a trade-off. Due to different rebound effects (direct, indirect, time-use rebounds as well as spillover effects), the achievements of nudging might be hampered (Newell, Twena, et al., 2021). Hampton and Adams (2018) also state that nudging does not permit changes that are large enough to solve the problem at hand: “One criticism frequently made in the context of energy policy is that nudge is simply not ambitious enough to bring about the scale of change required to radically decarbonize the economy.”

Further criticism of nudging pertains to the lack of empirical evidence on how it works and for nudging falling into its own trap. According to Hampton and Adams (2018), the concept of nudging is based on the notion of bounded and limited rationality of others, but does not necessarily account for the limited rationality of those who apply nudging. For example, policymakers may be stuck in their own mental models and thus fall prey to confirmation biases, which makes them want citizens being nudged to comply with the policymaker’s mental model. Additionally, science reporting on the success of nudging might fall in the trap of confirmation bias. That is as studies that show the unsuccessful application of nudging might not be published (Nature, 2020).

## 5.6 Habitual lock in

Baum and Gross (2017) state that habits are connected to the attitude-behavior gap since habits support the continuity and stability of our actions. They conclude that in order to facilitate behavior changes habits need to be disrupted. Similarly, Darnton and Evans (2013) state that habits are understood as a barrier to follow up on intentions. Wendel (2020) lists habit as a heuristic (shortcut) and defines a habit as “a repeated behavior that is triggered by cues in our environment.” He states that habits are automatic actions, and that individuals may not even be aware of this automatism taking place. Just like, other heuristics they save time and reduce the cognitive load.

While habits are here listed as a reason for lock-ins, habits can also be the key to long-lasting changes. A Worldbank (2015) report points out that after forcing citizens to change their energy consumption, energy consumption remained lower even 10 years after the policy was lifted. The long-lasting change in energy consumption was mostly attributed to behavioral changes in energy consumption patterns. Thus, habitual change leading to habitual lock-ins are a double-edged sword. Depending on whether the habitual behavior is desirable or not. Wendel (2020) calls habit the “most resilient and sustainable way to maintain a new behavior.” Thus, resilience can be understood to be positive or negative. While resilience is commonly attributed as an attainable state, socio-ecological theory does also know the negative side of resilience (Farley & Voinov, 2016).

Darnton (2008) presents socio-psychological models to help understand human behavior that are focusing on habits as a distinct class to models that are based on **Rational Choice Theory** or **Behavioral Economics**. He refers to the **Theory of Interpersonal Behavior** by Tirandis. Tirandis ranks the relevance of different factors to an actual observable behavior, whereas habit is the most important one (followed by intention and enabling conditions). He further refers to Cialdini who stated that habits at a point become detached from the original motivation (attitude, intention) to execute some behavior. Thus, when this happened, changing the attitude does not necessarily change the behavior. Rather the trigger of the habitual behavior needs to be addressed. The connection between habits and attitudes is expressed in Figure 42. The different phases of habitual behavior would call for sequenced interventions.

Yet another contribution in this realm is the one by Kurt Lewin, who connected habits to social norms and thus identity (see Figure 42). His work also highlights the notion of automatism, which differentiates habits from activities that previously formed the very habit. Referring to Lewin’s work Darnton (2008) indicates that emotions, or rather an “emotional stir-up,” is necessary to break with habits. Darnton (2008) states that for Lewin, a “habit is not measured by the consistency of behavior

[Type here]

over time but in terms of the consistency of behavior in the face of changing circumstances.” It is further interesting that Darnton (2008) explicitly refers to the concept of resilience in reference to not changing habits. “This resistance is not willfulness, but a sign of the resilience of a group or social organization, which will adapt to keep its behavior constant.”

The relevance of habits is also highlighted by Sarigil (2015). He argues that the habitual lock-in is a distinct kind of lock-in and may not be subsumed under normative and instrumental path dependencies. While he distinguishes between them, I argue that they can be combined. If they are, it illustrates the creation of **multilayered path dependencies**. Understanding the interconnectedness among them also serves to connect the macro with the meso and micro levels. This understanding can further be applied to **Systems Thinking** by lending an understanding of systems behavior and mutual interdependence, and the reinforcement of chosen paths. Finally, the work of Sarigil (2015) is useful as he describes different possibilities on how to overcome path dependencies. It needs to be mentioned that habits to a certain extent are connected to the concept of **habitus**. As mentioned in previous sections several sociological concepts also provide insights on path dependencies. This is true for **habitus**, **Structuration Theory**, as well as **Practice Theory** (Jackson, 2005; Sanne, 2002; Shove, 2003). A further discussion of these sociological concepts and their connection with path dependencies is not provided. The remainder of this section solely expands on habitual path dependencies.

First the different path dependencies and how they are interconnected is outlined. As already stated Sarigil (2015) presents **three distinct** types of path dependencies:

1. instrumental rationality (utilitarian paths, *homo economicus*)
2. normative rationality (normative lock-in, *homo sociologicus*)
3. habitual path: logic of habit, which constitutes a distinct mechanism of reproduction or self-reinforcement

These distinct types of path dependencies are based on different logics; 1) ratio, 2) norms and ethics, and 3) habits. Sarigil (2015) presents them as distinct logics that are not connected. Thus, a path is based on either, but not a combination of these logics. However, I argue that this may not be the case. It could be assumed that a norm is based on logic. Hence, for example, it is *good* to follow a *rational* choice and it is *bad* to follow an *irrational* choice. What might be understood to be rational and irrational is in itself a normative question (see the discussion about mental maps). It could be rational to follow a gut feeling as it is understood that intuition is superior to cognition (Julmi, 2019). The connection between the two is visible in day-to-day life. One may oppose the idea of intuition being superior to ratio. This is itself an indication of the interconnection of norms and logic. In the *modern* world, we are educated to follow THE logic (the ratio).

Decisions have to be based on logic rather than on a good guess. Though this may of course not always be followed in practice (Sadler-Smith & Shefy, 2004). Nevertheless, through back rationalization, we may convince ourselves that we followed some logic rather than a gut feeling (Apolte & Müller, 2021). Moreover, the distinction between ratio and norms may occur when ratio is strictly understood to be utilitarian in an orthodox economics sense. It may increase my economic utility to buy a cheap product even if from an ethical standpoint I should abstain from it as it may have been sourced and produced following unsustainable practices. Thus, my economic utility may not capture my overall *utility*<sup>14</sup>. From an economic utility perspective choosing a certain product may be irrational, but from another perspective, it might not be. Note that what is *good* and *bad* is also up to debate. What is now unsustainable and thus *bad* is a rather new framing for many products. For example, in cities with high air pollution due to burning wood and coal in stoves for heating and cooking purposes, the usage of

---

<sup>14</sup> The discussion of economic utility is in itself complex, and I cannot expand on it. Some may suggest that any value can be expressed monetarily, and that any consumer choice reflects true preferences. Others would argue that some values are incommensurable and that not every value can be expressed in monetary terms. Accordingly a consumer choice is not an expression of one's true preferences or values.

[Type here]

another fossil fuel (oil) had been welcomed (Heggie, 2016; Read & Parton, 2019; WHO, 2015). Today we know that the usage of fossil fuels is unsustainable. Though, due to the large socio-economic differences within and among countries a switch from wood to gas is still understood to be progress (Maes & Verbist, 2012). In short, the utilitarian and the normative logic may be different, overlapping, or the same. Furthermore, they might influence each other.

Sarigil (2015) introduces the behavioral path as he argues the other two are both based on some sort of rational deliberation. However, as the discussion above (see section 3.6) showed, habits might be based on actions that were executed after conscious deliberations. Even if at a later stage a habit is no longer triggered by conscious deliberation but by a cue, it does not mean that a habit is irrational (Jackson, 2005). Nevertheless, the distinction utility, norm, and habit, might be useful for analytical purposes.

Another point that could be discussed is the chaotic nature of path creation. Sarigil (2015) argues that the formation of path dependencies is unpredictable as they are based on stochastic, contingent events. I disagree with this statement, as first, it disagrees with the reason to introduce the habitual path dependency; rational deliberation. Second, just because not all factors involved in the formation of path dependencies are known and just because this makes it unpredictable for the analyst at this point, it does not mean that the formation is truly unpredictable (Mobus & Kalton, 2015)<sup>15</sup>. There might be rational reasons for taking a path that are unknown to the analyst.

