

THE ROLE OF THE INDIVIDUAL IN THE GREAT TRANSFORMATION TOWARD SUSTAINABILITY

EDITED BY: Sonja Maria Geiger, Sebastian Bamberg and Daniel Fischer
PUBLISHED IN: Frontiers in Psychology and Frontiers in Education





frontiers

Frontiers eBook Copyright Statement

The copyright in the text of individual articles in this eBook is the property of their respective authors or their respective institutions or funders. The copyright in graphics and images within each article may be subject to copyright of other parties. In both cases this is subject to a license granted to Frontiers.

The compilation of articles constituting this eBook is the property of Frontiers.

Each article within this eBook, and the eBook itself, are published under the most recent version of the Creative Commons CC-BY licence.

The version current at the date of publication of this eBook is CC-BY 4.0. If the CC-BY licence is updated, the licence granted by Frontiers is automatically updated to the new version.

When exercising any right under the CC-BY licence, Frontiers must be attributed as the original publisher of the article or eBook, as applicable.

Authors have the responsibility of ensuring that any graphics or other materials which are the property of others may be included in the CC-BY licence, but this should be checked before relying on the CC-BY licence to reproduce those materials. Any copyright notices relating to those materials must be complied with.

Copyright and source acknowledgement notices may not be removed and must be displayed in any copy, derivative work or partial copy which includes the elements in question.

All copyright, and all rights therein, are protected by national and international copyright laws. The above represents a summary only. For further information please read Frontiers' Conditions for Website Use and Copyright Statement, and the applicable CC-BY licence.

ISSN 1664-8714

ISBN 978-2-88971-291-5

DOI 10.3389/978-2-88971-291-5

About Frontiers

Frontiers is more than just an open-access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers Journal Series

The Frontiers Journal Series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the Frontiers Journal Series operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to Quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews.

Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact

THE ROLE OF THE INDIVIDUAL IN THE GREAT TRANSFORMATION TOWARD SUSTAINABILITY

Topic Editors:

Sonja Maria Geiger, Justus Liebig University, Germany

Sebastian Bamberg, Bielefeld University of Applied Sciences, Germany

Daniel Fischer, Wageningen University and Research, Netherlands

Citation: Geiger, S. M., Bamberg, S., Fischer, D., eds. (2021). The Role of the Individual in the Great Transformation Toward Sustainability.

Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88971-291-5

Table of Contents

- 04 Editorial: The Role of the Individual in the Great Transformation Toward Sustainability**
Sebastian Bamberg, Daniel Fischer and Sonja M. Geiger
- 09 Global Citizens – Global Jet Setters? The Relation Between Global Identity, Sufficiency Orientation, Travelling, and a Socio-Ecological Transformation of the Mobility System**
Laura S. Loy, Josephine Tröger, Paula Prior and Gerhard Reese
- 23 Resolving Conflicts Between People and Over Time in the Transformation Toward Sustainability: A Framework of Interdependent Conflicts**
Johann M. Majer, Matthias Barth, Hong Zhang, Marie van Treek and Roman Trötschel
- 39 Rebound and Spillovers: Prosumers in Transition**
Elisabeth Dütschke, Ray Galvin and Iska Brunzema
- 51 Conceptualizing the Role of Individual Agency in Mobility Transitions: Avenues for the Integration of Sociological and Psychological Perspectives**
Lisa Ruhrort and Viktoria Allert
- 63 We Need to Change: Integrating Psychological Perspectives Into the Multilevel Perspective on Socio-Ecological Transformations**
Marlis C. Wullenkord and Karen R. S. Hamann
- 68 Commentary: We Need to Change: Integrating Psychological Perspectives Into the Multilevel Perspective on Socio-Ecological Transformations**
Daniel Hanss
- 72 Coaching for a Sustainability Transition: Empowering Student-Led Sustainability Initiatives by Developing Skills, Group Identification, and Efficacy Beliefs**
Karen R. S. Hamann, Jana R. Holz and Gerhard Reese
- 88 Fostering Cultures of Sustainability in a Multi-Unit Office Building: A Theory of Change**
Bianca Christel Dreyer, Manuel Riemer, Brittany Spadafore, Joel Marcus, Devon Fernandes, Allan Taylor, Stephanie Whitney, Sean Geobey and Aisling Dennett
- 101 How Can Transformative Sustainability Research Benefit From Integrating Insights From Psychology?**
Thomas Bruhn
- 105 FridaysForFuture as an Enactive Network: Collective Agency for the Transition Towards Sustainable Development**
Denis Francesconi, Vasileios Symeonidis and Evi Agostini



