Bundesamt für Naturschutz

Unlocking the Societal Potential for Change

Documentation of the 4th Summer School on Environmental Psychology, Isle of Vilm

Gerhard Reese, Jonathan Kuhlmann and
Andreas W. Mues (Eds.)

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Impressum

Cover image: Isle of Vilm, BfN conference house during summer school (above) and beach scenery (below) (Andreas W. Mues).

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Climate change, environmental sustainability, ecosystem degradation, biodiversity loss and renewable energy are some of the pressing global issues in contemporary discourse requiring transformative social and behavioral change. These issues intersect with various scientific disciplines, including environmental psychology, which offers insights into the complex dynamics of human behavior, perceptions, and attitudes concerning the environment. It is this integrative perspective of our field that in particular allows fine grained and deep analysis of the processes involved in environmental (in)action. To foster and further develop this analysis, our Environmental Summer School has now – for several years – sparked new ideas and allowed researchers and practitioners to gather, discuss and plan new research.

In this issue of the BfN-Schriften, our authors, who were participants of the “4th Summer School on Environmental Psychology” on Vilm Island in May/June 2023, explore five distinct yet interconnected themes that delve into different aspects of environmental psychology, ranging from climate justice and emotional responses to sustainability strategies, incentives for pro-environmental behavior, and the social implications of emerging technologies like airborne wind energy (AWE). These papers highlight the multifaceted nature of human-environment interactions and the implications for addressing pressing environmental concerns.

The first paper by Susanne Nicolai (University of Greifswald) discusses the intersection of climate change and justice, highlighting how climate injustice disproportionately affects vulnerable communities worldwide. It emphasizes the need for climate protection especially in the light of climate justice, which involves addressing the shared responsibility for climate protection and the disproportionate burden faced by those least responsible for the crisis. According to Susanne Nicolai’s analysis, climate justice encompasses various principles and perspectives, including distributive justice, procedural justice, and recognition, each playing a crucial role in evaluating the fairness of resource allocation and decision-making processes related to climate change. The motivational power of justice in driving pro-environmental behaviors is then explored, with theories like Adams' equity theory and Folger's Referent Cognition Theory shedding light on how perceptions of fairness influence actions. The text also discusses justice sensitivity, which refers to individual differences in perceiving and reacting to injustice, and its impact on pro-environmental intentions. Susanne’s paper succinctly addresses the role of empathy in fostering a sense of responsibility towards addressing climate injustice and the significance of taking action to rectify passive injustice, such as inaction or insufficient response to climate change. The text underscores the importance of understanding justice perceptions within different social contexts and systems, noting how collective perceptions of justice can evolve over time and influence individual behaviors. It concludes with the IPCC's assertion that achieving climate resilience requires inclusive development choices prioritizing equity and justice, supported by international cooperation and partnerships with marginalized groups. Overall, the text provides a comprehensive overview of the complex relationship between climate change and justice to the reader, emphasizing the critical role of justice in motivating action to address climate injustice and achieve climate resilience.

In the second paper, Helen Landmann (FernUniversität in Hagen) explores common misconceptions surrounding emotions and their role in influencing pro-environmental behavior. The text addresses five key misconceptions and provides insights into the complexity of emotional responses in environmental contexts. Specifically, Helen Landmann's work shows that emotions are often seen as irrational, but they are not random reactions. Emotions are influenced by appraisals, fast evaluations of situations regarding well-being. Emotions and appraisals are closely intertwined, affecting reactions to environmental issues, and researchers must consider this connection when studying emotions and behavior. She then clarifies that emotions, whether incidental or integral, are directed at specific objects and vary in their impact on pro-environmental behavior. Understanding the object of an emotion is crucial for studying its effects on behavior, and typologies of emotions can guide research in this area. Her paper then enlightens the emotion – behavior link: She argues that while emotions strongly predict motivation for pro-environmental behavior, the causal relationship between emotions and behavior is complex. Emotional episodes and affective attitudes differ, with affective attitudes often influencing behavior more than short-lived emotional episodes. Distinguishing between these can improve research accuracy. She then points to an important aspect often overlooked or ignored in psychological research in general: it lacks diversity, with participants primarily coming from WEIRD (Western, Educated, Industrialized, Rich, Democratic) societies. However, concern for the environment varies globally, with different socio-demographic groups exhibiting diverse attitudes and behaviors. Including non-WEIRD perspectives in research can enhance understanding of environmental concerns. Finally, her work points out that while anger is commonly associated with collective action, positive emotions like being moved also play a significant role. The emotional path to collective action involves perceptions of injustice and collective efficacy beliefs. Understanding the role of positive emotions is thus crucial for addressing activist burnout and promoting sustainable collective action. In summary, understanding these processes can improve research and practice in environmental psychology. Recognizing the interconnectedness of emotions and appraisals, considering diverse perspectives, and acknowledging the role of positive emotions in collective action are essential for effective interventions and promoting pro-environmental behavior.

In the third paper, Tillmann Hüppauff (Fachhochschule Dortmund) introduces and discusses the concept of sufficiency as a strategy for achieving sustainability. He does so by putting his work explicitly into perspective of planetary boundaries being transgressed due to human activity. Sufficiency emphasizes social innovations and behavior change, aiming to meet human needs within planetary boundaries without excess or shortages. Sufficiency strategies include curtailment, shifting consumption modes, and sharing resources. Despite its potential, sufficiency strategies are underrepresented in sustainability discourse due to economic, political, and individual barriers. Contrary to the belief that pro-environmental behavior compromises wellbeing, Tillmann Hüppauff provides sound evidence supporting a positive relationship between sustainable living and wellbeing. For example, the concept of voluntary simplicity, which involves limiting consumption and practicing minimalism, has been associated with increased wellbeing in numerous studies. Meaning construction processes play a crucial role in connecting sustainable lifestyles with wellbeing, as they involve reflecting on experiences and integrating them into goals and values. In a study investigating sufficiency behavior, findings suggest that meaningfulness and intrinsic motivation are related to both behavioral wellbeing and the frequency of certain sufficiency behaviors. Biospheric values, which emphasize preservation of nature and the environment, strongly predicted intrinsic motivation for sufficiency behavior. This supports the idea that reducing consumption can be seen as a valuable

lifestyle choice when it aligns with personal values and goals. Tillmann Hüppauffs work then suggests that during crises like the Covid-19 pandemic, meaning construction processes have become more active, leading to increased engagement in sustainable leisure behaviors. Life reflection and the perception of having more time (Time Wealth) were positively associated with sustainable leisure activities, which in turn are linked to life satisfaction and the presence of meaning. Finally, his work focuses on how to promote meaningful lifestyle changes. Overall, his paper suggests that promoting sufficiency strategies not only contributes to mitigating climate change and biodiversity loss but also aligns with wellbeing when meaningful experiences are prioritized over excessive consumption. By identifying settings where nature protection provides rewarding experiences, policies can support meaningful engagement with nature conservation.

In the fourth paper of this issue, Valentina Kroker and Florian Lange (KU Leuven) present their work that discusses the effects of incentives on pro-environmental behavior (PEB), specifically focusing on financial (self-incentives) and pro-social incentives. Financial incentives, such as cash rewards or vouchers, have been shown to influence PEB positively, with studies indicating medium-sized positive effects that can persist beyond the discontinuation of the incentives. However, the authors also describe the rebound effect as an undesirable side effect, where increased spending on unsustainable items may occur as a result of financial incentives. They set out from the lack of reliable comparisons between different incentive types and address this gap, using the Pro-Environmental Behavior Task (PEBT) as a laboratory task to compare the effects of self-incentives and pro-social incentives on PEB. The PEBT involves participants choosing between environmentally friendly (e.g., biking) and environmentally harmful (e.g., driving) options, with real consequences simulated through the task. Kroker and Lange provide preliminary findings from the study that indicate that both types of incentives increased environmentally friendly choices compared to a control condition, but financial self-incentives were more effective than pro-social incentives in promoting PEB. However, these differences disappeared over time, suggesting that incentives may not have a lasting effect on behavior change once discontinued. The authors argue that despite this finding, incentives could still be valuable tools for promoting environmentally friendly behavior, especially in contexts where additional barriers exist, such as lacking infrastructure or perceived safety concerns. Overall, Kroker and Lange argue that while incentives can be effective in promoting behavior change, their long-term effectiveness and potential side effects should be carefully considered. In some cases, incentives may only be needed temporarily, while in others, they may need to be implemented on a permanent basis to maintain behavior change. Additionally, incentives may be more effective when they align with naturally rewarding consequences of the behavior, underscoring the complexity of incentive strategies in fostering pro-environmental behavior.

Last but not least, the paper from Helena Schmidt (Delft University) explores the concept of airborne wind energy (AWE) and its potential benefits compared to traditional wind turbines, as well as the urgent need for research on its social implications. AWE utilizes kites or drones tethered to the ground to harness wind energy, offering advantages such as accessibility to higher-altitude winds, easier transport and installation, adjustable harvesting altitude, reduced carbon footprint, and lower maintenance costs. However, the AWE industry faces technical complexity and challenges in meeting development targets. The succinct discussion of Helena Schmidt highlights the importance of understanding the social acceptance of AWE, which is often touted as more socially acceptable than wind turbines due to factors like lower

visibility, noise emissions, and impacts on wildlife. However, she also states that research on AWE's environmental impacts and societal acceptance is lacking, with few environmental impact assessments conducted and independent research on visual, sound, and ecological impacts missing. Additionally, the claim that AWE will be more socially accepted than wind turbines may not hold true due to residents' preconceptions, beliefs, and experiences shaping their attitudes toward renewable energy technologies in general. She reports a study conducted in Northern Germany in 2022 aimed to assess community acceptance of an AWE system compared to a wind farm. Results indicated that residents' attitudes toward the AWE system were positive but not significantly different from their attitude toward a “classic” wind farm. While visual impacts were rated somewhat better for the AWE system, safety concerns were not significantly higher for AWE than for wind turbines. Residents expressed preferences for remote sites for AWE deployment but were generally accepting of the local AWE system regardless of proximity. Overall, Helena Schmidt’s study suggests that while residents generally perceive AWE positively, there is a need for further research across different AWE systems, regions, and acceptance levels to better understand its social implications. Understanding and addressing residents' concerns and preferences are crucial for informed policy decisions and successful deployment of AWE technology, which could play a significant role in meeting future wind power generation targets.