Accordingly, it is argued that *rational* decisions once taken are the basis for setting up a path. The more often a path is chosen the more the path forms habits. Habits in themselves can give rise to rational decisions. An example would be to state that it takes too much effort to change. Thus, the transaction costs (hassle) to change are too high. The effort needed to change may, hence, override the possibility to go for an alternative which would be supported by other rational or normative logics. Thus, in this instance two types of norms are in opposition, the norm of increasing utility (which is here reducing transaction costs / hassle) and the norm of switching a habit to a more sustainable one, for example.

#### Box 5: Crossing the field

##### **Crossing a field. Which path to take?**

A simple example to illustrate path dependencies, is to think of crossing a field. Let us assume one wants to cross a freshly harvested field. There is no identifiable path. One looks for the quickest and easiest (quick and easy being logic and good) way and takes this one. As soon as there is an identifiable path, one will most likely take this one. Even if this path seems to be longer than optimal, one may assume that the path is there for some logic and good reason (e.g., not to trample on the field itself and destroy something). Or the path is longer, but it is safer (e.g., less dirty). Usually, the path existing is not questioned. Imagine the field has not been harvested yet and one is standing in front of huge maize plants. Making your own path is tedious, so one would first look for an existing path. Under these circumstances deviating from the path is even more unlikely. That is even if the path is set up like a maze. When one is not able to see (in this case a bird's eye view) if the existing path is the *best* one to take, one will just continue taking it and by that the existence of the path is reinforced.

Arguably, in any given situation all three logics are interacting. They may re-enforce each other, they may only overlap, or they may contradict with each other. If they re-enforce each other, no reflection about taken decisions is done. We do what we always do because we have always done it this way and thus it is THE logic and good thing to do. In the second case, there is a certain degree of

<sup>15</sup> Page 15 referring to chaos theory

[Type here]

disagreement. For example, we do what *we* have always done because it is logic under certain viewpoints, but new insights tell us it is a *bad* thing to do. The degree of disagreement is relatively small, though still big enough to be recognized by the individual. In the third case there might be a mayor disagreement with one, or among all three logics. It might be that because of new information we realize that our habit is neither logic nor good to have and should be changed. The internal disagreement pertaining our actions are the initiator for potential change. Only by *realizing* that something is off in relation to our norms and applied logic, we reflect about our behavior and might be able to change (Sarigil, 2015). This thought process has been discussed before in this working paper. See for example change as learning, change in systems, and cognitive dissonance.



[Type here]

## 6 Conclusion

In this working paper different behavioral theories have been outlined. Orthodox linear models have been provided as well as more circular, systemic and holistic approaches. It needs to be highlighted that no single approach or theory captures everything and that harvesting low-hanging fruits might be as relevant as harvesting the ones that are harder to reach. An integration of different approaches and theories will be needed to tackle sustainability issues such as the energy transition (Heiskanen & Laakso, 2019). The idea of spiral scaling might be of particular use here. It is the combination of shallow approaches and deep approaches (Newell, Daley, et al., 2021). The provision of information, default choices or choice editing might not be enough to facilitate a deep transition, however they might create fertile ground to accelerate a deep sustainability transition. The idea of **Double, Triple, or Multi-Loop Learning** as well as **the U-Theory** have indicated that people need to be emotionally and cognitively ready for a deeper transition (Fahrenbach & Kragulj, 2019; Pahl-Wostl, 2009; Peschl, 2007). Theories and approaches that take a systemic view, such as **Systems Thinking**, and **Practice Theory** provide a good addition to orthodox linear theories that often neglect environmental factors and feedback mechanisms.

Thus, to tackle sustainability issues an integration of different approaches is needed. That calls for inter as well as transdisciplinary research. Interdisciplinary because not only psychology, sociology, or behavioral science should contribute to the discussion, but other disciplines as well (e.g., anthropology, engineering, economics). Transdisciplinarity, as well as certain approaches such as **Practice Theory** and **Systems Thinking**, call for post-normal science approaches that transcend scientific borders to include citizens in their roles as experts. Inter- and transdisciplinary research is tricky. Though, as has been indicated in this working paper, scientists are not immune to heuristics such as confirmation biases. Collaborating with people from other disciplines as well as with non-scientists could be a good means to at least bring such heuristics to the fore.

“A concerted strategy is needed to make it easy to behave more sustainably: ensuring that **incentive structures and institutional rules** favour sustainable behaviour, **enabling access** to pro-environmental choice, **engaging people** in initiatives to help themselves, and **exemplifying the desired changes** within Government’s own policies and practices” (Jackson, 2005). This quote highlights the need to not see human behavior through siloed lens. Not only disciplines need to be connected, different levels that are part of and influence human behavior need to be connected too. This applies to connecting the individual, with the group, with the system, or connecting the behavior to agency and structure, or to shallow and deep changes. The need for deeper transformations has also been highlighted by the IPCC (Pörtner et al., 2022) and thus, any intervention should ultimately be evaluated in its capacity to support a deep transition.

It is tempting to remain in the area of low-hanging fruits. That might be one reason why tools that serve harvesting low-hanging fruits have been more prominent. The interventions offered appear rather easy to implement, straight forward and quantifiable. Furthermore, they fit into orthodox economic thinking which provides prominent guiding principles within the political arena. Thus, this builds an example of how different ideas are jointly locked in (Heiskanen & Laakso, 2019). It is an example of how approaches are preferred that fit our **mental model**.

While it is necessary to gather low-hanging fruits, it clearly needs to be communicated that this will not be enough to achieve the transition that we need. Approaches that support a deep transition are not only about day-to-day **practices** and habits, they are about the root cause of undesired behavior and the unsustainable state our sustainable is in. They are about questioning paradigms, **mental models**, and values. They call for self-reflection and for potentially letting go of **mental models** that keep us stuck and limited to harvesting low-hanging fruits. As already stated, such a self-reflection (on individual and societal level) is not easy and calls for emotional and cognitive readiness. Hence, shallow approaches need to be employed to create this preparedness. The question is thus, how can

[Type here]

we be **nudged** into honest self-reflection? How can we be **nudged** into letting go? How can we be **nudged** in welcoming the new?

Breaking out of our own system is a difficult task. At several points within this working paper, it is indicated that confirmation biases lock us in our own **mental models**, worldviews, values and beliefs. From **Cultural Theory** we have learned that the current system can be categorized as individualistic. This categorization is accompanied with a respective worldview, paradigm, values, etc. It has been indicated that, for example, the predominance of linear thinking and of models that focus on the individual can be explained with our society being characterized by individualistic. Thus, even scientific processes may re-enforce the pre-dominant worldview (Kahneman, 2011). It is beyond the scope of this working paper, though, the individualist culture is also expressed by the current neo-liberal economic system. This system understands economic growth and technological advancements as the main solution to almost every problem. An approach that can be summarized by the notion of weak sustainability, which was developed by economists as a response to criticism to the growth addicted neo-liberal system. How explosive the attempt to break out of the current worldview can be, is exemplified by the pull back of an official document that proposed the necessity of cutting back consumption. In October 2021 the UK's Behavioral Insights Team published a report that suggests behavioral changes in order to meet the Net Zero target (Londakova et al., 2021). The report does not only show that behavior change needs a multi-faceted approach, it has also a clear message: "low carbon behaviors are often more costly, less convenient, less available, less enjoyable, and rarely the default choice." Although the report does not expand in depth on what a shift to Net Zero behavior would entail, the message was strong enough for the report being pulled back within hours. It is suggested that this move was necessary as the message contradicts with other political promises, which can be summarized as: *no one will have to give up on anything. We all can continue flying, eating meat and drive cars* (Laville, 2021). Potentially, this illustrates the limitations of behavior change models. The fundamental change that is necessary to achieve sustainability also requires to look at power structures and vested interests.