Editorial: The Role of the Individual in the Great Transformation Toward Sustainability

Sebastian Bamberg^{1*}, Daniel Fischer² and Sonja M. Geiger³

¹ Department for Social Sciences, Bielefeld University of Applied Sciences, Bielefeld, Germany, ² Department for Social Sciences, Wageningen University and Research, Wageningen, Netherlands, ³ Department of Consumer Research, Communication and Food Sociology, Justus Liebig University, Giessen, Germany

Keywords: socio-ecological transformation, sustainable development, environmental psychology, education for sustainable development, multi-level perspective framework, research avenues

Editorial on the Research Topic

The Role of the Individual in the Great Transformation Toward Sustainability

Natural scientists have repeatedly cautioned that various planetary boundaries that are thought to safeguard earth's systems equilibrium have been trespassed in recent years (Steffen et al., 2015). At the same time, many people are still denied the opportunity to satisfy their basic needs (UNDP, 2020). The question of how to guide human development on this planet on a just and safe trajectory has therefore become a central task of our time (Häyhä et al., 2016; O'Neill et al., 2018). Science is expected to make important contributions to this task (Bai et al., 2016). In recent years, it has become clear that technological innovations alone will not be enough, but that changes in human behavior are needed on a large scale (Wiedmann et al., 2020; Newell et al., 2021). Why has the human response to the multiple social and environmental crises been so inadequate despite the growing global concern about their consequences? Why are people not taking the right measures to advance sustainable development? Providing insights that help to answer these questions should be the central task for both psychologists and educational scientists concerned with human behavior and learning.

However, we have to confess that the research results currently produced by mainstream psychology and the learning sciences provide little politically impactful insights to answer this question. Why has psychology—a science devoted to the understanding and prediction of human behavior—such difficulties to answer the question “Why aren't people taking enough action?” Why have questions like “How can we facilitate individual and social learning for change toward sustainability?” received so little attention in the mainstream of the education and the learning sciences so far? The desire to deal more systematically with this uncomfortable issue has provided the motivation for organizing this Research Topic. As the editorial team, we share the assumption that answers to the above raised questions have to start with a critique of the problematic meta-theoretical perspective currently underlying mainstream psychological and educational research on sustainability. According to this problematic meta-theoretical perspective, at the core of unsustainable developments lie the wrong decisions of billions of individual consumers. Consequently, the central task of psychological and educational research consists in understanding and changing the psycho-social factors or competencies that motivate the individual to change their consumption and lifestyle related choices. With this problem framing, psychology, and education alike locate the barriers preventing people from behaving in accordance to sustainability principles at the individual level rather than the social-contextual level. Schmitt et al. (2020) refer to this perspective as the “psychological barriers explanation” for inaction, a view that other

OPEN ACCESS

Edited and reviewed by:

Giuseppe Carrus,
Roma Tre University, Italy

*Correspondence:

Sebastian Bamberg
sebastian.bamberg@fh-bielefeld.de

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 17 May 2021

Accepted: 31 May 2021

Published: 05 July 2021

Citation:

Bamberg S, Fischer D and Geiger SM
(2021) Editorial: The Role of the
Individual in the Great Transformation
Toward Sustainability.
Front. Psychol. 12:710897.
doi: 10.3389/fpsyg.2021.710897

scholars criticize for one-sidedly attributing responsibility to individuals and thereby ignoring and de-politicizing structural issues (“responsibilization,” see Giesler and Veresiu, 2014).