In conclusion, these papers show how environmental psychology offers a multifaceted lens through which to examine and address pressing environmental challenges. By exploring topics such as climate justice, emotional responses, sufficiency strategies, incentives for pro-environmental behavior, and social acceptance of emerging technologies, environmental psychology provides valuable insights into understanding and promoting sustainable behavior change. As we navigate the complexities of human-environment interactions, interdisciplinary approaches that integrate psychological insights with broader environmental discourse are essential for fostering meaningful engagement with sustainability and addressing global environmental concerns. These insights therefore offer valuable indications and tools on how to further proceed on the United Nations Goal of living in harmony with nature on the global and local level. We are happy that with this collection, we could generate a look into how environmental psychology helps navigating through responding to global environmental challenges, hopefully inspiring many more researchers and practitioners to engage in this discourse and make a change.

2 From Social Glue to Climate Justice: Unraveling the Motivational Power of Justice in an Unjust World

Susanne Nicolai, University of Greifswald, Germany

Abstract

In this article, the fundamental connection between climate change and justice is explored. It is argued that the climate crisis is fundamentally a matter of justice because different populations around the world are unequally affected by climate change, with the most vulnerable communities suffering the most despite contributing the least to the crisis. The concept of climate justice encompasses various principles of justice within the context of climate change, emphasizing the shared responsibility of humanity for climate protection and repair. The article discusses the motivational power of justice, highlighting how individuals are guided by a sensitivity towards (in)justice in their actions and decisions. Moreover, different principles of justice and how they apply to climate justice, are explored, including distributive justice, procedural justice, and recognition and explores psychological theories related to justice, namely the Equity Theory and the Referent Cognition Theory. In conclusion, the article underscores the importance of justice in addressing the climate crisis and suggests that fostering a sensitivity towards climate injustice and empathy can motivate pro-environmental behaviors and collective action.

2.1 From Social Glue to Climate Justice: Unraveling the Motivational Power of Justice in an Unjust World

In recent times, it has become increasingly evident that the climate crisis is fundamentally a matter of justice. Different population groups across the globe are impacted to varying degrees by the consequences of climate change. Climate change is not solely about rising sea levels; it also revolves around who can shield themselves from such floods and who cannot. The most vulnerable communities often face the harshest consequences of climate change, despite contributing the least to the crisis. The major contributors to the climate crisis possess the resources, both financial and in terms of political influence, access to education, and knowledge, to protect themselves from its effects. Strikingly, the carbon footprint of someone in the wealthiest 1% can be up to 175 times larger than that of someone in the poorest 10% (Otto et al., 2019). For instance, the global wealthiest 0.54% is responsible for 13.6% (3.9 billion t carbon emissions per year) of annual global carbon emissions, while the world's poorest 50% contribute to only 10% (Otto et al., 2019). Those who are least responsible for climate change often bear the burden of its consequences, and this injustice is known as climate injustice.

Addressing the climate crisis involves two key aspects: climate protection and climate justice. Climate protection, on the one hand, refers to taking measures to combat or adapt to the climate crisis. On the other hand, climate justice emphasizes the shared responsibility of humanity for climate protection, with a particular focus on the responsibility of those who are the primary polluters to repair the damage and prevent further harm (also called "polluter pays principle”) and to give support and protect especially vulnerable groups. Thus, calling solely for "climate protection" falls short of what is truly needed; what is essential is a demand for climate justice.

The concept of climate justice encompasses various justice principles within the realm of climate change. Moreover, its meaning can vary depending on the context and group using the term, including social movements, NGOs, academics, and policymakers (Schlosberg and Collins, 2014). The origin of the term can be traced back to events like the Warren County Events in 1982, where a marginalized community resisted the dumping of hazardous waste. However, environmental concerns have been part of the agendas of various minority social movements even before that. Climate justice unites seemingly distinct issues such as peace, human rights, and the environment.

Climate justice not only serves as a goal to aspire to but also acts as a means of achieving that goal. This is because justice possesses a powerful motivational force for humans. In the following text, I will explore how the sense of justice and the associated emotions can drive pro-environmental behaviors.

First and foremost, justice holds immense value for individuals. It serves as a guiding principle in an intricate world, offering orientation (Müller, 2004), acting as a motivator (justice motive, Lerner, 1975), and playing a crucial role in regulating and sustaining social relationships (Gollwitzer & van Prooijen, 2016). Justice is an integral component of social interactions and lays the foundation for stable societies, often referred to as a "social glue" that contributes significantly to the functioning of organizations and societies. It is regarded as the paramount principle for justifying normative orders, one of the most important virtues in our society, and is intrinsically linked to the concept of the good (Peter, 2012). People are willing to endure financial losses (Engel, 2011), forgo potentially profitable deals (Sutter et al., 2020), or modify their behavior (Kals et al., 2006) to uphold justice. The desire for justice stems from the fundamental need for security and control over one's life. When individuals perceive the world as just, the "rules of the game" become clear, transparent, and predictable (Lerner, 1975; Dalbert, 1996).

2.2 Justice Principles

Injustice can manifest in various forms: it may arise from interactions with others, referred to as interactional justice (1); official processes, such as hiring procedures, known as procedural justice (2); reparations, such as post-crime actions, termed restorative justice (3); or the allocation of resources, referred to as distributive justice (4) (Ehrhardt-Madapathi et al., 2018). To determine whether a situation is just or unjust, different principles of justice come into play (Deutsch, 1985). Within the sustainability realm, the focus primarily lies on distributive justice, concerning the distribution of both goods (e.g., money or power) and tasks or hurdles, such as the allocation of remaining CO2 budgets to meet the 1.5° limit.

Three distinct principles are employed to assess whether all parties have received a fair share. The principle of equality entails everyone receiving an equal amount. The principle of merit dictates that individuals should receive based on their contributions through performance. Lastly, the principle of need suggests that each person should receive according to their specific requirements (Jasso et al., 2016; Ehrhardt-Madapathi et al., 2018). Depending on the context, situation, person, and relationship, each of these principles may be perceived differently in terms of their level of justice and appropriateness (Deutsch, 1985; Jasso et al., 2016; Skitka et al., 2016). Within the context of climate justice, individuals vary in the weight they assign to these principles and how they use them to evaluate the distribution of resources and tasks.

The Intergovernmental Panel on Climate Change (IPCC) addresses these points by highlighting three principles of climate justice in their AR6 (2022): distributive justice, procedural justice and recognition. Distributive justice in the climate domain refers to the allocation of burdens and benefits among individuals, nations and generations. Procedural justice refers to who decides and participates in decision making. Recognition entails basic respect and robust engagement with and fair consideration of diverse cultures (and in particular indigenous knowledge) and therefore can also be seen as interactional justice. However, the status quo in recognition is also still highly unfair: For example, most politicians, members of the management boards of DAX companies, as well as even climate scientists are still white and male. Maybe this missing recognition also is the reason why retributive justice, e.g. reparation payments, are not part of the AR6.

2.3 Justice Theories

One of the most influential theories is Adams' equity theory (1965), which posits that justice equates to equality when evaluating resource distribution. According to Adams, equality means having the same ratio of inputs to outputs as others. In cases of inequality, individuals have the option to reframe the situation as equal through cognitive reconstruction or take action to restore justice. However, this theory has been criticized for focusing solely on the principle of merit (the more input, the more output) and disregarding other justice principles. Moreover, it remains ambiguous with regard to whom comparisons are made and how inputs and outputs are weighted (Peter, 2012).

When applied to climate justice, the equity theory might support the polluter-pays-principle, but its emphasis on merit alone is seen as limited. In consideration of climate injustice, vulnerable groups may require higher outputs (e.g., financial assistance) to adapt to the consequences of climate change.

Alternatively, the Referent Cognition Theory by Folger (1986) appears more beneficial as a response to the equity theory. This theory suggests that injustice is associated with negative emotions arising from the discrepancy between perceived reality and imaginary alternatives. The appraisal of negative emotions is thus based on this disparity. The Referent Cognition Theory is adaptable not only to distributive justice but also to interactional and procedural justice. Additionally, it considers not only the principle of merit but also principles of equality and need (Peter, 2012). This theory is supported empirically: negative emotions (e.g., guilt and anger, as observed by other researchers) arise due to perceived injustice. Furthermore, these emotions can predict pro-environmental intentions and behaviors, which can be seen as a means of restoring justice (Nicolai et al., 2022).

Justice has been identified as a fundamental human motive (Baumert et al., 2013a; Montada, 2007). Individuals generally strive for justice while avoiding injustice (Lerner, 1977), desiring fair treatment for themselves and others and willing to act in accordance with justice principles (Baumert et al., 2013b).

Baumert et al. (2013b) summarize:

“assuming that justice is a fundamental motive for individuals means that the perception of a potential injustice triggers emotional reactions (e.g., anger, moral outrage, compassion, guilt) and urges the individual to act in order to restore justice or to avoid the injustice. Hence, the concept of a human justice motive implies the assumption of a psychological link between the perception of (potential) injustice and affective and behavioral reactions” (p. 161).

Indeed, the perception of fairness or (in)justice is a crucial predictor of both pro-environmental behavior and the acceptance of climate-related policies, including mitigation and adaptation measures (Clayton, 2018; Kals et al., 2006; Nicolai et al., 2022). For instance, in a study conducted by Clayton (2018), the fairness ratings of specific policies held greater sway over their acceptability than the perceived effectiveness of those policies. Additionally, a strong endorsement of environmental justice was found to be significantly associated with the acceptance of a range of climate policies, surpassing the influence of political orientation and consistently outweighing the impact of environmentalism.

Moreover, individuals are willing to relinquish their own advantages (Engel, 2011), engage in sustainable actions (Kals et al., 2006), or reject beneficial yet unfair deals (Sutter et al., 2020) to uphold justice. A meta-analysis based on 182 studies on collective behavior confirmed that individuals who perceive a situation as unjust are more inclined to participate in collective action, such as protest behavior, to improve the situation (van Zomeren et al., 2008).

Although justice is a fundamental motive, individuals may differ in their judgments regarding whether a particular situation, such as the climate crisis, is just or unjust. Thus, understanding the underlying mechanisms behind these varying perceptions of injustice is essential. Such differences in assessments are influenced by distinct principles of justice that vary among individuals, contexts, situations, and relationships (Deutsch, 1985; Jasso et al., 2016; Sabbagh & Schmitt, 2016; Skitka et al., 2016).