[Type here]

## References

- Abson, D. J., Fischer, J., Leventon, J., Newig, J., Schomerus, T., Vilsmaier, U., . . . Lang, D. J. (2017). Leverage points for sustainability transformation. *AMBIO*, *46*(1), 30-39. doi:10.1007/s13280-016-0800-y
- Adams, M. (2014). Approaching Nature, 'Sustainability' and Ecological Crises from a Critical Social Psychological Perspective. *Social and Personality Psychology Compass*, *8*(6), 251-262. doi:<https://doi.org/10.1111/spc3.12104>
- Adams, M. (2017). Climate change, sustainability & psychosocial defence mechanisms: infographic. In.
- Ajzen, I. (2002). Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior1. *Journal of Applied Social Psychology*, *32*(4), 665-683. doi:<https://doi.org/10.1111/j.1559-1816.2002.tb00236.x>
- Akenji, L., Lettenmeier, M., Toivio, V., Nielsen, S., & Kamei, M. (2019). *1.5-Degree Lifestyles: Targets and options for reducing lifestyle carbon footprints*. Retrieved from
- Andersson, D., Nässén, J., Larsson, J., & Holmberg, J. (2014). Greenhouse gas emissions and subjective well-being: An analysis of Swedish households. *Ecological Economics*, *102*, 75-82. doi:<https://doi.org/10.1016/j.ecolecon.2014.03.018>
- Andrés, K., Scheepers, M., Brink, R. v. d., & Smokers, R. (2022). *De Energietransitie moet sneller: dit is nodig om de klimaat doelstellingen te halen*. Retrieved from file:///Users/katharinabiely/Downloads/TNO-2022-energietransitie-sneller-1.pdf
- Apolte, T., & Müller, J. (2021). The persistence of political myths and ideologies. *European Journal of Political Economy*, 102076. doi:<https://doi.org/10.1016/j.ejpoleco.2021.102076>
- Attfield, R. (2013). Sustainability. In *International Encyclopedia of Ethics*.
- Bamberg, S., Rees, J. H., & Schulte, M. (2018). 8 - Environmental protection through societal change: What psychology knows about collective climate action—and what it needs to find out. In S. Clayton & C. Manning (Eds.), *Psychology and Climate Change* (pp. 185-213): Academic Press.
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, *50*(2), 248-287. doi:[https://doi.org/10.1016/0749-5978\(91\)90022-L](https://doi.org/10.1016/0749-5978(91)90022-L)
- Baum, C. M., & Gross, C. (2017). Sustainability policy as if people mattered: developing a framework for environmentally significant behavioral change. *Journal of Bioeconomics*, *19*(1), 53-95. doi:10.1007/s10818-016-9238-3
- Bergquist, M., Blumenschein, P., Karinti, P., Köhler, J., Martins Silva Ramos, É., Rödström, J., & Ejelöv, E. (2021). Replicating the focus theory of normative conduct as tested by Cialdini et al. (1990). *Journal of Environmental Psychology*, *74*, 101573. doi:<https://doi.org/10.1016/j.jenvp.2021.101573>
- Bernard, M., & Terjesen, M. D. (2020). Rational Emotive, Cognitive Behavioral Approaches to the Challenge of Child and Adolescent Mental Health. In M. Bernard & M. D. Terjesen (Eds.), *Rational-Emotive and Cognitive-Behavioral Approaches to Child and Adolescent Mental Health: Theory, Practice, Research, Applications*. (pp. 3-30). Cham: Springer International Publishing.
- Bhojar, S. P., Dusad, S., Shrivastava, R., Mishra, S., Gupta, N., & Rao, A. B. (2014). Understanding the Impact of Lifestyle on Individual Carbon-footprint. *Procedia - Social and Behavioral Sciences*, *133*, 47-60. doi:<https://doi.org/10.1016/j.sbspro.2014.04.168>
- Biely, K., Maes, D., & Van Passel, S. (2018). The idea of weak sustainability is illegitimate. *Environment, Development and Sustainability*, *20*(1), 223-232. doi:10.1007/s10668-016-9878-4
- Bissing-Olson, M. J., Fielding, K. S., & Iyer, A. (2016). Experiences of pride, not guilt, predict pro-environmental behavior when pro-environmental descriptive norms are more positive. *Journal of Environmental Psychology*, *45*, 145-153. doi:<https://doi.org/10.1016/j.jenvp.2016.01.001>

[Type here]

- Bobrow, E. (2018). Fight Climate Change with Behavior Change. Retrieved from <https://behavioralscientist.org/fight-climate-change-with-behavior-change/>
- Borg, K., Curtis, J., & Lindsay, J. (2020). Social norms and plastic avoidance: Testing the theory of normative social behaviour on an environmental behaviour. *Journal of Consumer Behaviour*, 19(6), 594-607. doi:<https://doi.org/10.1002/cb.1842>
- Boudon, R. (1998). Limitations of Rational Choice Theory. *American Journal of Sociology*, 104(3), 817-828. doi:10.1086/210087
- Bouman, T., van der Werff, E., Perlaviciute, G., & Steg, L. (2021). Environmental values and identities at the personal and group level. *Current Opinion in Behavioral Sciences*, 42, 47-53. doi:<https://doi.org/10.1016/j.cobeha.2021.02.022>
- Boyer, J. (2020). Toward an Evolutionary and Sustainability Perspective of the Innovation Ecosystem: Revisiting the Panarchy Model. *Sustainability*, 12(8), 3232. Retrieved from <https://www.mdpi.com/2071-1050/12/8/3232>
- Brosch, T. (2021). Affect and emotions as drivers of climate change perception and action: a review. *Current Opinion in Behavioral Sciences*, 42, 15-21. doi:<https://doi.org/10.1016/j.cobeha.2021.02.001>
- Brown, R. (2000). Social identity theory: past achievements, current problems and future challenges. *European Journal of Social Psychology*, 30(6), 745-778. doi:[https://doi.org/10.1002/1099-0992\(200011/12\)30:6<745::AID-EJSP24>3.0.CO;2-O](https://doi.org/10.1002/1099-0992(200011/12)30:6<745::AID-EJSP24>3.0.CO;2-O)
- Bujold, P. M., Williamson, K., & Thulin, E. (2020). *The Science of Changing Behavior for Environmental Outcomes: A Literature Review*. Retrieved from [https://behavior.rare.org/wp-content/uploads/2020/12/Final\\_Rare-Literature-Review.pdf](https://behavior.rare.org/wp-content/uploads/2020/12/Final_Rare-Literature-Review.pdf)
- Burnes, B. (2004a). Kurt Lewin and complexity theories: back to the future? *Journal of Change Management*, 4(4), 309-325. doi:10.1080/1469701042000303811
- Burnes, B. (2004b). Kurt Lewin and the Planned Approach to Change: A Re-appraisal. *Journal of Management Studies*, 41(6), 977-1002. doi:<https://doi.org/10.1111/j.1467-6486.2004.00463.x>
- Burr, V., & Dick, P. (2017). Social Constructionism. In B. Gough (Ed.), *The Palgrave Handbook of Critical Social Psychology* (pp. 59-80). London: Palgrave Macmillan UK.
- Caldwell, R. (2012). Systems Thinking, Organizational Change and Agency: A Practice Theory Critique of Senge's Learning Organization. *Journal of Change Management*, 12(2), 145-164. doi:10.1080/14697017.2011.647923
- Calver, M. C., & Fleming, P. A. (2020). Evidence for Citation Networks in Studies of Free-Roaming Cats: A Case Study Using Literature on Trap–Neuter–Return (TNR). *Animals*, 10(6), 993. Retrieved from <https://www.mdpi.com/2076-2615/10/6/993>
- Campbell, J. L. (2007). Why would corporations behave in socially responsible ways? an institutional theory of corporate social responsibility. *Academy of Management Review*, 32(3), 946-967. doi:10.5465/amr.2007.25275684
- Canter, D. V., & Craik, K. H. (1981). Environmental psychology. *Journal of Environmental Psychology*, 1(1), 1-11. doi:[https://doi.org/10.1016/S0272-4944\(81\)80013-8](https://doi.org/10.1016/S0272-4944(81)80013-8)
- Carlitz, A., & Rios, K. (2020). Beliefs. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (pp. 435-439). Cham: Springer International Publishing.
- Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design Studies*, 47, 118-163. doi:<https://doi.org/10.1016/j.destud.2016.09.002>
- Chao, Y.-L. (2012). Predicting people's environmental behaviour: theory of planned behaviour and model of responsible environmental behaviour. *Environmental Education Research*, 18(4), 437-461. doi:10.1080/13504622.2011.634970
- Chatterton, T. (2011). *An introduction to Thinking about 'Energy Behaviour': a Multi Model Approach*. Retrieved from London:

[Type here]