Indeed, one consequence of this deficient meta-theoretical perspective is that most psychologists and educational researchers, while in principle acknowledging their role, treat structural barriers as something separate from the psychological and learning processes they are dealing with. This is reflected in the underdeveloped theorizing of how social-structural realities might inform their analyses (for a related debate on transgressive, transformative, civic and social learning to expand an individualistic scope in environmental and sustainability education research; see Lotz-Sisitka et al., 2015; Khoo and Jørgensen, 2021). This is problematic, because treating structural barriers as separate from psychology and education denies the reality that psychological and learning processes exist within these external structures and intergroup relationships, and both shape and are shaped by them (see Reicher et al., 2012). We argue that decoupling psychological barriers to sustainable behavior from the larger systems in which these psychological processes take place, constitutes a form of psychological reductionism in which explanations for human behavior primarily consider individual mental states (Martin-Baro, 1994). It also runs the risk of promoting an instrumental form of “educationalization” that tasks educational institutions to solve societal problems by instilling pre-determined attitudes, knowledges, and behaviors (Bridges, 2008).

Furthermore, because they treat structural barriers as something separate from the psychological and pedagogical processes they are interested in, mainstream psychologists and educators tend to neglect the issues of power, inequality, and social structure. This is precisely what also makes it difficult for them to see the group-based nature of sustainability action: Not humans in general are inactive, on the contrary, many people and groups are working extremely hard for a more sustainable development of our societies. However, these people and organizations do not tend to hold much power in our societies. Others, particularly those in positions of power, such as the fossil fuel and car industry (Leonard, 2019), actively try to delay change and maintain the unsustainable status quo that profits them, despite environmental and human costs (Lamb et al., 2020). Thus, much of mainstream sustainability research in psychology and education neglects to raise questions about the failure of democratic institutions, how power is distributed, and why people in positions of power choose to use that power in particular ways (Fuchs et al., 2016).

In the past decade, the field of sustainability science in particular has driven efforts to understand and address sustainability not just as a thematic challenge, but also as a structural and systemic one. In the paradigm of transition management for example, the necessary changes are no longer examined primarily as those of individual behavior and individual competencies, but as transformations of layered socio-technical systems in which the individual is embedded. We are convinced that such a perspective also offers an important opportunity for psychology and education to evolve

and become more effective in their own contributions to sustainable development.

To incorporate such a socio-technical systems view, we are proposing to use the multilevel perspective (MLP) developed by Geels (2002, 2004, 2011) as an integrative frame model. The MLP views societal change as occurring through the transformation of socio-technical systems. The term socio-technical indicates the complexity of such systems: They include technology, production capacities, supply networks, infrastructure, maintenance networks, legal regulation, cultural meaning, as well as user practices and markets (Geels, 2002). As the name implies, the MLP posits three analytical and heuristic levels on which processes interact and align to result in socio-technical system transformations:

(1) The landscape (macro level) describes exogenous developments such as the development of deep-seated cultural patterns, macro-politics, and economics or natural disasters. An example is climate change, but also economic crises, political upheaval, and other natural disasters (e.g., floods, droughts).

(2) Regimes (meso level) represent the current structures such as dominant rules, institutions, and technologies that are self-reinforcing. The sociotechnical regime is dynamically stable along a predictable trajectory. Many products and industries are currently based on fossil fuels, and rules and institutions were developed for these industries. This makes the regime “locked-in” and resistant to both technological and social innovations toward sustainability.

(3) Niches (micro level) are the locus for radical innovations. Incubated from market and regulation influences, the niche fosters innovations that differ fundamentally from the prevailing regime and usually require landscape developments that open windows of opportunity on the regime level. Examples in the context of the climate crisis are people who pioneer innovations as producers and investors (e.g., alternatives to fossil fuels) and citizens and activists who call for new regulations and lifestyles.