2.4 Perceived Injustice and Justice Sensitivity

Individuals exhibit systematic differences in the intensity with which they perceive injustice. These variations in injustice perception, along with associated emotional and behavioral reactions, are collectively referred to as "justice sensitivity" (Schmitt et al., 1995, Schmitt et al., 2005, Baumert & Schmitt, 2016). Justice sensitivity is regarded as a stable personality trait, remaining consistent across different situations, contexts, and over time (Schmitt et al., 1995; Schmitt et al., 2005). Furthermore, different facets of injustice sensitivity can be observed not only between individuals but also within the same person. Depending on the perspective adopted (perpetrator, victim, beneficiary, or observer), people may perceive and respond to injustice differently. Those with high observer, beneficiary, and perpetrator sensitivity show a strong desire for justice concerning others rather than themselves and demonstrate a sense of social responsibility. In contrast, individuals high on victim sensitivity exhibit a drive for justice specifically for themselves (Preiser & Beierlein, 2017).

These differences in injustice sensitivity are reflected in the emotions experienced. Individuals with high perpetrator and beneficiary sensitivity are more prone to feelings of guilt compared to those with lower levels. Observer-sensitive individuals often experience moral outrage when observing injustice, while victim-sensitive individuals predominantly experience anger (Preiser & Beierlein, 2017). Consequently, the perception of injustice from different perspectives triggers varying emotions, which, in turn, generate different inclinations to take action. Perpetrator and beneficiary sensitives may seek to make amends, whereas victim sensitives may have a stronger inclination to punish the wrongdoers rather than change their own behavior (Gollwitzer et al., 2009; Preiser & Beierlein, 2017; Schmitt et al., 2009; review: Landmann, 2021). The relevant distinction lies in the perception of injustice and the accompanying emotional facets.

Recent research has shown that prosocial injustice sensitivities significantly and positively predict pro-environmental intentions. However, victim sensitivity is found to predict pro-environmental intentions negatively (Nicolai et al., 2022). The prediction of pro-environmental intentions based on perpetrator sensitivity and beneficiary sensitivity is mediated by the moral emotion of guilt. Consequently, highlighting the injustice of climate change and fostering prosocial justice sensitivities within society appear promising to achieve pro-environmental behavior.

An initial study in this area (Maltese et al., 2013) demonstrated that specific ambiguity training can help individuals recognize the consequences of their own behavior as unjust. Applied to the climate crisis, the aim is to draw attention to why the climate crisis is an issue of justice and how one's own actions are linked to the unjust consequences of the climate crisis. This can lead to a collective climate anger, providing the impetus to demand just distribution of climate protection measures and adaptation resources on political and social levels. For instance, Traut-Mattausch et al. (2011) argue that the perception of injustice serves as the essential starting point for any social protest. Social protest or collective action presents an opportunity to bring about changes to the established system (Bamberg et al., 2021).

2.5 Requirements to Perceive Injustice

Within the context of climate justice, individuals in industrialized countries can be seen as beneficiaries of the adverse living conditions faced by people in less developed nations. This connection arises from the exploitation of natural and human resources in less developed countries, which directly contributes to the higher standard of living in industrialized countries (Dorninger et al., 2021; Hickel et al., 2022). However, many individuals may not be fully aware of this fact, perceiving their actions driving climate change as unintentional side effects of goal-directed behavior (Markowitz & Shariff, 2012). The consumption of unfairly produced products in more affluent countries is often driven by the pursuit of status symbols that consume significant resources in a neoliberal system. Alternatively, individuals may choose cheaper products to maximize their available capital. Recognizing the link between one's behavior and its consequences requires knowledge and an ability to perceive the unjust situation from the perspective of beneficiaries, perpetrators, or observers. Such a perception of injustice can lead people to recognize their social responsibility toward others on the planet and future generations, prompting them to renounce their privileges and act in solidarity in a climate-just manner. Markowitz and Shariff (2012) refer to this phenomenon as the blamelessness of unintentional action. Consequences that are unintentionally caused are often judged less harshly than equally severe but intentionally caused consequences (Guglielmo et al., 2009). However, the presence or absence of intention does not alter the consequences of an action. Therefore, it is hypothesized that individuals need to acknowledge their responsibility to renounce privileges and act in solidarity with the disadvantaged, which can serve as a motivator for pro-environmental behavior change and is crucial in achieving climate justice.

To gain a comprehensive understanding of the situation faced by the most affected groups, empathy plays a vital role. Beyond perceiving justice cognitively, individuals must be emotionally motivated by compassion or genuine concern for the wellbeing of others to take action. For instance, Roeser (2012) found that emotional competencies are necessary to comprehend the moral dimension of decisions. The study showed that information about climate change with emotional content provided better insight into its moral significance and served as a deeper, more reliable source of motivation for action compared to information without

emotional content. Consequently, promoting cognitive and behavioral empathy, the ability to correctly recognize and appropriately respond to the feelings and thoughts of others, is crucial in fostering a sense of empathy and promoting pro-environmental action.

2.6 Inaction as Injustice

In the context of climate justice, it is essential to consider the omission of action as a form of injustice (Shklar, 1990). This could occur when people accept the unjust status quo of climate injustice without taking necessary actions to address it. A significant example of this was seen in the landmark ruling of 2021 by the German Federal Constitutional Court, which found Germany's then climate protection law to be insufficient in safeguarding the freedoms of future generations. The court deemed the government's efforts as inadequate and a failure to act as needed. Shklar's term "passive injustice" acknowledges that injustice can arise not only from active actions but also from inaction. When someone fails to take action to prevent injustice or mitigate its consequences, they are behaving passively unjustly. The definition of injustice in each case may vary.

The experience of passive injustice depends on the expectations one might reasonably have of state actors and fellow citizens in a liberal democracy, such as being protected from disasters or receiving help when needed. Shklar views passive injustice primarily as a political rather than moral category - a form of disappointed democratic expectations. These expectations apply to both private behavior, as we expect fellow citizens not to ignore injustice when it affects us, and to state representatives, who can be passively unjust when they neglect their official duties, delay action, or mismanage. The focus of preventing passive injustice should not be solely on identifying the guilty parties but on remedying the suffering of the victims. Even in cases where catastrophic effects result from inaction rather than action, the victims still endure suffering, cruelty, and bondage.

However, within the realm of climate justice, it is necessary to identify the origins and originators (high emitters) of climate change to address its continuation. Climate change is the result of continuous actions emitting significant amounts of greenhouse gases, rather than a single event. Therefore, addressing climate justice involves appealing to the responsibility of high emitters to change their high-emission lifestyles (mitigation) and providing support to the most vulnerable communities (adaptation), in accordance with Shklar's perspective (1990).

2.7 Individual Behavior in an Unjust World

In this article, I have highlighted the significance of justice as a cross-cultural, fundamental human motive. However, it is juxtaposed with the prevalent issue of climate injustice, which creates a profound discrepancy. As discussed in the Referent Cognition Theory (as mentioned earlier), this disparity often leads to inconvenient emotions. Consequently, people utilize justification strategies as a coping mechanism to handle these negative emotions, as insights from the theory of cognitive dissonance (Festinger, 1957) and moral disengagement (Bandura, 2002) show. These justification strategies were found to be a strong barrier for pro-environmental behavior and intention (Nicolai et al., 2022).

Justice, being an integral part of social systems, can vary between different systems or undergo changes as social systems evolve. Depending on the context, situation, individual, and relationship, different principles of justice may be deemed appropriate. The notion of

appropriateness may develop through social systems. In a climate unjust world, we are often conditioned to believe that certain injustices, such as the vast wealth gap between the rich and the poor, are justified. This perspective is reinforced by widespread neoliberalism, which propagates the idea that wealth is solely a result of hard work, aligning with the principle of merit and perceived as just. Furthermore, social norms come into play: individuals from disadvantaged backgrounds may aspire to emulate the consumption patterns of the wealthy as it is associated with a higher social status. In contrast, there are societies where people already demonstrate more climate just behaviors. This suggests that the collective perception of justice within a social system can evolve over time. For instance, justifications for evident climate injustices may be rejected in the future and recognized for what they are: unjust.

Individual perceptions and behaviors are intricately linked to collective perceptions and behaviors. Therefore, perceived injustice can be seen as a bridge connecting the individual to their social context (examining how political and economic systems influence individuals) and vice versa (how individuals can shape collective behaviors, such as engaging in demonstrations or petitions due to perceived injustice).

As the IPCC (2022) concludes, to become more climate resilient, our societies need to become more equal and just.

“Climate resilient development is enabled when governments, civil society and the private sector make inclusive development choices that prioritize risk reduction, equity and justice, and when decision-making processes, finance and actions are integrated across governance levels, sectors and timeframes (very high confidence). Climate resilient development is facilitated by international cooperation and by governments at all levels working with communities, civil society, educational bodies, scientific and other institutions, media, investors and businesses; and by developing partnerships with traditionally marginalized groups, including women, youth, Indigenous Peoples, local communities and ethnic minorities (high confidence). These partnerships are most effective when supported by enabling political leadership, institutions, resources, including finance, as well as climate services, information and decision support tools (high confidence)” (p.29).

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3 Emotions and Pro-Environmental Action – Common Misconceptions

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Pro-environmental action is a multifaceted concept that includes saving energy, avoiding waste or protesting for climate protection (Barbett & Landmann, 2023). Emotions are one of the strongest predictors for these behaviors (Brosch, 2021). In my research on emotions and pro-environmental action, I have come across common assumptions about emotions and pro-environmental action that appear to be misconceptions when compared to the accumulating evidence from emotion research and pro-environmental psychology. I will describe these misconceptions and suggest implications for research and practice.

3.1 Misconception 1: Emotions are Irrational

Emotions are often described as being irrational. However, emotions do not occur randomly and they are not direct automatic responses to a stimulus (Hess & Kappas, 2009): Imagine, for example, that you are walking through a forest and suddenly you notice a tiger approaching you. You would probably feel intense fear. However, the same stimulus would probably evoke very different emotions if you saw a tiger in a zoo. You might even feel joy.

These different emotional responses to the same stimulus can be explained by appraisals. Appraisals are fast and intuitive evaluations of the world with regard to our own wellbeing (Arnold, 1960). The idea is that we evaluate whether the situation is new, pleasant, good for our goals, whether we can cope with the situation, and whether the situation is compatible with our values (Scherer, 1999). Which emotion is elicited depends on these evaluations and they are often considered part of the emotion itself (see Table 1).

This means that feelings and evaluations are closely intertwined, which is also true for emotions in response to environmental problems: People experience more intense fear when they believe that environmental problems are dangerous (Böhm & Pfister, 2000), and they are more emotionally moved when they believe that the pro-environmental behavior requires extraordinary effort (Landmann et al., 2019).