- Chatterton, T., & Wilson, C. (2014). The 'Four Dimensions of Behaviour' framework: a tool for characterising behaviours to help design better interventions. *Transportation Planning and Technology*, 37(1), 38-61. doi:10.1080/03081060.2013.850257
- Cieciuch, J., & Schwartz, S. H. (2020). Values. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (pp. 5704-5708). Cham: Springer International Publishing.
- Cinelli, M., Morales, G. D. F., Galeazzi, A., Quattrociocchi, W., & Starnini, M. (2021). The echo chamber effect on social media. *Proceedings of the National Academy of Sciences*, 118(9), e2023301118. doi:doi:10.1073/pnas.2023301118
- Clot, S., Grolleau, G., & Ibanez, L. (2022). Projection bias in environmental beliefs and behavioural intentions - An application to solar panels and eco-friendly transport. *Energy Policy*, 160, 112645. doi:<https://doi.org/10.1016/j.enpol.2021.112645>
- Coghlan, D. (2021). Edgar Schein on Change: Insights Into the Creation of a Model. *The Journal of Applied Behavioral Science*, 57(1), 11-19. doi:10.1177/0021886320924029
- Collet, F. (2009). Does Habitus Matter? A Comparative Review of Bourdieu's Habitus and Simon's Bounded Rationality with Some Implications for Economic Sociology. *Sociological Theory*, 27(4), 419-434. Retrieved from <http://www.jstor.org.tudelft.idm.oclc.org/stable/40376121>
- Common, M. S. (1996). Beckerman and his Critics on Strong and Weak Sustainability: Confusing Concepts and Conditions. *Environmental Values*, 5(1), 83-88. Retrieved from <http://www.jstor.org/stable/30301549>
- Connolly, J. (2016). Elias and habitus: explaining bureaucratisation processes in the Gaelic Athletic Association. *Culture and Organization*, 22(5), 452-475. doi:10.1080/14759551.2014.1001394
- Darnton, A. (2008). *Reference Report: An overview of behaviour change models and their uses* Retrieved from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/498065/Behaviour\\_change\\_reference\\_report\\_tcm6-9697.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/498065/Behaviour_change_reference_report_tcm6-9697.pdf)
- Darnton, A., & Evans, D. (2013). *Influencing Behaviors: A technical Guide to the ISM Tool* Retrieved from <https://digital.nls.uk/pubs/scotgov/2013/9781782565666.pdf>
- Day, K., Rickett, B., & Woolhouse, M. (2020). Conceptualising Social Class: Towards a Critical Social Psychological Approach (Maxine Woolhouse). In *Critical Social Psychology of Social Class* (pp. 67-99). Cham: Springer International Publishing.
- Day, T., Mooldijk, S., Smit, S., Posada, E., Hans, F., Fearnough, H., . . . Höhne, N. (2022). *Corporate Climate Responsibility Monitor 2022: Assessing the transparency and integrity of companies' emission reduction and net-zero targets*. Retrieved from [https://carbonmarketwatch.org/wp-content/uploads/2022/02/CMW\\_CCRM2022\\_v08\\_FinalStretch2.pdf](https://carbonmarketwatch.org/wp-content/uploads/2022/02/CMW_CCRM2022_v08_FinalStretch2.pdf)
- de Coninck, H., Revi, A., Babiker, M., Bertoldi, P., Buckeridge, M., Cartwright, A., . . . Sugiyama, T. (2018). Strengthening and Implementing the Global Response. In V. Masson- Delmotte, P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor , & T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*: IPCC.
- De Groot, J. I. M., & Steg, L. (2009). Morality and Prosocial Behavior: The Role of Awareness, Responsibility, and Norms in the Norm Activation Model. *The Journal of Social Psychology*, 149(4), 425-449. doi:10.3200/SOCP.149.4.425-449
- de Leeuw, A., Valois, P., Ajzen, I., & Schmidt, P. (2015). Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students:

[Type here]

- Implications for educational interventions. *Journal of Environmental Psychology*, 42, 128-138. doi:<https://doi.org/10.1016/j.jenvp.2015.03.005>
- Design for Transition. (2022). Design for Transition. Retrieved from <https://designfortransition.com/>
- Dickinson, J. L. (2009). The people paradox: self-esteem striving, immortality ideologies, and human response to climate change. *Ecology and Society*, 14(1). Retrieved from <http://www.ecologyandsociety.org/vol14/iss1/art34/>
- Drury, J. (2014). Crowd Psychology. In T. Teo (Ed.), *Encyclopedia of Critical Psychology* (pp. 341-344). New York, NY: Springer New York.
- Dyson, T. (2005). On Development, Demography and Climate Change: The End of the World as We Know It? *Population and Environment*, 27(2), 117-149. Retrieved from <http://www.jstor.org.tudelft.idm.oclc.org/stable/27503954>
- Edgerton, J. D., & Roberts, L. W. (2014). Habitus. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 2631-2636). Dordrecht: Springer Netherlands.
- Edmonds, B., Le Page, C., Bithell, M., Chattoe-Brown, E., Grimm, V., Meyer, R., . . . Squazzoni, F. (2019). Different Modelling Purposes. *Journal of Artificial Societies and Social Simulation*, 22(3), 6. doi:10.18564/jass.3993
- Ehret, P. J., Hodges, H. E., Kuehl, C., Brick, C., Mueller, S., & Anderson, S. E. (2021). Systematic Review of Household Water Conservation Interventions Using the Information–Motivation–Behavioral Skills Model. *Environment and Behavior*, 53(5), 485-519. doi:10.1177/0013916519896868
- Ellis, S., Carette, B., Anseel, F., & Lievens, F. (2014). Systematic Reflection: Implications for Learning From Failures and Successes. *Current Directions in Psychological Science*, 23(1), 67-72. doi:10.1177/0963721413504106
- Fahrenbach, F., & Kragulj, F. (2019). The ever-changing personality: revisiting the concept of triple-loop learning. *The Learning Organization, ahead-of-print*(ahead-of-print). doi:10.1108/TLO-01-2019-0016
- Farley, J., & Voinov, A. (2016). Economics, socio-ecological resilience and ecosystem services. *Journal of Environmental Management*, 183, Part 2, 389-398. doi:<http://dx.doi.org/10.1016/j.jenvman.2016.07.065>
- Fischer, J., & Riechers, M. (2019). A leverage points perspective on sustainability. *People and Nature*, 1(1), 115-120. doi:<https://doi.org/10.1002/pan3.13>
- Fleary, S. A., Joseph, P., & Chang, H. (2020). Applying the information-motivation-behavioral skills model to explain adolescents' fruits and vegetables consumption. *Appetite*, 147, 104546. doi:<https://doi.org/10.1016/j.appet.2019.104546>
- Furnham, A., & Boo, H. C. (2011). A literature review of the anchoring effect. *The Journal of Socio-Economics*, 40(1), 35-42. doi:<https://doi.org/10.1016/j.socec.2010.10.008>
- Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6–7), 897-920. doi:<http://dx.doi.org/10.1016/j.respol.2004.01.015>
- Gelfand, M. J., & Harrington, J. R. (2015). The Motivational Force of Descriptive Norms: For Whom and When Are Descriptive Norms Most Predictive of Behavior? *Journal of Cross-Cultural Psychology*, 46(10), 1273-1278. doi:10.1177/0022022115600796
- Gifford, R. (2009). Environmental psychology: Manifold visions, unity of purpose. *Journal of Environmental Psychology*, 29(3), 387-389. doi:<https://doi.org/10.1016/j.jenvp.2009.09.002>
- Gilderbloom, J. I., Hanka, M. J., & Lasley, C. B. (2009). Amsterdam: planning and policy for the ideal city? *Local Environment*, 14(6), 473-493. doi:10.1080/13549830902903799
- Goldfield, M., & Gilbert, A. (1995). The Limits of Rational Choice Theory. In T. Carver & P. Thomas (Eds.), *Rational Choice Marxism* (pp. 275-300). London: Palgrave Macmillan UK.
- Göpel, M. (2016). *The Great Mindshift: How a New Economic Paradigm and Sustainability Transformations go Hand in Hand*. Cham: Springer.