The multilevel perspective argues that transformations of socio-technical systems come about through interactions between processes at these three levels:

(a) niche innovations build up an internal momentum, through learning processes, price/performance improvements, and support from powerful groups,

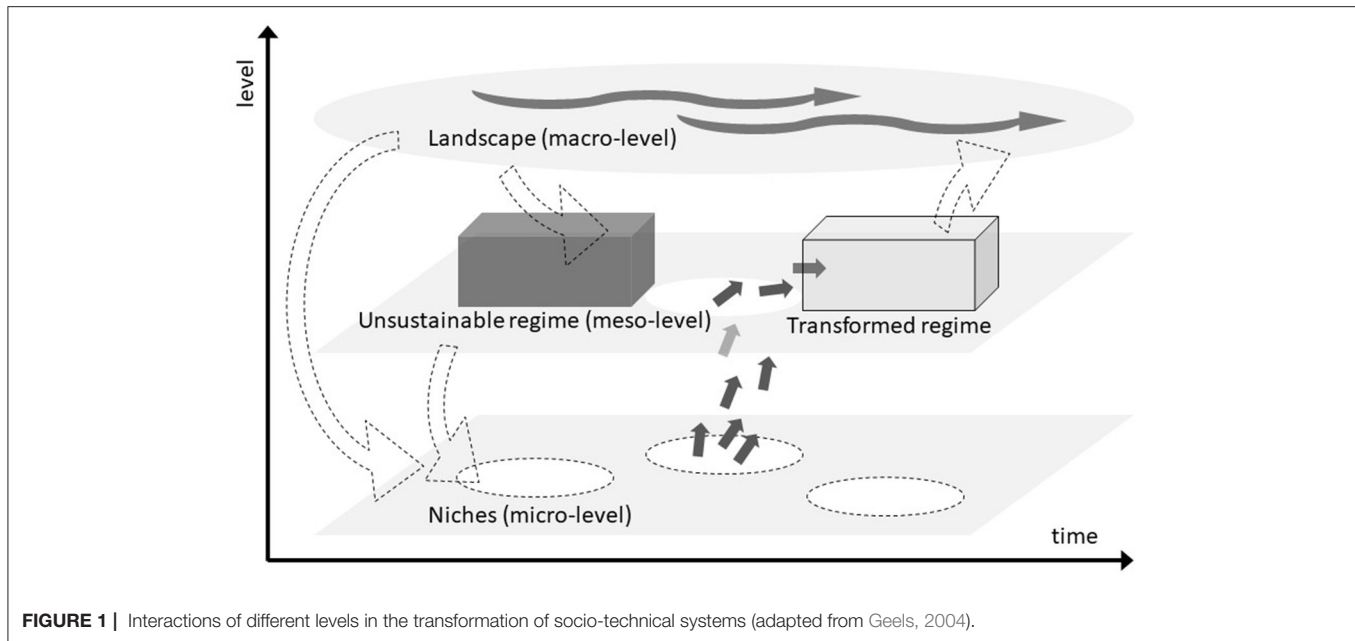
(b) changes at the landscape level create pressure on the regime, and

(c) destabilization of the regime creates windows of opportunity for niche innovations.

The alignment of these processes enables the breakthrough of novelties in mainstream markets where they compete with the existing regime. **Figure 1** has become a somewhat iconic picture of this dynamic.

What might be the practical consequences of such a paradigmatic change for sustainability-related psychological and educational research and an according adoption of a MLP perspective?

With our call for papers, we invited colleagues also interested in developing the transformative paradigm within psychology and the learning sciences to present their ideas



how to theoretically relate psychological constructs and learning processes with broader social-structural contexts they are embedded in. In the following, we discuss three overarching implications of a shift toward a multi-level perspective that the contributions to this special section propose as future research avenues for psychological and education sustainability research. First, psychological and educational researchers are challenged to broaden their traditional focus on individual, often low-impact consumption behavior toward more sustainably-relevant high impact actions in a first instance (Bilharz and Schmitt, 2011; see also current debate Nielsen et al., 2021, and van Valkengoed et al., 2021). Focusing on high-impact behaviors alone should be surpassed by opening up for peoples' role as active members of communities, citizens, and activists trying to bring about social change through their engagement in public protest and social movements. This comprises further outcome categories such as peoples' perception of environmental crises as the result of changing social discourses, their support of transformative policy alternatives as well as their decision to vote the representatives of such policies. As an example, Loy et al. focus on an individual behavior with a high environmental impact (flying) and show how psychological variables such as global identity also influence support of policy measures toward a sustainable transformation of the transport sector. In an educational perspective, Francesconi et al. describe Fridays for Future as an enactive network that acts as an informal learning space by transforming scientific knowledge to spur collective agency. Hamann et al. examine student-led sustainability initiatives as an example of how group-based coaching processes can build individual and collective efficacy that can have transformative impact in educational institutions and the communities in which they are embedded.