The link between appraisals and feelings has important implications for research. Most importantly, appraisals and feelings should not be treated as if they were independent predictors of behavior. At least three different methodological approaches are frequently used to address this point:

1. One proposed solution to account for the association between appraisals and feelings is to combine appraisals and feelings in the items that assess emotions (e.g., I felt guilty that Americans today produce greenhouse gas emissions, Ferguson et al., 2010; I feel indignant when others act in an environmentally unfriendly manner, Hahnel & Brosch, 2018; I am angry about the fact that many people act carelessly toward nature, Reese & Jacobs, 2015). These items include both feelings (guilt, indignation, anger) and appraisals (that the ingroup is doing harm, that the behavior is environmentally unfriendly, that many people act carelessly toward nature). This approach is consistent with the claim that appraisals as well as feelings are components of emotions (see Table 1) but can be criticized for making the items double-barreled (Lenzner & Menold, 2016).

2. A second solution is to assess feelings and appraisals in separate items but then combine the scale (e.g., I feel joy just being in nature; Protecting the wellbeing of nature for its own sake is important to me, Perkins, 2010). This approach is consistent with the claim that appraisals and feelings are components of emotions and avoids double-barreled items.

Both approaches (1 and 2) can be appropriate when it is clear with which appraisals and feelings a specific emotion is associated. If this link has not yet been established by research, the two approaches come with the risk of confronting participants with false assumptions about these feelings-appraisal-links. The third approach provides a solution for this.

3. The third solution to handle the associations between feelings and appraisals is to assess feelings (e.g., angry, sad, guilty) and appraisals (e.g., Continued environmentally damaging behavior as in the past is ethically unacceptable; Landmann & Naumann, 2023) separately and to consider the associations among them when analyzing the data. This can be done for instance with mediation analyses, in which appraisals are specified as predictors, feelings as mediators and behavior/intentions as dependent variable (e.g., Böhm & Pfister, 2000; Landmann & Rohmann, 2020; Weinstein et al., 2015).

These close associations between emotions and evaluations are of practical relevance as well. For instance, the assumption that it is impossible to discuss topics when emotions are involved (e.g., when people are angry about climate protection measures) does not hold. It may not be possible to directly change the emotions. But it is possible to discuss the appraisals underlying these emotional processes, which then eventually also leads to a change of the emotional reaction.

Taken together, as emotions and rational evaluations are closely linked, it would not be correct to say that emotions are completely irrational (see Pfister & Böhm, 2017). However, emotions can draw attention to specific aspects of a situation (see Yiend, 2010). Hence, when people experience emotions they may not consider all possible aspects of a situation or they might weigh specific aspects more strongly than others. Hence, emotions can be described as selectively rational.

Table 1 Definitions and examples of emotions and related concepts

Concept	Definition and Examples
Emotion / Emotional Episode	Episode that is characterized by changes in appraisals, motor expression, autonomic physiology, action-tendency, and subjective feelings (Scherer, 2005); often assessed by asking about feelings in a specific situation (e.g., How do you feel right now? or What did you feel while watching the video?)[a]
Affective Attitude	Stable association between an object and an affect (Paolini et al., 2006); often assessed by asking about general feelings towards an object (e.g., How do you feel about climate change?)[b]
Appraisal	Fast and intuitive evaluations of the world with regard to our own well-being (Arnold, 1960); often assessed by asking to what extent someone agrees with specific statements (e.g., Continued environmentally damaging behavior as in the past is ethically unacceptable)[b]
Feeling	Subjective experience of an emotional episode or an affective attitude (Scherer, 2005) assessed by a list of emotion labels (e.g. angry, sad, guilty)[a]
Incidental Emotion	Emotion elicited in situations that had nothing to do with the situation, in which a decision was made (Ferguson & Branscombe, 2010)
Integral Emotion	Emotion elicited in the situation, in which the behavior also takes place (Ferguson & Branscombe, 2010)

Note. Examples from a: Landmann and Rohmann (2020), and b: Landmann and Naumann (2023)

3.2 Misconception 2: Some Emotions are Good for the Environment while others are Bad

Some studies test whether emotions in general have positive or negative effects on pro-environmental behavior. For example, Chatelain et al. (2018) showed that general positive affect can promote pro-environmental behavior. These studies examine incidental emotions, meaning that the emotions were elicited in situations unrelated to the situation, in which a decision was made (Ferguson & Branscombe, 2010). However, the effect of incidental emotions on pro-environmental behavior is not very stable (Brosch, 2021). These incidental emotions can be differentiated from integral emotions, which are elicited in the situation, in which the behavior takes place. For example, guilt about one's own environmentally harmful behavior mediates the effect of beliefs about global warming on pro-environmental intentions. The association between these integral emotions and pro-environmental behavior (or intentions) is often strong (Landmann, 2020).

One reason for the different role of incidental and integral emotions is the fact that emotions are usually directed at specific objects (see Deonna & Scherer, 2010 as well as Brentano, 1874, second book, first chapter, §5). One person may be angry about climate change and another person may be angry about the activists from the Last Generation. These individuals will have very different attitudes towards environmentally relevant behaviour and policies. The same is true for other emotions such as guilt, compassion, and fear as well as positive emotions (Landmann, 2020). The impulses to act that often accompany emotions are also directed at a specific object (Böhm & Pfister, 2000). Thus, whether an emotion is good or bad for the environment depends on the object of the emotion (see Chapman et al., 2017).

When conducting research, it is useful to distinguish between the described incidental and integral emotions and to clarify the object of the emotion. Typologies of emotions (e.g., Landmann, 2020; Pihkala, 2022) can be used to guide the decision which emotions to consider.

The finding that different emotions are associated with different impulses is also relevant for communication: Highlighting injustice may elicit anger and punitive impulses. Emphasizing individual responsibility may evoke guilt and the impulse to correct one's own wrongdoing.

3.3 Misconception 3: Emotions affect Behavior

Emotions are among the strongest predictors of motivation for pro-environmental behavior and public support for climate policies (Brosch, 2021). However, the studies demonstrating these associations are mainly correlational. Experimental studies that test for causal effects of emotion induction on pro-environmental behavior and policy support are rare and inconsistent (see Landmann, 2020). These inconsistencies may be explained when considering the difference between emotional episodes and affective attitudes.

Emotional episodes have a clear beginning and a clear end, they are associated with physiological changes and motor expression (Scherer, 1999). For instance, if we were told that a tsunami was about to hit us, this would elicit an episode of intense fear. These episodes are usually associated with physiological changes such as increased heart rate (see section 1). Affective attitudes, by contrast, are stable associations between an object and an affect (Paolini et al., 2006). For example, some people find climate change threatening. Such an affective attitude is not necessarily associated with physiological changes. People who find climate change threatening have a representation of fear when they think about climate change but they do not necessarily experience an intense emotional episode of fear whenever they talk about it (Landmann, 2020).

Many studies do not explicitly distinguish between emotional episodes and affective attitudes although in many studies both play a role: For example, an emotional episode can be elicited by a video about climate change. This may elicit appraisals of threat, feelings of fear and the impulse to escape or protect oneself. What we then often assess in psychological studies are behavioral intentions via self-report. However, answering these questions is a very controlled process. People may be thinking about whether it is realistic for them to change their behavior in the next days, months or years. These controlled processes may be influenced more by participants' stable affective attitudes than by the single emotional episode they have just experienced (Landmann, 2020). The model of affect generalization (Paolini et al, 2006) suggests that emotion-eliciting stimuli affect behavioral intentions only if the emotional episode changes affective attitudes, which then affect behavioral intentions. This may explain why emotion induction often has no effect on attitudes, intentions or controlled behavior (Landmann, 2020).

Differentiating between emotional episodes and affective attitudes could improve research. Specifically, assessing both emotional episodes (e.g., What did you feel while watching the video?) and affective attitudes (e.g., How do you feel about climate change?) can make the process of affect generalization observable (Landmann & Rohmann, 2020, Study 2). Future research that is more sensitive to the distinction between emotional episodes and affective attitudes can identify factors that explain when affective attitudes and subsequently behavioral intentions are affected by pro-environmental interventions.

Identifying these processes is practically relevant as it explains why single interventions may elicit an emotional episode without necessarily affecting behavior.

In summary, rather than saying that "emotions affect behavior", it would be better to say that „emotions are associated with impulses, whereas controlled behavior is associated with generalized affect."

3.4 Misconception 4: Pro-environmental Attitudes are WEIRD

A total of 96% of participants of studies published in top psychology journals in 2008 were recruited from WEIRD (Western, Educated, Industrialized, Rich, Democratic) societies although only 12% of the world's population share these attributes (Henrich et al., 2010). The limited diversity in psychological research has contributed to the perception that people in WEIRD societies are more concerned about the environment and are more likely to engage in environmentally friendly behaviour. This impression seems to be supported by studies, in which rich and educated people show more concern for the environment than poor and less educated individuals (Franzen & Meyer, 2010). However, more recent studies show that numerous young people from the Global South self-report difficult climate emotions (Hickman et al., 2021; Ogunbode et al., 2021). Moreover, the association between socio-democratic status and environmental concern is highly dependent on the assessment of environmental concern. Fairbrother (2013) showed that local environmental concern (e.g., concern for clean water) is even stronger in countries with lower income. This type of environmental concern as well as related pro-environmental behavior is not well represented in environmental psychology.

Furthermore, when more diverse perspectives are represented in research, they are sometimes not widely recognized. An example is research on climate justice, which is closely linked to emotional responses to climate change (Martiskainen et al., 2020). Currently, the term climate justice is mainly associated with intergenerational justice (i.e., acting in a way that is fair to future generations). However, the term actually evolved from the concept of environmental justice (Schlosberg & Collins, 2014). The term environmental justice can be traced back to a conflict in Warron Country, where toxic waste was about to be dumped in an African-American community. Robert Bullard, an African-American researcher, studied and supported the anti-waste campaign (Bullard, 1983). Based on his work, the term climate justice was later introduced by Edith Weiss (Weiss, 1989). This shows that when we look more closely, environmental behavior and science are sometimes more diverse than they may appear at first sight.

Research could make environmental concerns and associated behaviors more visible by creating scales that assess more diverse behaviors and intentions (e.g., Barbett & Landmann, 2023) and by assessing a wide range of diversity dimensions (see Landmann et al., 2023 for a discussion of diversity assessment in environmental psychology). In addition, research from non-WEIRD societies could be made more visible as the journals such as Global Environmental Psychology are attempting to do (https://gep.psychopen.eu/index.php/gep).

Considering more diverse forms of pro-environmental behavior is also practically relevant. For example, it could lead to the identification and promotion of more diverse sufficient lifestyles, thus making individuals aware of additional behavioral options.

In summary, the science of pro-environmental behavior is sometimes WEIRD, and non-WEIRD science is often overlooked. Pro-environmental concern and behavior is highly prevalent in non-WEIRD societies, just with a stronger focus on local environmental problems.