[Type here]

- Gorge, H., Herbert, M., Özçağlar-Toulouse, N., & Robert, I. (2015). What Do We Really Need? Questioning Consumption Through Sufficiency. *Journal of Macromarketing*, 35(1), 11-22. doi:10.1177/0276146714553935
- Gough, B. (2017). Critical Social Psychologies: Mapping the Terrain. In B. Gough (Ed.), *The Palgrave Handbook of Critical Social Psychology* (pp. 3-14). London: Palgrave Macmillan UK.
- Grills, S. (2014). Emotions, Sociology of. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 1876-1880). Dordrecht: Springer Netherlands.
- Grin, J., Rotmans, J., & Schot, J. (2010). *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*. London, UNITED KINGDOM: Taylor & Francis Group.
- Gunderson, L. H., & Holling, C. S. (2002). *Panarchy: Understanding transformations in human and natural systems*. Washington, Covelo, London: Island Press.
- Günther, H. (2009). The environmental psychology of research. *Journal of Environmental Psychology*, 29(3), 358-365. doi:<https://doi.org/10.1016/j.jenvp.2009.02.004>
- Haberl, H., Wiedenhofer, D., Virág, D., Kalt, G., Plank, B., Brockway, P., . . . Creutzig, F. (2020). A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part II: synthesizing the insights. *Environmental Research Letters*, 15(6), 065003. doi:10.1088/1748-9326/ab842a
- Habib, R., White, K., Hardisty, D. J., & Zhao, J. (2021). Shifting consumer behavior to address climate change. *Current Opinion in Psychology*, 42, 108-113. doi:<https://doi.org/10.1016/j.copsy.2021.04.007>
- Hampton, S., & Adams, R. (2018). Behavioural economics vs social practice theory: Perspectives from inside the United Kingdom government. *Energy Research & Social Science*, 46, 214-224. doi:<https://doi.org/10.1016/j.erss.2018.07.023>
- Harth, N. S. (2021). Affect, (group-based) emotions, and climate change action. *Current Opinion in Psychology*, 42, 140-144. doi:<https://doi.org/10.1016/j.copsy.2021.07.018>
- Haws, K. L., Winterich, K. P., & Naylor, R. W. (2014). Seeing the world through GREEN-tinted glasses: Green consumption values and responses to environmentally friendly products. *Journal of Consumer Psychology*, 24(3), 336-354. doi:<https://doi.org/10.1016/j.jcps.2013.11.002>
- Hebinck, A., Diercks, G., von Wirth, T., Beers, P. J., Barsties, L., Buchel, S., . . . Loorbach, D. (2022). An actionable understanding of societal transitions: the X-curve framework. *Sustainability Science*. doi:10.1007/s11625-021-01084-w
- Hediger, W. (1999). Reconciling “weak” and “strong” sustainability. *International Journal of Social Economics*, 26(7/8/9), 1120-1144. doi:doi:10.1108/03068299910245859
- Heggie, V. (2016). Over 200 years of deadly London air: smogs, fogs, and pea soupers. *The Guardian*. Retrieved from <https://www.theguardian.com/science/the-h-word/2016/dec/09/pollution-air-london-smogs-fogs-pea-soupers>
- Heiskanen, E., & Laakso, S. (2019). Editing out unsustainability from consumption: From information provision to nudging and social practice theory. In *A Research Agenda for Sustainable Consumption Governance*. Cheltenham, UK: Edward Elgar Publishing.
- Heller, P. W. (2019). The Philosophy of Theory U: A Critical Examination. *Philosophy of Management*, 18(1), 23-42. doi:10.1007/s40926-018-0087-0
- Hickel, J., & Kallis, G. (2020). Is Green Growth Possible? *New Political Economy*, 25(4), 469-486. doi:10.1080/13563467.2019.1598964
- Hoff, K., & Stiglitz, J. E. (2010). Equilibrium Fictions: A Cognitive Approach to Societal Rigidity. *American Economic Review*, 100(2), 141-146. doi:10.1257/aer.100.2.141
- Holland, A. (1997). SUBSTITUTABILITY: Or, why strong sustainability is weak and absurdly strong sustainability is not absurd. In J. Foster (Ed.), *Valuing Nature? Economics, ethics and environment*. London: Routledge.
- Homans, G. C., Hare, A. P., & Polley, R. B. (1993). *The Human Group* (1st edition ed.): Routledge.

[Type here]

- Hornsey, M. J. (2008). Social Identity Theory and Self-categorization Theory: A Historical Review. *Social and Personality Psychology Compass*, 2(1), 204-222. doi:<https://doi.org/10.1111/j.1751-9004.2007.00066.x>
- IPCC. (2021). *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: Summary for Policymakers*. Retrieved from
- IRENA. (2021). *World Energy Transitions Outlook: 1.5°C Pathway*. Retrieved from Abu Dhabi: [https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/IRENA\\_World\\_Energy\\_Transitions\\_Outlook\\_2021.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/IRENA_World_Energy_Transitions_Outlook_2021.pdf)
- Irwin, T. (2015). Transition Design: A Proposal for a New Area of Design Practice, Study, and Research. *Design and Culture*, 7(2), 229-246. doi:10.1080/17547075.2015.1051829
- Issock Issock, P. B., Roberts-Lombard, M., & Mpinganjira, M. (2020). Understanding household waste separation in South Africa. *Management of Environmental Quality: An International Journal*, 31(3), 530-547. doi:10.1108/MEQ-08-2019-0181
- Ivanova, D., Vita, G., Steen-Olsen, K., Stadler, K., Melo, P. C., Wood, R., & Hertwich, E. G. (2017). Mapping the carbon footprint of EU regions. *Environmental Research Letters*, 12(5), 054013. doi:10.1088/1748-9326/aa6da9
- Jackson, T. (2005). *Motivating Sustainable Consumption: a review of evidence on consumer behaviour and behavioural change*. Retrieved from <https://coolclimate.berkeley.edu/files/coolclimate/Jackson+2005+-+Motivating+sustainable+consumption.pdf>
- Jaeger-Erben, M., & Offenberger, U. (2014). A Practice Theory Approach to Sustainable Consumption. *GAIA - Ecological Perspectives for Science and Society*, 23(3), 166-174. doi:10.14512/gaia.23.S1.4
- Jones, T., Harms, L., & Heinen, E. (2016). Motives, perceptions and experiences of electric bicycle owners and implications for health, wellbeing and mobility. *Journal of Transport Geography*, 53, 41-49. doi:<https://doi.org/10.1016/j.jtrangeo.2016.04.006>
- Julmi, C. (2019). When rational decision-making becomes irrational: a critical assessment and re-conceptualization of intuition effectiveness. *Business Research*, 12(1), 291-314. doi:10.1007/s40685-019-0096-4
- Kahneman, D. (2003). Maps of Bounded Rationality: Psychology for Behavioral Economics. *The American Economic Review*, 93(5), 1449-1475. doi:10.1257/00028280322655392
- Kahneman, D. (2011). *Schnelles Denken, Langsames Denken* (17th edition ed.). München: Penguin Verlag.
- Kallgren, C. A., Reno, R. R., & Cialdini, R. B. (2000). A Focus Theory of Normative Conduct: When Norms Do and Do not Affect Behavior. *Personality and Social Psychology Bulletin*, 26(8), 1002-1012. doi:10.1177/01461672002610009
- Kasper, D. (2009). Ecological Habitus: Toward a Better Understanding of Socioecological Relations. *Organization & Environment*, 22(3), 311-326. doi:10.1177/1086026609343098
- Kasper, D. (2016). Re-conceptualizing (environmental) sociology. *Environmental Sociology*, 2(4), 322-332. doi:10.1080/23251042.2016.1197474
- Kasser, T., & Sheldon, K. M. (2000). Of Wealth and Death: Materialism, Mortality Salience, and Consumption Behavior. *Psychological Science*, 11(4), 348-351. Retrieved from <http://www.jstor.org/stable/40063846>
- Kingston, C. (2019). Institutional Change. In A. Marciano & G. B. Ramello (Eds.), *Encyclopedia of Law and Economics* (pp. 1153-1161). New York, NY: Springer New York.
- Klotz, L., Weber, E., Johnson, E., Shealy, T., Hernandez, M., & Gordon, B. (2018). Beyond rationality in engineering design for sustainability. *Nature Sustainability*, 1(5), 225-233. doi:10.1038/s41893-018-0054-8



[Type here]

- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260. doi:10.1080/13504620220145401
- Kovacs, B., Miller, L., Heller, M. C., & Rose, D. (2021). The carbon footprint of dietary guidelines around the world: a seven country modeling study. *Nutrition Journal*, 20(1), 15. doi:10.1186/s12937-021-00669-6
- Kuhnhenh, K., Costa, L., Mahnke, E., Schneider, L., & Lange, S. (2021). *A Societal Transformation Scenario for Staying Below 1.5°C*. Retrieved from <https://konzeptwerk-neue-oekonomie.org/wp-content/uploads/2020/12/A%20Societal%20Transformation%20Scenario.pdf>
- Laville, S. (2021, 20.10.2021). UK meat tax and frequent-flyer levy proposals briefly published then deleted. *The Guardian*. Retrieved from <https://www.theguardian.com/environment/2021/oct/20/meat-tax-and-frequent-flyer-levy-advice-dropped-from-uk-net-zero-strategy>
- Leifer, L. J., & Steinert, M. (2011). Dancing with ambiguity: Causality behavior, design thinking, and triple-loop-learning. *Information Knowledge Systems Management*, 10, 151-173. doi:10.3233/IKS-2012-0191
- Li, J., Zhang, D., & Su, B. (2019). The Impact of Social Awareness and Lifestyles on Household Carbon Emissions in China. *Ecological Economics*, 160, 145-155. doi:<https://doi.org/10.1016/j.ecolecon.2019.02.020>
- Lidskog, R., & Waterton, C. (2016). Conceptual innovation in environmental sociology. *Environmental Sociology*, 2(4), 307-311. doi:10.1080/23251042.2016.1259865
- Lin, P.-C., & Huang, Y.-H. (2012). The influence factors on choice behavior regarding green products based on the theory of consumption values. *Journal of Cleaner Production*, 22(1), 11-18. doi:<https://doi.org/10.1016/j.jclepro.2011.10.002>
- Lissack, M. (2021). Cybernetics and Control. In G. S. Metcalf, K. Kijima, & H. Deguchi (Eds.), *Handbook of Systems Sciences* (pp. 87-106). Singapore: Springer Singapore.
- Lockie, S. (2015a). What is environmental sociology? *Environmental Sociology*, 1(3), 139-142. doi:10.1080/23251042.2015.1066084
- Lockie, S. (2015b). Why environmental sociology? *Environmental Sociology*, 1(1), 1-3. doi:10.1080/23251042.2015.1022983
- Londakova, K., Park, T., Reynolds, J., & Wodak, S. (2021). *Net Zero: principles for successful behavior change initiatives*. Retrieved from <https://cms.qz.com/wp-content/uploads/2021/10/net-zero-behaviour-change-initiatives2.pdf>
- Loorbach, D., Frantzeskaki, N., & Avelino, F. (2017). Sustainability Transitions Research: Transforming Science and Practice for Societal Change. *Annual Review of Environment and Resources*, 42(1), 599-626. doi:10.1146/annurev-environ-102014-021340
- Maes, W. H., & Verbist, B. (2012). Increasing the sustainability of household cooking in developing countries: Policy implications. *Renewable and Sustainable Energy Reviews*, 16(6), 4204-4221. doi:<https://doi.org/10.1016/j.rser.2012.03.031>
- Maniates, M. F. (2001). Individualization: Plant a Tree, Buy a Bike, Save the World? *Global Environmental Politics*, 1(3), 31-52. doi:10.1162/152638001316881395
- Mansell, W., & Marken, R. S. (2015). The Origins and Future of Control Theory in Psychology. *Review of General Psychology*, 19(4), 425-430. doi:10.1037/gpr0000057
- Meadows, D. (1999). Leverage Points: Places to Intervene in a System. *Hartland*. Retrieved from file:///C:/Users/lucp8666/Downloads/Meadows.%201999%20Leverage\_Points.pdf
- Metcalf, G. S., & Kauffman, S. A. (2021). Systems Science, Cybernetics, and Complexity. In G. S. Metcalf, K. Kijima, & H. Deguchi (Eds.), *Handbook of Systems Sciences* (pp. 29-63). Singapore: Springer Singapore.
- Metcalf, G. S., Kijima, K., & Deguchi, H. (2021). *Handbook of Systems Sciences* (G. S. Metcalf, K. Kijima, & H. Deguchi Eds.). Singapore: Springer.

[Type here]

- Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(1), 42. doi:10.1186/1748-5908-6-42
- Milieucentraal. (2021). Wat veroorzaakt de meeste CO2-uitstoot? In.
- Milieucentraal. (2022). Klimaatklappers. Retrieved from <https://www.milieucentraal.nl/klimaat-en-aarde/klimaatverandering/klimaatklappers/>
- Mobus, G. E., & Kalton, M. C. (2015). *Principles of Systems Science*. New York, NY: Springer.
- Monroe, M. C., Andrews, E., & Biedenweg, K. (2008). A Framework for Environmental Education Strategies. *Applied Environmental Education & Communication*, 6(3-4), 205-216. doi:10.1080/15330150801944416
- Morrison, K. (2005). Structuration Theory, Habitus and Complexity Theory: Elective Affinities or Old Wine in New Bottles? *British Journal of Sociology of Education*, 26(3), 311-326. Retrieved from <http://www.jstor.org.tudelft.idm.oclc.org/stable/30036070>
- Moser, C., Rösch, A., & Stauffacher, M. (2015). Exploring Societal Preferences for Energy Sufficiency Measures in Switzerland. *Frontiers in Energy Research*, 3. doi:10.3389/fenrg.2015.00040
- Naderi, I., & Van Steenburg, E. (2018). Me first, then the environment: young Millennials as green consumers. *Young Consumers*, 19(3), 280-295. doi:10.1108/YC-08-2017-00722
- Nature. (2020). Nudges that don't nudge. *Nature Human Behaviour*, 4(2), 121-121. doi:10.1038/s41562-020-0832-y
- Newell, P., Daley, F., & Twena, M. (2021). *Changing our ways? Behaviour change and the climate crisis. The report of the Cambridge Sustainability Commission on Scaling Behaviour Change*. Retrieved from <https://www.rapidtransition.org/resources/cambridge-sustainability-commission/>
- Newell, P., Twena, M., & Daley, F. (2021). Scaling behaviour change for a 1.5 degree world: Challenges and opportunities. *Global Sustainability*, 1-25. doi:10.1017/sus.2021.23
- Nielsen, K. S., Clayton, S., Stern, P. C., Dietz, T., Capstick, S., & Whitmarsh, L. (2021). How psychology can help limit climate change. *Am Psychol*, 76(1), 130-144. doi:10.1037/amp0000624
- Norgaard, K. M. (2006). "People Want to Protect Themselves a Little Bit": Emotions, Denial, and Social Movement Nonparticipation\*. *Sociological Inquiry*, 76(3), 372-396. doi:<https://doi.org/10.1111/j.1475-682X.2006.00160.x>
- Nowak, A., & Vallacher, R. R. (2019). Nonlinear societal change: The perspective of dynamical systems. *British Journal of Social Psychology*, 58(1), 105-128. doi:<https://doi.org/10.1111/bjso.12271>
- Nys, T. R., & Engelen, B. (2017). Judging Nudging: Answering the Manipulation Objection. *Political Studies*, 65(1), 199-214. doi:10.1177/0032321716629487
- O'Rourke, D., & Lollo, N. (2015). Transforming Consumption: From Decoupling, to Behavior Change, to System Changes for Sustainable Consumption. *Annual Review of Environment and Resources*, 40(1), 233-259. doi:10.1146/annurev-environ-102014-021224
- OECD. (2019). *Behavioural Insights Toolkit and Ethical Guidelines for Policy Makers*. Retrieved from <https://oecd-opsi.org/toolkits/basic-the-behavioural-insights-toolkit-and-ethical-guidelines-for-policy-makers/>
- Onwezen, M. C., Antonides, G., & Bartels, J. (2013). The Norm Activation Model: An exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. *Journal of Economic Psychology*, 39, 141-153. doi:<https://doi.org/10.1016/j.joep.2013.07.005>
- Oren, S., & Sklar, N. (2022). *Planning on an Empty Stomach: On Agents with Projection Bias*, Cham.
- Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, 19(3), 354-365. doi:<https://doi.org/10.1016/j.gloenvcha.2009.06.001>
- Parente, R. (2011). Learning. In J. S. Kreutzer, J. DeLuca, & B. Caplan (Eds.), *Encyclopedia of Clinical Neuropsychology* (pp. 1440-1445). New York, NY: Springer New York.