Second, in a sustainability context, psychologists and educational researchers alike face a world where the

psychological and learning processes they are interested in exist within larger societal structures and intergroup relationships, and both shape and are shaped by them. Or more precisely, if psychologists and educational researchers want to actively contribute to the necessary transformation of socio-technical systems, they have to embed their research into a broader theoretical framework explicitly dealing with the nature and the course of societal transformation processes. Examples for this explicit consideration of structural conditions are offered by Ruhrort and Allert who focus on integrating sociological practice theory with psychological perspectives, or by Dreyer et al. who explore how structural changes can unfold cultural impacts on an organizational level. Before the backdrop of the MLP as integrative framework one central task of psychological research consists in identifying/developing transformative theoretical constructs allowing to link transformative societal processes with change oriented psychological processes. The commentary by Wullenkord and Hamann, in which the authors call for embedding existing psychological constructs in transformative theories, shows that such an embedding of psychological perspectives can indeed have innovative potential for transformation theories. Another implication of a more embedded and interactional paradigm is to better understand and account for the dynamic interaction of behavior and structure, which can sometimes also result in detrimental effects (systematic rebounds) when gains in one behavioral domain can cause new pressures on other levels (Dütschke et al.).

Third, psychology and educational science need to assert more proactively and explicitly that they are more than mere "implementation agents" tasked to achieve certain strategic goals by organizing acceptance and changing targeted behaviors. The idea of sustainability in and of itself raises normative questions about purpose: what is the envisioned state that should orient our actions and changes as "sustainable?" These questions cannot

be answered technically or scientifically alone—they require deliberation. Psychological and educational contributions are needed to create conditions in the first place that empower people and enable them to participate in processes of goal clarifications, in challenging deeply ingrained worldviews and inherited patterns of thinking, and in extending the imaginary of what sustainability might mean. Supporting such “emancipatory” processes in a kind of “enabling function” is a contribution in the primarily instrumental approach to psychology and education that has received comparatively little attention so far. The contributions by Majer et al. on negotiation as well as by Bruhn on the potential contributions of therapeutic approaches indicate the direction in which work in this perspective could go.

In the end, the oeuvre of approaches to which a systemic and multilevel perspective may lead psychological and educational research must necessarily remain exemplary and incomplete at this point. The contributions to this Research Topic, which have predominantly been submitted from German-speaking research hubs, have given first answers to our questions

raised and will hopefully spark a wider discussion on the future of sustainability-oriented psychological and educational research in the years to come. For the important impulses to intensify efforts in this promising avenue for future research, we are indebted to all contributing authors as well as all critical reviewers.

AUTHOR CONTRIBUTIONS

SB provided the first draft. DF and SG extended the draft by further aspects and edited the final version. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

We would like to thank the authors of the contributions and numerous reviewers who invested their time and expertise to assure the quality of this interdisciplinary research topic.