3.5 Misconception 5: Anger is the Strongest Motivation of Climate Protest

Collective action can be defined as action taken together to pursue a political goal in a situation that is not formally organized (Barbett & Landmann, 2023). This includes both normative actions (e.g., signing petitions, participating in legal demonstrations) and non-normative actions (e.g., occupying trees, blocking roads, or damaging property; Wright et al., 1990).

Previous research has identified three important predictors of collective action (Van Zomeren et al., 2008): 1) perceptions of injustice (e.g., that environmental destruction is wrong), 2) collective efficacy beliefs (e.g., believing that it is possible to change something together) and 3) identification with those who are affected by the injustice or with the group of activists. These psychological factors were combined in the social identity model of collective action (Van Zomeren et al., 2008). The model suggests an emotional path to collective action via injustice perceptions and anger and a rational path to collective action via collective efficacy beliefs. The idea is that people go to the streets to vent their anger or because they rationally think that they can achieve more by acting together. This idea has been widely supported by empirical studies in different contexts and recent research supports the strong relevance of anger for climate protest (Gregersen et al., 2023). However, most of these studies on collective action consider only a limited set of emotions.

To address this point, we conducted a series of studies examining the role of positive emotions for pro-environmental collective action. These studies revealed a second emotional path to collective action: People are moved and positively overwhelmed by the idea that they can change something together and this motivates them to act. We investigated this in the context of a forest protection campaign in Germany (Landmann & Rohmann, 2020) and in the context of the Fridays for Future protests (Landmann & Naumann, 2023). In both studies, anger did not strongly predict collective action intentions when controlling for other influences. In qualitative interviews, climate activists reported that they try to transform their anger into more constructive emotions (Kleres & Wettergren, 2017). This transformation may explain the limited effect of anger on pro-environmental collective action intentions.

This shows that collective action research can more correctly identify how important anger is – or is not - for collective action, when controlling for positive emotions such as feelings of being moved.

Identifying the role of positive emotions for collective action also has practical relevance. Being moved by protest may be a risk or protective factor for activist burnout. Identifying the relevance of positive emotions for activists' wellbeing may help them cope with their emotions in a healthy way.

Taken together, the role of anger for climate action is less clear than previous research on collective action might suggest. Positive emotions such as feelings of being moved seem to be highly relevant to these pro-environmental movements.

3.6 Summary

Being aware of these common misconceptions can advance research and practice. When studying emotions, it is useful to consider that they do not occur independently of appraisals and that they are directed towards an object. When communicating with lay people, the sources of these gut feelings can be discussed. Furthermore, an explicit distinction between emotional episodes and affective attitudes could improve emotion-based interventions. Research would benefit from reflecting diversity with regard to participants, researchers and research history. As a specific application, more diverse role models of sufficiency can be identified and communicated. Considering positive emotions in collective action research can clarify the role of negative emotions such as anger as well as their relevance to activist burnout, which can then be used for training and coaching.

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4 Valuing Less. How Wellbeing of Sufficiency Lifestyles can be Fostered Through Meaning Construction

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Abstract

To solve the ecological crisis, a demand-side mitigation in energy and resources is necessary (IPCC, 2022). Therefore, sufficiency strategies must be an integral part of the socio-ecological transformation. Sufficiency focuses on limiting consumption through curtailment, shifting consumption modes and sharing (Sandberg, 2021). However, in industrialised countries there is still an ongoing debate about how consuming less can go along with wellbeing. Here, meaning construction processes might be of high relevance. Study 1 (Hüppauff et al., 2023) investigates meaningfulness and wellbeing of sufficiency behaviour, applying the hierarchic model of meaning (Schnell, 2009). Study 2 (Hüppauff et al., 2022) investigates meaning construction processes during the Covid-19 lockdown in connection with sustainable leisure behaviour. Future studies might identify and investigate specific social settings (Hunecke, 2022) to foster meaning construction around sufficiency lifestyles. The final section derives implications for environment protection interventions and policies based on theory and research findings.

4.1 Sufficiency on a systemic and individual level

Due to human activity, six out of nine identified planetary boundaries are currently transgressed (Richardson et al., 2023). To reconciliate human activity with planetary health, consistency, efficiency and sufficiency have been developed as strategies to accomplish sustainability. Consistency and efficiency mostly focus on technological innovation and improvement. The sufficiency strategy however puts social innovations and behaviour change in the center of sustainable solutions (Lage, 2022). With the principle of neither shortages nor excess sufficiency defines consumption goals that provide for human needs within planetary boundaries (Linz, 2004). Thereby a reduction in resource consumption is accomplished through curtailment (e.g. meat, flying), shifting consumption modes (e.g., plant-based diet, bicycle instead of car) and sharing (e.g., cars, flats) (Sandberg, 2021).

Sufficiency strategies are still underrepresented in the discourse around sustainability. This is due to barriers on economic, political and individual levels. From a psychological perspective consumerism and materialism can be regarded as antagonists of sufficiency (Tröger & Wullenkord, 2022). To increase sufficiency, materialistic oriented lifestyles that go along with high resource consumption need to be transformed. From a sufficiency perspective the central question is how much consumption is needed to create wellbeing. Therefore, pathways to foster sustainable wellbeing have to be explored (Isham et al., 2022). The next section will give an overview on how wellbeing is related to sustainable lifestyles.

4.2 Wellbeing concepts and sustainable living

In contrast to the public debate, there is now sound evidence for a positive relationship between pro-environmental behaviour and wellbeing (Capstick et al., 2022; Schmitt et al., 2018; Zawadzki et al., 2020), although the effect is not always observed (Binder et al., 2020; Defloor et al., 2022). A recent study review was conducted to investigate wellbeing experienced in lifestyles of voluntary simplicity (Hook et al., 2023). In line with the sufficiency strategy, voluntary simplifiers seek to acquire wellbeing through limiting consumption, practicing

minimalism and working time reduction. Of the 16 studies that were investigated, 13 found a positive relationship between voluntary simplicity and wellbeing.

What mechanisms connect sustainable lifestyles and wellbeing? Here meaning construction processes might play an intermediary role. Meaning construction refers to the process of consciously reflecting and integrating experiences into goals and values. Thus, meaning construction can be an important resource for developing a lifestyle that connects sustainability and wellbeing (Hunecke, 2013). In principle, meaning can be found in diverse ways of living, including materialistic lifestyles with high consumption. However, to actively engage in questions of meaning might increase the probability of finding meaning in altruistic or environmental values (Hunecke, 2022). The presence of meaning describes a positive psychological state through a sense of purpose, coherence and significance (Martela & Steger, 2016) and is associated with numerous aspects of positive functioning such as life satisfaction, resilience and positive affect (Schnell, 2021). Meaning is commonly defined as an indicator of eudaimonic wellbeing (Heintzelman, 2018). Eudaimonic wellbeing comes from the impression of "doing what is worth doing and having what is worth having" (Waterman et al., 2008, p. 42), by living according to intrinsic values and goals (Ryan et al., 2008).

In their meta-analysis Zawadzki et al. (2020) argue that meaning plays a central role in explaining the positive relationship between wellbeing and pro-environmental behaviour. However, only recently the role of meaning in sustainable lifestyles has been investigated empirically (Hunecke & Richter, 2019; Hüppauff et al., 2022; Venhoeven et al., 2020).

4.3 Study 1: Investigating Meaning, Intrinsic Motivation and Wellbeing in Sufficiency Behaviour

In this study we aimed to explain meaning and wellbeing in the context of behaviour in line with the sufficiency approach (for a preprint see Hüppauff et al., 2023). Therefore, we applied the hierarchic model of meaning by Schnell (2009). The hierarchic model of meaning describes different levels where meaning making can take place: perceptions, actions, goals, sources of meaning and meaning in life (Schnell, 2009). In order to become meaningful, one level has to be integrated into the corresponding higher level. This "surplus of significance" (Schnell, 2021, pp. 29–30) lies at the core of each meaning construction process.

Therefore, we conducted a survey with N = 544 participants and assessed a battery of constructs including frequency of sufficiency behaviour (Henn, 2013; Seewald & Schmies, 2014; Zähres, 2020), ascribed meaningfulness of sufficiency behaviour (items adapted from White & Dolan, 2009), behavioural wellbeing, intrinsic motivation to perform sufficiency behaviours (adapted from LeFebvre & Huta, 2021), behavioural costs (adapted from Schmitt et al., 2018) as well as egoistic, altruistic, and biospheric values (De Groot & Steg, 2008).

Our results suggest that behavioural meaningfulness was related to both behavioural wellbeing and behaviour frequency of sharing household items and repairing items. For curtailment behaviour, behavioural meaning did relate to wellbeing, but not to behaviour frequency. Intrinsic motivation was strongly related to behavioural meaning. Intrinsic motivation for sufficiency behaviour again was related to biospheric values (valuing the environment) and partly to altruistic values (valuing social connections and the welfare of others).

Our results further indicated that wellbeing can go along with sufficiency oriented consumption behaviour if it is valued intrinsically and thus is regarded as meaningful. Biospheric values were the strongest predictors for the intrinsic motivation to occur. Thereby the study supports

the sufficiency perspective that views consumption reduction not necessarily as a sacrifice but as a valuable lifestyle for which meaning construction can be an important psychological resource (Hunecke, 2022).

So while meaning might play a role in promoting sustainable wellbeing the question remains how meaningfulness of sufficiency can be changed. Here I distinguish two pathways: Change by disaster vs. change by design.

4.4 Study 2 – Change by disaster: The Covid-19 crisis

The foundational assumptions from which we draw meaning from are resistant to change and are not questioned in daily life (Kahneman, 2003). However, there is substantial evidence that meaning making becomes more active in times of crisis. As Viktor Frankl quotes “In times of crisis, people reach for Meaning. Meaning is strength. Our survival may depend on our seeking and finding it.” (Schaffner, 2020). Successful meaning making is associated with better coping strategies of adversive life events (Delle Fave, 2020). Meaning is connected to values and beliefs and experiencing a crisis can challenge existing assumptions and lead to an active search for meaning (Park, 2010).

During the onset of the Covid-19 pandemic in 2020 we investigated whether the disruption of the crisis led to increased meaning construction associated with sustainable leisure behaviour (Hüppauff et al., 2022). Due to the massive lockdown restrictions, daily routines, habits and worldviews were disrupted. The goal of the study was to analyse changes of consumption behaviour and behaviour that poses an alternative to buying and consuming products. We conceptualised this behaviour sustainable leisure behaviour (Ropke & Godskesen, 2007), which stands in line with a sufficiency oriented lifestyle. Furthermore, we examined Time Wealth and Life Reflection as relevant factors connected to sustainable leisure behaviour. Time Wealth can be regarded as an alternative model of affluence that potentially promotes low consumption life-styles. Life reflection describes fundamental reflection processes stimulated by the Covid-19 crisis. Life reflection can be regarded as meaning making efforts in reaction to a crisis or threat (Lüders et al., 2021).