[Type here]

- Park, J., & Ha, S. (2014). Understanding Consumer Recycling Behavior: Combining the Theory of Planned Behavior and the Norm Activation Model. *Family and Consumer Sciences Research Journal*, 42(3), 278-291. doi:<https://doi.org/10.1111/fcsr.12061>
- Parker, P. M., & Tavassoli, N. T. (2000). Homeostasis and consumer behavior across cultures. *International Journal of Research in Marketing*, 17(1), 33-53. doi:[https://doi.org/10.1016/S0167-8116\(00\)00006-9](https://doi.org/10.1016/S0167-8116(00)00006-9)
- Peschl, M. F. (2007). Triple-loop learning as foundation for profound change, individual cultivation, and radical innovation. Construction processes beyond scientific and rational knowledge. In (Vol. 2, pp. 136-145).
- Piko, B. F., & Brassai, L. (2016). A reason to eat healthy: The role of meaning in life in maintaining homeostasis in modern society. *Health Psychology Open*, 3(1), 2055102916634360. doi:10.1177/2055102916634360
- Pörtner, H.-O., Roberts, D. C., Adams, H., Adler, C., Aldunce, P., Ali, E., . . . Ibrahim, Z. Z. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II contribution to the IPCC Sixth Assessment Report*. Retrieved from [https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\\_AR6\\_WGII\\_FinalDraft\\_FullReport.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_FullReport.pdf)
- Quackenbush, S. (2004). The Rationality of Rational Choice Theory. *International Interactions*, 30(2), 87-107. doi:10.1080/03050620490462595
- RARE. (2021). *Behavior-Centered Design: An overview*. Retrieved from <https://behavior.rare.org/wp-content/uploads/2021/10/BCD-Users-Journey-booklet-10-21.pdf>
- Raskovic, M. (2015). Economic sociology and the ARA interaction model. *Journal of Business & Industrial Marketing*, 30(5), 472-485. doi:10.1108/JBIM-09-2011-0123
- Read, C., & Parton, K. A. (2019). The impact of the 1952 London smog event and its relevance for current wood-smoke abatement strategies in Australia. *Journal of the Air & Waste Management Association*, 69(9), 1049-1058. doi:10.1080/10962247.2019.1623936
- Reckwitz, A. (2002). Toward a Theory of Social Practices: A Development in Culturalist Theorizing. *European Journal of Social Theory*, 5(2), 243-263. doi:10.1177/13684310222225432
- Rees, J. H., & Bamberg, S. (2014). Climate protection needs societal change: Determinants of intention to participate in collective climate action. *European Journal of Social Psychology*, 44(5), 466-473. doi:<https://doi.org/10.1002/ejsp.2032>
- Reynolds, K. J. Self-Categorization Theory. In *The Wiley-Blackwell Encyclopedia of Social Theory* (pp. 1-4).
- Richardson, K., Tortoriello, G. K., & Hart, W. (2020). Attitudes. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (pp. 310-312). Cham: Springer International Publishing.
- Rimal, R. N. (2008). Modeling the Relationship Between Descriptive Norms and Behaviors: A Test and Extension of the Theory of Normative Social Behavior (TNSB). *Health Communication*, 23(2), 103-116. doi:10.1080/10410230801967791
- Rimal, R. N., & Real, K. (2005). How Behaviors are Influenced by Perceived Norms: A Test of the Theory of Normative Social Behavior. *Communication Research*, 32(3), 389-414. doi:10.1177/0093650205275385
- Rogers, E. M. (2002). Diffusion of preventive innovations. *Addictive Behaviors*, 27(6), 989-993. doi:[https://doi.org/10.1016/S0306-4603\(02\)00300-3](https://doi.org/10.1016/S0306-4603(02)00300-3)
- Rogers, E. M. (2004). A Prospective and Retrospective Look at the Diffusion Model. *Journal of Health Communication*, 9(sup1), 13-19. doi:10.1080/10810730490271449
- Rogers, E. R. (1983). *Diffusion of Innovations*. New York: The Free Press.
- Roy, J., & Pal, S. (2009). Lifestyles and climate change: link awaiting activation. *Current Opinion in Environmental Sustainability*, 1(2), 192-200. doi:<https://doi.org/10.1016/j.cosust.2009.10.009>

[Type here]

- Russell, S. V., Young, C. W., Unsworth, K. L., & Robinson, C. (2017). Bringing habits and emotions into food waste behaviour. *Resources, Conservation and Recycling*, 125, 107-114. doi:<https://doi.org/10.1016/j.resconrec.2017.06.007>
- Sadler-Smith, E., & Shefy, E. (2004). The intuitive executive: Understanding and applying 'gut feel' in decision-making. *Academy of Management Perspectives*, 18(4), 76-91. doi:10.5465/ame.2004.15268692
- Salonen, A., & Åhlberg, M. (2012). The Path towards Planetary Responsibility - Expanding the Domain of Human Responsibility Is a Fundamental Goal for Lifelong Learning in a High-Consumption Society. *Journal of Sustainable Development*, 5(8). doi:DOI:10.5539/jsd.v5n8p13
- Salonen, A., & Helne, T. (2012). Vegetarian Diets: A Way towards a Sustainable Society. *Journal of Sustainable Development*, 5(6). doi:doi: 10.5539/jsd.v5n6p10
- Sanders, M., Snijders, V., & Hallsworth, M. (2018). Behavioural science and policy: where are we now and where are we going? *Behavioural Public Policy*, 2(2), 144-167. doi:10.1017/bpp.2018.17
- Sanne, C. (2002). Willing consumers—or locked-in? Policies for a sustainable consumption. *Ecological Economics*, 42(1–2), 273-287. doi:[http://dx.doi.org/10.1016/S0921-8009\(02\)00086-1](http://dx.doi.org/10.1016/S0921-8009(02)00086-1)
- Sarigil, Z. (2015). Showing the path to path dependence: the habitual path. *European Political Science Review*, 7(2), 221-242. doi:10.1017/S1755773914000198
- Scharmer, O. (2020). Social Systems as If People Mattered Response to the Kühl Critique of Theory U. *Journal of Change Management*, 20(4), 322-332. doi:10.1080/14697017.2020.1744884
- Schein, E. H. (1996). Kurt Lewin's change theory in the field and in the classroom: Notes toward a model of managed learning. *Systems practice*, 9(1), 27-47. doi:10.1007/BF02173417
- Schein, E. H. (2002). Models and Tools for Stability and Change in Human Systems. *Reflections: The Sol Journal*, 4, 34-46.
- Schmidt, R., & Stenger, K. (2021). Behavioral planning: Improving behavioral design with “roughly right” foresight. *Strategic Design Research Journal*, 14(1). doi: DOI: <https://doi.org/10.4013/sdrj.2021.141.12>
- Schwartz, S. H. (1992). Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 25, pp. 1-65): Academic Press.
- See, Y. H. M. (2020). Cognitive-Affective Processing System. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (pp. 733-739). Cham: Springer International Publishing.
- Shigetomi, Y., Kanemoto, K., Yamamoto, Y., & Kondo, Y. (2021). Quantifying the carbon footprint reduction potential of lifestyle choices in Japan. *Environmental Research Letters*, 16(6). doi:<https://doi.org/10.1088/1748-9326/abfc07>
- Shove, E. (2003). Converging Conventions of Comfort, Cleanliness and Convenience. *Journal of Consumer Policy*, 26(4), 395-418. doi:10.1023/A:1026362829781
- Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Amsterdam, Lausanne, Melbourn, Milan, New York, Sao Paulo: Metalibri
- Smith, J. R., Louis, W. R., Terry, D. J., Greenaway, K. H., Clarke, M. R., & Cheng, X. (2012). Congruent or conflicted? The impact of injunctive and descriptive norms on environmental intentions. *Journal of Environmental Psychology*, 32(4), 353-361. doi:<https://doi.org/10.1016/j.jenvp.2012.06.001>
- Solomon, S., Greenberg, J. L., & Pyszczynski, T. A. (2004). Lethal consumption: Death-denying materialism. In *Psychology and consumer culture: The struggle for a good life in a materialistic world*. (pp. 127-146). Washington, DC, US: American Psychological Association.
- Sörqvist, P., Haga, A., Langeborg, L., Holmgren, M., Wallinder, M., Nöstl, A., . . . Marsh, J. E. (2015). The green halo: Mechanisms and limits of the eco-label effect. *Food Quality and Preference*, 43, 1-9. doi:<https://doi.org/10.1016/j.foodqual.2015.02.001>