REFERENCES

- Bai, X., van der Leeuw, S., O'Brien, K., Berkhout, F., Biermann, F., Brondizio, E. S., et al. (2016). Plausible and desirable futures in the anthropocene: a new research agenda. *Glob. Environ. Change Human Policy Dimens.* 39, 351–362. doi: 10.1016/j.gloenvcha.2015.09.017
- Bilharz, M., and Schmitt, K. (2011). Going big with big matters: the key points approach to sustainable consumption. *GAIA Ecol. Perspect. Sci. Soc.* 20, 232–235. doi: 10.14512/gaia.20.4.5
- Bridges, D. (2008). Educationalization: on the appropriateness of asking educational institutions to solve social and economic problems. *Educ. Theory* 58, 461–474. doi: 10.1111/j.1741-5446.2008.0300.x
- Fuchs, D., Di Giulio, A., Glaab, K., Lorek, S., Maniates, M., Princen, T., et al. (2016). Power: the missing element in sustainable consumption and absolute reductions research and action. *J. Clean. Prod.* 132, 298–307. doi: 10.1016/j.jclepro.2015.02.006
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Res. Policy* 31, 1257–1274. doi: 10.1016/S0048-7333(02)00062-8
- Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: insights about dynamics and change from sociology and institutional theory. *Res. Policy* 33, 897–920. doi: 10.1016/j.respol.2004.01.015
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: responses to seven criticisms. *Environ. Innov. Soc. Trans.* 1, 24–40. doi: 10.1016/j.eist.2011.02.002
- Giesler, M., and Veresiu, E. (2014). Creating the responsible consumer: moralistic governance regimes and consumer subjectivity. *J. Consumer Res.* 41, 840–857. doi: 10.1086/677842
- Häyhä, T., Lucas, P. L., van Vuuren, D. P., Cornell, S. E., and Hoff, H. (2016). From Planetary Boundaries to national fair shares of the global safe operating space — how can the scales be bridged? *Glob. Environ. Change Human Policy Dimens.* 40, 60–72. doi: 10.1016/j.gloenvcha.2016.06.008
- Khoo, S., and Jørgensen, N. J. (2021). Intersections and collaborative potentials between global citizenship education and education for sustainable development. *Globalisation Soc. Educ.* 1–12. doi: 10.1080/14767724.2021.189361
- Lamb, W. F., Mattioli, G., Levi, S., Roberts, J. T., Capstick, S., Creutzig, F., et al. (2020). Discourses of climate delay. *Glob. Sustain.* 3, 1–5. doi: 10.1017/sus.2020.13
- Leonard, C. (2019). *Kochland: The Secret History of Koch Industries and Corporate Power in America*. New York, NY: Simon & Schuster.
- Lotz-Sisitka, H., Wals, A. E. J., Kronlid, D., and McGarry, D. (2015). Transformative, transgressive social learning. Rethinking higher education pedagogy in times of systemic global dysfunction. *Curr. Opin. Environ. Sustain.* 16, 73–80. doi: 10.1016/j.cosust.2015.07.018
- Martin-Baro, I. (1994). “Toward a liberation psychology,” in *Ignacio Martin-Baro: Writings for a Liberation Psychology*, eds A. Aron and S. Corne (New York, NY: Harvard University Press), 17–32.
- Newell, P., Daley, F., and Twena, M. (2021). *Changing Our Ways? Behaviour Change and the Climate Crisis*. The report of the Cambridge Sustainability Commission. Cambridge: Cambridge University Press.
- Nielsen, K. S., Cologna, V., Lange, F., Brick, C., and Stern, P. (2021). The case for impact-focused environmental psychology. *J. Environ. Psychol.* 101559. doi: 10.1016/j.jenvp.2021.101559
- O'Neill, D. W., Fanning, A. L., Lamb, W. F., and Steinberger, J. K. (2018). A good life for all within planetary boundaries. *Nat. Sustain.* 1, 88–95. doi: 10.1038/s41893-018-0021-4
- Reicher, S. D., Haslam, S. A., Spears, R., and Reynolds, K. J. (2012). A social mind: the context of John Turner's work and its influence. *Euro. Rev. Soc. Psychol.* 23, 344–385. doi: 10.1080/10463283.2012.745672
- Schmitt, M. T., Neufeld, S. D., Mackay, C. M. L., and Dys-Steenbergen, O. (2020). The perils of explaining climate inaction in terms of psychological barriers. *J. Soc. Issues* 76, 123–135. doi: 10.1111/josi.12360
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., et al. (2015). Sustainability. Planetary boundaries: guiding human development on a changing planet. *Science* 347, 1259855–1–1259855–10.
- United Nations Development Programme (UNDP) (2020). *The Next Frontier: Human Development and the Anthropocene*. New York, NY: United Nations Development Programme.
- van Valkengoed, A. M., Steg, L., Perlaviciute, G., Schultz, P. W., Brosch, T., Gatersleben, B., et al. (2021). Theory enhances impact. Reply to: ‘the case for impact-focused environmental psychology’. *J. Environ. Psychol.* 75:101597. doi: 10.1016/j.jenvp.2021.101597