We collected data from 947 participants in Germany in an online survey. Participants reported behaviour frequencies of consumption and sustainable leisure before and during lockdown. Furthermore, participants evaluated potential behaviour changes and rated statements regarding their future intentions.

The results of our analyses revealed sustainable leisure behaviours to be increased during lockdown. Increases in sustainable behaviour received positive evaluation and were intended to extend into the future. Time Wealth and Life Reflection was positively related to most sustainable leisure behaviours. Furthermore, sustainable leisure behaviour correlated positively with Life Satisfaction and Presence of Meaning.

Our findings of increased sustainable leisure activities were also found in other studies investigating behaviour effects of the pandemic (Evers et al., 2021; Greenfield et al., 2021; Whitmarsh et al., 2020). In our data these activities were linked to presence of meaning and reflection processes. Thus, our findings indicated that meaning construction processes become active in response to a crisis and can be linked to changed lifestyles.

4.5 Future Studies: Meaning construction – change by design?

Although a crisis can be an effective changemaker it comes with obvious disadvantages. A crisis is almost always accompanied with increased stress, fear and suffering. Furthermore, not every crisis leads to productive change, but can also result in prolonged distress and denial (Jonas et al., 2014). To support a socio-ecological transformation there is more research needed on how to support meaning construction processes towards sufficiency in absence of a crisis. One promising approach might be to investigate settings that already provide opportunities to make enjoyable and proactive experiences of sufficiency lifestyles. Hunecke (2022) defined settings as a "settings are places or social contexts in which people carry out their daily activities and in which environmental, organizational, and personal factors interact." (p.115). Settings that offer sufficiency experiences can often be found in societal niches in form of social innovations and grassroot initiatives such as repair cafes, community-supported agriculture and housing projects (Lage, 2022). Participating in those projects might open the possibility to gradually strengthen meaningfulness of sufficiency through a cycle of experience and reflection (Park, 2010). Future studies might concentrate on observing meaning construction processes in sufficiency settings and how they might be supported through interventions such as reflection practices or coaching.

4.6 Implications for Environment Protection Interventions and Policies

A demand side mitigation of energy and resources is necessary to reach climate targets (IPCC, 2022; Wiese et al., 2022). Sufficiency strategies help to limit consumption, thus they can be beneficial not only to reducing emissions but also to reducing biodiversity loss (Schneidewind & Zahrnt, 2014).

It is promising that the common narrative which depicts a reduction in consumption as detrimental to wellbeing is questioned by substantial research evidence. Low consumption lifestyles can be compatible to wellbeing. Therefore, it is important to note that wellbeing cannot merely be reduced to hedonic experiences of pleasure and pain, but has a strong symbolic component manifested in meaning experiences that can originate from a variety of meaning sources. Research has shown that the relationship with nature is a prominent source from which people make meaning in life (Schnell, 2011). Here a crisis such as the pandemic might be used as a "window of opportunity" (Reese et al., 2020) to support meaning construction processes. The Covid-19 pandemic for example has shown how valuable an intact nature is for human health, on a systemic level but also when it comes to practices such as gardening (Corley et al., 2021). Furthermore, to identify social settings in which nature protection can provide rewarding experiences to participants might be a promising avenue for a "change by design". Supporting urban gardening projects for example helps to bring nature back into cities. Thereby these projects enable experiences of green environment and gardening in urban areas which strengthen the meaningfulness of intact biodiversity and nature.

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5 An Experimental Study Into the use of Incentives to Encourage Pro-Environmental Behavior.

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Abstract

Incentives have been used to motivate people to behave more pro-environmentally. They have been shown to be effective in general, but it is less known which incentive works best for altering behavior. To fill this gap, we conducted a laboratory experiment using the Pro-Environmental Behavior Task (PEBT), a validated computer task that involves actual consequences, to test the effectiveness of two different incentives. Participants were either incentivized with a 5-cent bonus for every time they used the environmentally friendly energy-saving option, or they were told that 5 cents would be donated to a charity organization every time they used that option. These two groups were each compared to a non-incentivized control group. Preliminary results suggest that both incentives increased the number of environmentally friendly choices in comparison to the control group and that the bonus payment was more effective than the donation. These effects seemed to largely disappear after the incentives were discontinued. After a summary of the methodology and results of this study, we discuss some implications for practitioners aiming to promote pro-environmental behaviors in the field.

5.1 Incentive effects on pro-environmental behavior

5.1.1 Incentives for the self: financial incentives (self-incentives)

Incentives have been shown to successfully alter behavior, including pro-environmental behavior (PEB). One type of incentive involves providing people with a financial advantage that is tied to a specific target behavior. For instance, it has been shown that giving a free bus pass to people who have just moved to a new neighborhood significantly increased public transport usage (Bamberg, 2006). Other self-incentives that have been shown to influence PEB are, for example, cash, gifts, and coupons (Maki et al., 2016). Cash incentives have been shown to momentarily alter purchasing behavior, as can be seen in a study by Kaiser and colleagues (2020). They found that university students significantly increased their vegetarian meal purchases when they were reimbursed by the researchers. Furthermore, in an influential meta-analysis (i.e., an analysis that integrated multiple studies on incentives) by Maki et al. (2016), it was shown that financial self-incentives have a medium-sized positive effect on PEB. Further, this meta-analysis has shown that this behavior change has the potential to persist beyond the discontinuation of the incentives and therefore affect behavior even after the incentives are no longer present. This line of research underlines the effect that incentives for the self-incentives can have on PEB. However, financial self-incentives like cash and vouchers can have the adverse effect of leading to increased spending on products that can be harmful to the environment, a phenomenon that is known as the rebound effect (Otto et al., 2014). It is therefore important to investigate incentives that might also promote PEB without giving the option of leading to increased spending on unsustainable items.

5.1.2 Incentives for others: pro-social incentives

Pro-social incentives are incentives that are not of direct advantage to the person who engages in the incentivized behavior but rather to other people or social causes. Their potential effectiveness is illustrated by Ghesla and colleagues (2020), who found that incentivizing participants with the promise of planting a tree if they reached their goal of reducing their energy consumption by 5% increased the number of households meeting this goal. It was further reported that the behavior persisted even in the post-intervention period after the incentive had been discontinued (and the tree had already been planted; Ghesla et al., 2020). Therefore, there is evidence that pro-social incentives, just like financial incentives, can have a lasting impact on behavior change (Ghesla et al., 2020; Maki et al., 2016). Additional evidence for the effectiveness of pro-social incentives comes from field research that showed that the number of vegetarian dish choices can be increased (Lange et al., 2023) and that plastic bag usage can be reduced (Lange et al., 2021) by implementing posters that link the respective target behavior to monetary donations to charity organizations. Interestingly, Lange et al. (2021) found that pro-social incentives can also be effective if the charity that is donated to is not connected to the environment. They showed that plastic bags are also reduced if the poster links the refusal of plastic bags to donations to a non-environmental charity organization (i.e., Oxfam). Such pro-social incentives may make a PEB attractive to people who do not care about the environment but about other social issues (Lange et al., 2021).

5.1.3 Lack of reliable comparison of different incentives

So far, to our knowledge, only one study has compared these two different incentives using an experimental research design. Imas (2014) found that when a target behavior was linked to a small incentive amount (~ 5 cents), pro-social incentives were more effective in altering behavior than self-incentives. However, whether this result (obtained using a laboratory handgrip task) generalizes to the domain of PEB is unknown. One reason for this lack of evidence may be that it used to be challenging to study PEB in laboratory settings that allow controlled comparisons between different incentive types. Here, we describe and discuss how we used the Pro-Environmental Behavior Task (PEBT, Lange et al., 2018) to compare the effect of self-incentives and pro-social incentives on PEB in the laboratory.

5.2 Pro-Environmental Behavior Task

The PEBT is a laboratory task that involves real consequences. The task is set up as follows: Participants are asked multiple times (24 times, in our study) to choose between the “bike” or the “car” option on the screen in front of them. After each choice, they have to wait for a certain time before they can make the next choice. The “bike” option will always take more time (i.e., involve longer waiting time periods) than the “car” option. However, choosing the “car” option also lights 12 LED lamps, which use more electricity and, therefore, emit additional CO2 (Lange et al., 2018). In Figure 1, you can see the first author trying out the PEBT and the LED lights that are lit after a “car” choice. When participants choose the “bike” option, the LED lights are not lit, and no additional CO2 is emitted.

The PEBT has been validated as a behavioral paradigm for the study of pro-environmental behavior (Lange, 2023). Participants’ behavior on the task has been shown to be sensitive to the environmental consequences implemented in the laboratory (i.e., to the number of lights to be lit; Lange et al., 2018; Lange & Iwasaki, 2020) and to be correlated to individual differences in other pro-environmental behaviors and related psychological constructs (Kaiser &

Lange, 2021; Lange et al., 2018; Lange & Dewitte, 2021). It allows testing the effect of potential determinants of pro-environmental behavior or of interventions for the promotion of pro-environmental behavior under controlled conditions, and the task can be flexibly adapted to the needs of the user.

5.3 The PEBT and incentives

We used the PEBT to investigate PEB in response to different incentives in two waves. To do so, we randomly assigned participants to one of three groups. The first group, the so-called "self-incentive group", received an additional 5 cents for every time they chose the bike over the car. The second experimental group was told that we would donate 5 cents to the charity organization "Voices of Children" every time they chose the bike over the car (pro-social group). Voices of Children extends psycho-social help to children in Ukraine, especially to children who are affected by the war that is taking place at the time of writing this (https://voices.org.ua/en/). Participants in this condition were briefly introduced to the charity. We adapted the PEBT slightly for our purposes and included instructions and feedback for participants in the incentive conditions, indicating whether they received an additional payment/donated something or not. Lastly, we implemented a control condition. In this group, we did not implement any incentives and merely let the participants do the plain task. We generally anticipated that participants in each of the incentive conditions would, on average, choose the bike more often than the car compared to the control condition. Additionally, as was suggested by the findings of Imas (2014) that were obtained with a similar incentive amount, we expected that the pro-social incentive would increase PEB more compared to the self-incentive condition.