[Type here]

- Spaargaren, G. (2003). Sustainable Consumption: A Theoretical and Environmental Policy Perspective. *Society & Natural Resources*, 16(8), 687-701. doi:10.1080/08941920309192
- Spangenberg, J. H., & Lorek, S. (2019). Sufficiency and consumer behaviour: From theory to policy. *Energy Policy*, 129, 1070-1079. doi:<https://doi.org/10.1016/j.enpol.2019.03.013>
- Starr, D. (2016). Just 90 companies are to blame for most climate change, this 'carbon accountant' says. *Science*.
- Sterman, J. D. (2002). All models are wrong: reflections on becoming a systems scientist. *System Dynamics Review*, 18(4), 501-531. doi:10.1002/sdr.261
- Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A Value-Belief-Norm Theory of Support for Social Movements: The Case of Environmentalism. *Human Ecology Review*, 6(2), 81-97. Retrieved from <http://www.jstor.org.tudelft.idm.oclc.org/stable/24707060>
- Stollberg, J., & Jonas, E. (2021). Existential threat as a challenge for individual and collective engagement: Climate change and the motivation to act. *Current Opinion in Psychology*, 42, 145-150. doi:<https://doi.org/10.1016/j.copsyc.2021.10.004>
- Supran, G., & Oreskes, N. (2021). Rhetoric and frame analysis of ExxonMobil's climate change communications. *One Earth*, 4(5), 696-719. doi:<https://doi.org/10.1016/j.oneear.2021.04.014>
- Taylor, M., & Watts, J. (2019). Revealed: the 20 firms behind a third of all carbon emissions. *The Guardian*. Retrieved from <https://www.theguardian.com/environment/2019/oct/09/revealed-20-firms-third-carbon-emissions>
- Thaler, R. H. (2021). *Nudge: The Final Edition* (3rd edition ed.): Penguin Books.
- Thompson, M., Ellis, R., & Wildavsky, A. (1990). Introduction to Part One: Against Dualism. In M. Thompson, R. Ellis, & A. Wildavsky (Eds.), *Cultural Theory* (1st edition ed.): Routledge.
- Thorpe, A., & Gamman, L. (2011). Design with society: why socially responsive design is good enough. *CoDesign*, 7(3-4), 217-230. doi:10.1080/15710882.2011.630477
- Tonkinwise, C. (2015). Design for Transitions – from and to what? *Design Philosophy Papers*, 13(1), 85-92. doi:10.1080/14487136.2015.1085686
- Turnheim, B., & Geels, F. W. (2012). Regime destabilisation as the flipside of energy transitions: Lessons from the history of the British coal industry (1913–1997). *Energy Policy*, 50, 35-49. doi:<https://doi.org/10.1016/j.enpol.2012.04.060>
- Unerman, J. (2020). Risks from self-referential peer review echo chambers developing in research fields: 2018 Keynote Address presented at The British Accounting Review 50th Anniversary Celebrations, British Accounting and Finance Association Annual Conference, London. *The British Accounting Review*, 52(5), 100910. doi:<https://doi.org/10.1016/j.bar.2020.100910>
- Uzzell, D., & Moser, G. (2009). Introduction: Environmental psychology on the move. *Journal of Environmental Psychology*, 29(3), 307-308. doi:<https://doi.org/10.1016/j.jenvp.2009.08.003>
- Verhofstadt, E., Van Ootegem, L., Defloor, B., & Bleys, B. (2016). Linking individuals' ecological footprint to their subjective well-being. *Ecological Economics*, 127, 80-89. doi:<https://doi.org/10.1016/j.ecolecon.2016.03.021>
- Verplanken, B., & Whitmarsh, L. (2021). Habit and climate change. *Current Opinion in Behavioral Sciences*, 42, 42-46. doi:<https://doi.org/10.1016/j.cobeha.2021.02.020>
- Visser, M. (2003). Gregory Bateson on deutero-learning and double bind: A brief conceptual history. *Journal of the History of the Behavioral Sciences*, 39(3), 269-278. doi:<https://doi.org/10.1002/jhbs.10112>
- Vlek, C. (2000). Essential Psychology for Environmental Policy Making. *International Journal of Psychology*, 35(2), 153-167. doi:<https://doi.org/10.1080/002075900399457>
- Ward, N., Jackson, P., Russell, P., & Wilkinson, K. (2008). Productivism, Post-Productivism and European Agricultural Reform: The Case of Sugar. *Sociologia Ruralis*, 48(2), 118-132. doi:10.1111/j.1467-9523.2008.00455.x

[Type here]

- Warszawski, L., Kriegler, E., Lenton, T. M., Gaffney, O., Jacob, D., Klingensfeld, D., . . . Rockström, J. (2021). All options, not silver bullets, needed to limit global warming to 1.5 °C: a scenario appraisal. *Environmental Research Letters*, 16(6), 064037. doi:10.1088/1748-9326/abfeec
- Weintrobe, S. (2021). *Psychological Roots of the Climate Crisis: Neoliberal Exceptionalism and the Culture of Uncare*. New York, London: Bloomsbury Academic.
- Wendel, S. (2020). *Designing for Behavior Change: Applying Psychology and Behavioral Economics* O'Reilly UK Ltd.
- Whitmarsh, L., Poortinga, W., & Capstick, S. (2021). Behaviour change to address climate change. *Current Opinion in Psychology*, 42, 76-81. doi:<https://doi.org/10.1016/j.copsy.2021.04.002>
- Whittington, R. (2015). Giddens, structuration theory and strategy as practice. In D. Golsorkhi, D. Seidl, E. Vaara, & L. Rouleau (Eds.), *Cambridge Handbook of Strategy as Practice* (2 ed., pp. 145-164). Cambridge: Cambridge University Press.
- WHO. (2015). *Residential heating with wood and coal: health impacts and policy options in Europe and North America*. Retrieved from [https://www.euro.who.int/\\_data/assets/pdf\\_file/0009/271836/ResidentialHeatingWoodCoalHealthImpacts.pdf](https://www.euro.who.int/_data/assets/pdf_file/0009/271836/ResidentialHeatingWoodCoalHealthImpacts.pdf)
- Wilkinson, T. M. (2013). Nudging and Manipulation. *Political Studies*, 61(2), 341-355. doi:10.1111/j.1467-9248.2012.00974.x
- Williams, B. K., & Brown, E. D. (2018). Double-Loop Learning in Adaptive Management: The Need, the Challenge, and the Opportunity. *Environmental Management*, 62(6), 995-1006. doi:10.1007/s00267-018-1107-5
- Williamson, K., Bujold, P. M., & Thulin, E. (2020). *Behavior Change. Interventions in Practice: A synthesis of criteria, approaches, case studies & indicators*. Retrieved from <https://behavior.rare.org/wp-content/uploads/2021/02/Behavior-Change-Interventions-in-Practice-final.pdf>
- Williamson, K., Satre-Meloy, A., Velasco, K., & Green, K. (2018). *Climate Change Needs Behavior Change: Making the Case for Behavioral Solutions to Reduce Global Warming*. Retrieved from <https://rare.org/wp-content/uploads/2019/02/2018-CCNBC-Report.pdf>
- Wilpert, B. (2001). Organizational Behavior, Psychology of. In N. J. Smelser & P. B. Baltes (Eds.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 10917-10921). Oxford: Pergamon.
- Woiwode, C., Schöpke, N., Bina, O., Veciana, S., Kunze, I., Parodi, O., . . . Wamsler, C. (2021). Inner transformation to sustainability as a deep leverage point: fostering new avenues for change through dialogue and reflection. *Sustainability Science*. doi:10.1007/s11625-020-00882-y
- Worldbank. (2015). *World Development Report 2015: Mind, Society, and Behavior*.
- Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources, Conservation and Recycling*, 155, 104660. doi:<https://doi.org/10.1016/j.resconrec.2019.104660>
- Zavala-Rojas, D. (2014). Fixed Reference Points. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 2283-2284). Dordrecht: Springer Netherlands.
- Zimbardo, P. G., & Gerrig, R. J. (2004). *Psychology* (16 ed.). Munich, Boston, San Francisco: Pearson Studium.