The participants were asked to return a week later, where we let them perform the same computer PEBT again, but this time all incentives were discontinued. Therefore, all participants performed the control version of the task on their second visit. By doing this, we wanted to see whether we could replicate the findings by Maki et al. (2016) and Ghesla et al. (2020) that showed that behavior change remains after the discontinuation of an incentives for both self-incentives (Maki et al., 2016) and pro-social incentives (Ghesla et al., 2020).

5.4 Preliminary findings

In preliminary analyses, we found that both incentives increased the number of bicycle choices on the PEBT compared to the non-incentive control condition. Contrary to our expectations, and to what Imas (2014) suggested, however, we found that the financial self-incentive related to higher bicycle use compared to the pro-social incentive. These differences largely disappeared the second time the participants were asked to come to the laboratory, about a week later. Therefore, we did not find any support for our hypothesis that incentives increase PEB after their discontinuation.

5.5 Implications

Our preliminary findings indicate that incentives can be used to motivate people to behave more environmentally friendly. Incentives similar to the ones used in our study might be useful for promoting PEBs outside the laboratory. For example, donating or paying people a small reward for the distance covered to get to work when using a bicycle (or other sustainable mobility options like walking or using public transport) might stimulate employees to choose the more sustainable and healthy option of cycling (or other sustainable mobility options).

However, it should be noted that situations of environmental relevance (e.g., travel mode choices) outside the laboratory may involve additional relevant features that have not been mirrored in our PEBT experiment. For example, missing or poor cycling infrastructure, perceived lack of safety, and environmental factors (e.g., bad weather) are some of the barriers that are repeatedly mentioned in a systematic review by Pearson and colleagues (2023). In the presence of such additional features and barriers, the effect of an intervention (e.g., incentives) might be smaller than in a simplified laboratory context. Field studies as the ones summarized in the meta-analysis by Maki et al. (2016) can be used to test how much of the effect of incentives remains in concrete real-world situations. Alternatively, features (e.g., related to safety, convenience, or comfort) can be independently added to the PEBT environment to test whether any concrete feature moderates the effect of incentives.

Figure 1 The PEBT in action (car is chosen). Demonstrating the PEBT and the screen of the control-condition. 12 LED lights are lit: 8 on the table (pictured), and 4 underneath the table (not pictured).

If our results are corroborated, they might be taken to imply that practitioners should always use financial self-incentives rather than prosocial incentives to promote PEBs. We think the issue is more complex and that the choice between incentives should not be determined by the size of their effect on the target behavior alone. Prosocial incentives have, by definition, positive social consequences, and they could also be designed in a way that benefits the natural environment directly (e.g., by planting a tree for every person who engages in a particular target behavior; Lange et al., 2023). Financial self-incentives, on the other hand, may have negative consequences for the environment. When people receive or can save money by

behaving pro-environmentally, many of them will likely invest the additional financial resources into environmentally harmful consumption. Practitioners and policymakers interested in environmental impact (i.e., in addressing environmental issues rather than in promoting an isolated behavior), should take these side effects of financial incentives into account when deciding between intervention approaches. To know whether a particular financial incentive for a particular behavior will have a net positive effect on the environment, they will likely require knowledge not only about the environmental impact of the target behavior, but also about the things people will do with the incentive money.

A last point we find important to consider is that the lack of an incentive effect after incentive discontinuation observed in our study and other research (e.g., Kaiser et al., 2020), might be used as an argument against the implementation of incentives altogether. For ex-ample, Handgraaf and colleagues (2013) have stated that discontinuing the incentive or even lowering it could lead to changes in the behavior influenced by the incentives. The authors argue that they are an ineffective tool to promote behavior change. However, this limited long-term effectiveness might not be a problem as the potential for long-term effectiveness is irrelevant in some cases. For example, some pro-environmental behaviors only need to take place once to have a lasting environmental impact (Bolderdijk & Steg, 2015). An example of this would be the installation of solar panels or purchasing an electric vehicle. Therefore, people will most likely only need an incentive for this behavior implementation one time in their lives.

In other cases, a drop in effectiveness after incentive removal might not be problematic because the incentives do not need to be removed. For many behaviors of environmental relevance, it might be cost-effective to implement (financial) incentives on a permanent basis. The KU Leuven, for example, pays employees a small financial bonus for cycling to work (11 cents/km). This equates to cents or a few euros each day for people taking advantage of this policy, and the associated environmental, societal, and health benefits that come from commuting by bike (e.g., Banerjee et al., 2022) may outweigh these costs. The implementation of bottle fees plays with the same idea and may even be largely cost-neutral. It is an incentive that attaches a small increase in price for (plastic) bottles that is paid back upon return to the store or designated areas.

In yet other situations, incentives might actually be effective beyond incentive removal because they encourage people to try out a behavior that is naturally rewarding (Bolderdijk & Steg, 2015). People might start using public transport because of an incentive (e.g., the German 9-Euro ticket implemented in the Summer of 2022), but continue using it because of the positive consequences they experience on the bus or train (e.g., the free time as no attention has to be paid to traffic and one is able to play games instead or read). Similarly, some people will likely find cycling enjoyable but may need an incentive (e.g., a subsidized bike, Bjørnaå et al., 2019) to find out that they do. In such circumstances, it would be plausible for them to continue cycling after the incentive has been removed. As behaving pro-environmentally in our laboratory study did not involve such naturally rewarding consequences (participants simply had to wait in front of a computer screen), it might not be sur-prising that we did not observe a long-term effect of incentive there. Therefore, in many cases, (financial and prosocial) incentives, even one-time incentives, can be a good tool to foster behavior change.

Author's note

This project was supported by a FWO postdoctoral fellowship (No 12U1221N) awarded to Florian Lange. The original version of the PEBT (we used this version for the control condition) can be freely used and adapted. It can be accessed at https://osf.io/bj8vy. Correspondence should be addressed to hannahvalentina.kroker@kuleuven.be.

We plan on submitting the study for publication, so while it is not yet published, we hope that by the time this comes out, we can add a note about the publishing of the study!

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6 Flying With the Wind: Will Energy Kites Close the Wind Power Generation gap and Solve Acceptance Problems?

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Abstract

In line with the Paris Climate Accords, emissions must reach net zero in the early 2050s to limit global warming to 1.5°C. This requires changing from fossil fuels to renewable energy, especially solar and wind energy. To produce the required 7400 terawatt-hours of wind energy yearly by 2030, wind energy generation must increase fast. Part of the solution could be to use energy kites that can access stronger, more constant winds at higher altitudes. However, while airborne wind energy's technical and material advantages are clear, little is known about how people perceive and respond to the technology. For the long-term success of airborne wind energy, it is important to research its social implications so that they can already be considered in the technology development and early deployment. The present paper provides first insights into how residents evaluate a local airborne wind energy system.

6.1 Introduction

Burning fossil fuels and other human activities releasing greenhouse gasses have caused the global surface temperature to rise by 1.1°C compared to pre-industrial times (1850 – 1900) (IPCC 2023). This has already led to extensive and fast changes in the atmosphere, ocean, biosphere, and cryosphere (i.e., the frozen water part of the Earth's system) (ibid.). As a result of these changes, increasingly more devastating weather and climate extremes are occurring in every region worldwide (ibid.). In the first seven months of 2023 alone, some of the extreme events occurring were an ice storm across Texas and the Midwest; one of the longest-lived tropical cyclones on record, killing at least 400 people in Malawi and Mozambique; several heat waves in Asia and the Mediterranean hitting record temperatures; deadly floods in India; widespread and long-lasting wildfires in Canada and the Mediterranean leaving many people homeless; and globally, the lowest sea ice coverage, the highest average sea surface temperature, and July being the hottest month on record (Rao 2023; World Meteorological Organization 2023). To prevent irreversible changes in the Earth's system and limit weather extremes, global warming must be limited to 1.5°C, requiring emissions to reach net zero in the early 2050s (IPCC 2023). The 1.5°C goal was agreed on by member states of the United Nations Framework Convention on Climate Change in the 2015 Paris Climate Accords (Paris Agreement 2015). Net zero means that any greenhouse gases humans emit are counterbalanced by removing emissions from the atmosphere so that, on the whole, no additional gases remain in the atmosphere. To be on track with the net zero pathway, global greenhouse gas emissions must be cut deeply and rapidly (ibid.). Emission reductions include transitioning from fossil fuels to renewable energies, especially solar and wind energy (ibid.). About 7400 terawatt-hours of wind energy must be generated yearly by 2030 to reach net zero emissions in 2050 (IEA 2023). To get an idea of the magnitude of wind power generation needed: In 2022, around 2100 terawatt-hours of wind power were produced (ibid.). To stay on track with the net zero pathway, wind power generation would have to increase, on average, by about 17% per year between 2023 and 2030 (ibid.). Thus, the world needs a lot more wind energy and needs it fast.

A promising way to generate more wind energy is to tap into neglected higher-altitude wind resources. The wind is generally stronger at higher altitudes because there are fewer obstacles, like vegetation and buildings, causing friction (Arya 1988). In fact, an analysis found that for parts of Europe, the wind power density doubles at an altitude of 500 m compared to 100 m, which is a typical hub height of many still operational wind turbines (Bechtle et al. 2019). Wind turbines have been substantially growing in size and thus capacity over the years, especially offshore (Walker 2020). However, the growth is expected to slow down significantly due to manufacturing, installation, and operational constraints (Baraniuk 2021). Therefore, researchers have been working for over two decades on a flying concept that allows harvesting wind energy at higher altitudes. The so-called airborne wind energy technology uses tethered flying devices to produce electricity at altitudes between roughly 200 and 500 m. An industry-sponsored report estimates that by 2035, 5 gigawatts of airborne wind energy could be installed, accelerating to 177 gigawatts by 2050 (BVG Associates 2022). The fact that the technology is also taken seriously outside the industry is shown by the International Renewable Energy Agency calling it a possible 'game change' and the European Commission conducting a study into airborne wind energy's potential and the measures needed to achieve commercialization faster (Directorate General for Research and Innovation 2018, IRENA 2021).

6.2 Wind energy 2.0 – How airborne wind energy works and what its benefits are

But how would an energy kite work? Two major types of airborne wind energy systems exist that work differently: ground-gen(eration) systems produce electricity on the ground, and fly-gen(eration) systems generate energy up in the air (Cherubini et al. 2015). Ground-gen systems consist of a flying device, also called a kite, which is attached to a tether (i.e., rope) that winds around a drum (Fig. 2). As the kite is launched, it follows a programmed flight pattern, thereby pulling the tether from the drum. The unwinding of the tether makes the drum turn, thereby powering the attached generator. When the end of the tether is reached, the kite is depowered (i.e., its angle to the relative wind is changed) and reeled in so that the next phase of energy generation can start. Because the kite produces more energy than it uses during the reel-in, there is a net power win (Vermillion et al. 2021). Rotary systems are a subtype of ground-gen systems that do not generate energy by reeling a kite out and in. Instead, multiple rotors are connected by tethers that are kept under tension, so the entire structure rotates (Airborne Wind Europe n.d.). A generator on the ground then converts the torque of the rotation into electricity. A fly-gen system also has a tethered kite, but generators are mounted on the kite that produce electricity while the kite is flying (Cherubini et al. 2015; Fig. 2). The tether then transmits the generated energy to the ground. The structures of the used kites vary: For ground-gen, soft-wing kites from flexible membrane or fixed-wing kites from carbon fibre-reinforced polymers can be used, as well as hybrid-wing kites that combine a rigid support structure with a textile canopy (ibid.). For fly-gen, fixed-wing kites are usually used because they can better support the weight of the generators.

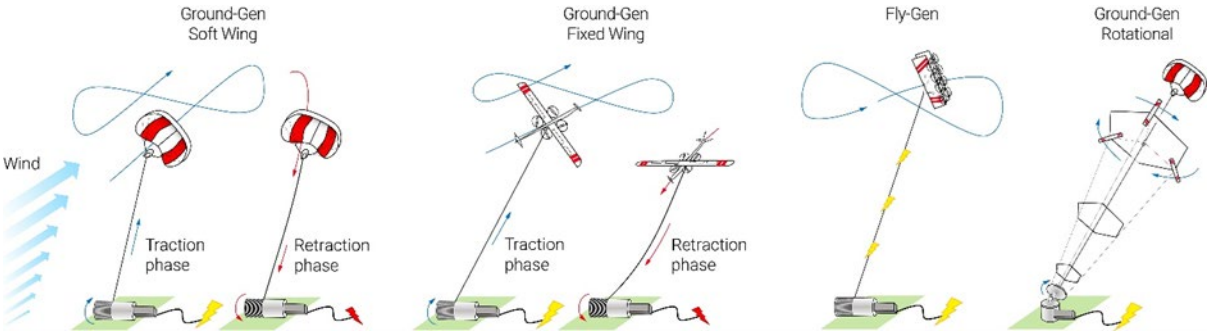

Figure 2 Operation of different ground-gen and fly-gen systems using soft-wing or fixed-wing kites (adapted from Fagiano et al. 2022).

Besides accessing higher-altitude winds, airborne wind energy could have additional benefits over wind turbines. First, airborne wind energy could be deployed in areas less suited for conventional wind energy or depending on diesel generators (Kitepower n.d.; SkySails Power n.d.). Examples are (small) islands, mining communities, and hurricane areas (the kite can be stored away in bad weather, whereas turbines cannot). The German developer SkySails Power launched the first ever commercial airborne wind energy system on the island of Mauritius in 2023 (SkySails Power 2023; Fig. 3). Airborne wind energy might also be used in the future to repower old wind turbine platforms offshore that cannot carry the weight of more modern and heavier wind turbines (SkySails Power n.d.).

Figure 3 The SkySails Power airborne wind energy system in Mauritius (Courtesy of the SkySail Groups).

Second, airborne wind energy systems are easier to transport and to (un)install than wind turbines (Kitepower n.d.). This makes them attractive for short-term and mobile applications,

such as events or natural disaster response and recovery. Third, the harvesting altitude of the kite can be adjusted to the available wind resources, thereby increasing the energy yield (Bechtle et al. 2019). Fourth, first assessments suggest that airborne wind energy has a lower carbon footprint than wind turbines because it requires up to 90% fewer materials (van Hagen et al., 2023). Fifth, maintenance and repair work can be performed on the ground, reducing costs and increasing occupational safety. Finally, once the airborne wind energy market and supply chain are further developed, the technology will potentially be cheaper than conventional wind energy because of lower installation costs and higher capacity (BVG Associates 2022). As promising as that sounds, the airborne wind energy industry faces multiple challenges, partially explaining why it has repeatedly failed its development targets. One of the main challenges is that airborne wind energy is technically much more complex than wind turbines because perfect control of a flying device needs to be achieved for reliable and robust operation and energy production (Directorate General for Research and Innovation 2018).

6.3 Is the industry just 'flying a kite'? Why research on the social implications of airborne wind energy is urgently needed

Next to the more tangible benefits discussed above, the airborne wind energy field commonly argues that the technology will be more socially accepted than wind turbines. To justify this claim, the field usually refers to airborne wind energy's lower visibility, lower sound emissions, and fewer impacts on birds and bats than wind turbines (Schmidt et al. 2022). The field only recognizes that safety risks and deployment in densely populated areas might impact acceptance negatively (ibid.). Aside from the fact that the literature fails to specify which acceptance level it refers to – residents' and local authorities' acceptance of a local airborne wind energy system, socio-political acceptance of airborne wind energy technology by key authorities, policymakers, and society at large, or market acceptance, as posited by Wolsink et al.'s model (see Fig. 4) –, there are other reasons why the field's claims are problematic: Developers have only conducted a few environmental impact assessments so far, and independent research on visual, sound, and ecological impacts of airborne wind energy is lacking altogether (ibid.).

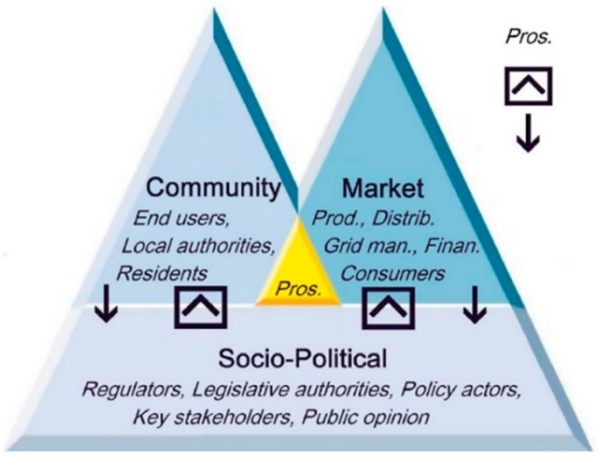

Figure 4 The three levels of social acceptance: Community, socio-political and market (Wolsink, 2018)

Even if there was convincing evidence that airborne wind energy has fewer environmental impacts than wind turbines, it is not said that this will automatically translate into a higher technology acceptance. Decades of research on how humans perceive and respond to renewable energy technologies have shown that people's assessments of renewables are strongly influenced by their preconceptions, beliefs, and experiences (e.g., Rand & Hoen 2017).

Furthermore, for a local renewable energy plant, the situational context plays a major role for residents' attitudes toward the plant. A team of German researchers has recently analyzed the existing energy acceptance literature and developed a model that can surprisingly well predict residents' attitudes to a local wind project from five main factors only: economic impacts, attitude to the energy transition, planning process, impact on nature and residents, and social norms (Hübner et al. 2023; Fig. 5).

Figure 5 The integrated acceptance model: Five determinants of the community acceptance of a local wind project (Hübner et al., 2023)

According to the integrated acceptance model, a resident's attitude towards a local wind project tends to be more positive when they perceive more positive impacts of the project on the local economy (e.g., tourism, agriculture), have a more positive attitude towards the energy transition in general, perceive the planning process of the project and the responsible parties as fairer and more transparent, recognize fewer negative project impacts on nature and residents, and appraise other residents' attitudes towards the project more positively. When the researchers applied the model to different data, the adjusted coefficients of determination, R2, were between .76 and .78, meaning that the five factors could explain up to 78% of the variance in residents' attitudes towards the local wind farm (ibid). Thus, the model has a rather high fit for such a complex social phenomenon as someone's attitude to a local wind project.

The integrated acceptance model could help study the community acceptance of airborne wind energy. But regardless of the approach, it is generally important to investigate the social implications of developing and deploying airborne wind energy. If the claims in the field are

wrong and remain unchallenged, they could lead to serious harm; policy decisions and deployment practices based on these claims would then be misinformed, increasing the risk that airborne wind energy will burden people disproportionately. Furthermore, if residents' and other key stakeholders' needs and concerns regarding the technology are not considered, it could lead to widespread opposition to airborne wind energy. As a result, implementation costs would rise, political support would decrease, and the technology's much-need contribution to 2050 targets for wind power generation would be limited. On the flip side, if social science research is done at this stage of technology development already, it would help to identify societally relevant aspects that could be considered early on in developing and deploying airborne wind energy.

6.4 First insights into residents' perceptions of an airborne wind energy system compared to a wind farm

In 2022, researchers from Delft University of Technology and MSH Medical School Hamburg conducted the first community acceptance study of an airborne wind energy system (Schmidt et al. 2023). The developer SkySails Power has operated the ground-gen, soft-wing-kite airborne wind energy system in question on a test site in Northern Germany since late 2019. The research team recruited residents living in a radius of 3.5 km around the test site. Fifty-four residents participated in structured in-person interviews online or in vivo. The researchers based the questionnaire they used loosely on the integrated acceptance model described above. The goal of the study was to test the previously discussed assumptions from the airborne wind energy field: (1) that acceptance is higher for airborne wind energy than wind turbines (i.e., residents' attitudes towards the airborne wind energy system are more positive than towards a local wind farm); (2) that residents rate visual, (3) noise, and (4) ecological impacts more positively for airborne wind energy than wind turbines; (5) that safety perceptions are highly relevant to the acceptance of airborne wind energy; (6) and that densely populated areas are less acceptable for deploying airborne wind energy. The study found that residents' average attitude towards the airborne wind energy system was positive and not significantly different from their attitude towards a local wind farm, disproving the first assumption. Furthermore, residents rated the impacts of the airborne wind energy system and the wind farm similarly, except for visual impacts, which were rated somewhat better for the airborne wind energy system. Safety concerns were not significantly higher for the airborne wind energy system than for the wind farm, and they mattered less for acceptance of the system than expected. Still, residents had different types of concerns about the two technologies. For example, fire, ice throw, and falling rotor blades were common concerns regarding the wind farm, whereas crashes and collisions were most feared for the airborne wind energy system. Lastly, if given the choice, residents would prefer more remote sites for airborne wind energy, but contradictorily, their attitudes towards the local airborne wind energy system were unrelated to how far away they lived. The corresponding publication of the study provides a more detailed account of the results (Schmidt et al. 2023). Taken together, residents generally perceived airborne wind energy positively but were not 'as high as a kite' as the airborne wind energy field suggests they would be. More research is needed across airborne wind energy systems, regions, and acceptance levels (i.e., community, socio-political, and market) to understand the social implications of this novel technology better.

6.5 References

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