Wiedmann, T., Lenzen, M., Keyßer, L. T., and Steinberger, J. K. (2020). Scientists' warning on affluence. *Nat. Commun.* 11:3107. doi: 10.1038/s41467-020-16941-y

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Bamberg, Fischer and Geiger. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Global Citizens – Global Jet Setters? The Relation Between Global Identity, Sufficiency Orientation, Travelling, and a Socio-Ecological Transformation of the Mobility System

Laura S. Loy^{1*†}, Josephine Tröger^{1†}, Paula Prior² and Gerhard Reese¹

¹ Department of Social, Environmental and Economic Psychology, Faculty of Psychology, University of Koblenz-Landau, Landau, Germany, ² Institute of Psychology, University of Hamburg, Hamburg, Germany

OPEN ACCESS

Edited by:

Sonja Maria Geiger,
Justus Liebig University, Germany

Reviewed by:

Sophia Becker,
Technical University of Berlin,
Germany
Roger Tyers,
University of Southampton,
United Kingdom

*Correspondence:

Laura S. Loy
loy@uni-landau.de

[†]These authors share first authorship

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 29 October 2020

Accepted: 19 February 2021

Published: 30 March 2021

Citation:

Loy LS, Tröger J, Prior P and
Reese G (2021) Global Citizens –
Global Jet Setters? The Relation
Between Global Identity, Sufficiency
Orientation, Travelling,
and a Socio-Ecological
Transformation of the Mobility
System. *Front. Psychol.* 12:622842.
doi: 10.3389/fpsyg.2021.622842

Global crises such as the climate crisis require fast concerted action, but individual and structural barriers prevent a socio-ecological transformation in crucial areas such as the mobility sector. An identification with people all over the world (i.e., *global identity*) and an openness toward less consumption (i.e., *sufficiency orientation*) may represent psychological drivers of a socio-ecological transformation. We examined the compatibility of both concepts as well as their relation to people's support of a decarbonised mobility system and their flight mobility behaviour – a CO₂-intensive behaviour that may be particularly difficult to refrain from for globally identified people, but less so for sufficiency-oriented people. In an online study conducted in Germany (N = 317), we found that global identity and sufficiency orientation were positively related. Both were negatively related to past flight-related CO₂ emissions and positively related to refraining from flying and the support of decarbonised mobility policies. Accounting for both showed that sufficiency orientation in particular was related to fewer flight-related CO₂ emissions and refraining from flying. Furthermore, we examined people's travel experiences. While global identity was unrelated to the frequency and duration of international travelling, it was positively related to the frequency and quality of contact with local people met on journeys. An experimental variation of whether participants first answered questions on global identity or on travel experiences revealed that remembering past international travelling led to higher reported levels of global identity. Taken together, global identity seems to profit from in-depth international contact with people, but can be decoupled from resource-intensive travel behaviour. Globally identified and sufficiency-oriented people may support a socio-ecological transformation. Our results indicate a compatibility of global identity and sufficiency orientation. Experimental and longitudinal research should examine causal links to foster our understanding of the conditions under which both can be strengthened.

Keywords: global identity, sufficiency orientation, travelling, pro-environmental behaviour, policy support, mobility, socio-ecological transformation, flight shame

INTRODUCTION

Global crises such as climate change are challenging humanity as a whole and collective efforts from people all over the world are required to build a sustainable future. A sustainable future, however, seems at odds with the current status of the planet. Global environmental change has reached levels that surpass a safe operating space for humanity (Rockström et al., 2009; Steffen et al., 2015; O'Neill et al., 2018). It is evident that together with technological developments, a socio-structural transformation is necessary (Abson et al., 2017; Fischer and Riechers, 2019). Paths include less resource-intensive behaviour patterns, particularly in affluent countries, but also political measures that remove structural constraints and provide structural incentives for such behavioural changes. Our psychological perspective addresses potential drivers of transformation on the level of behavioural *niches* (Geels, 2004). Specifically, we focus on the domain of (air) mobility and potential psychological predictors of individual and system change.

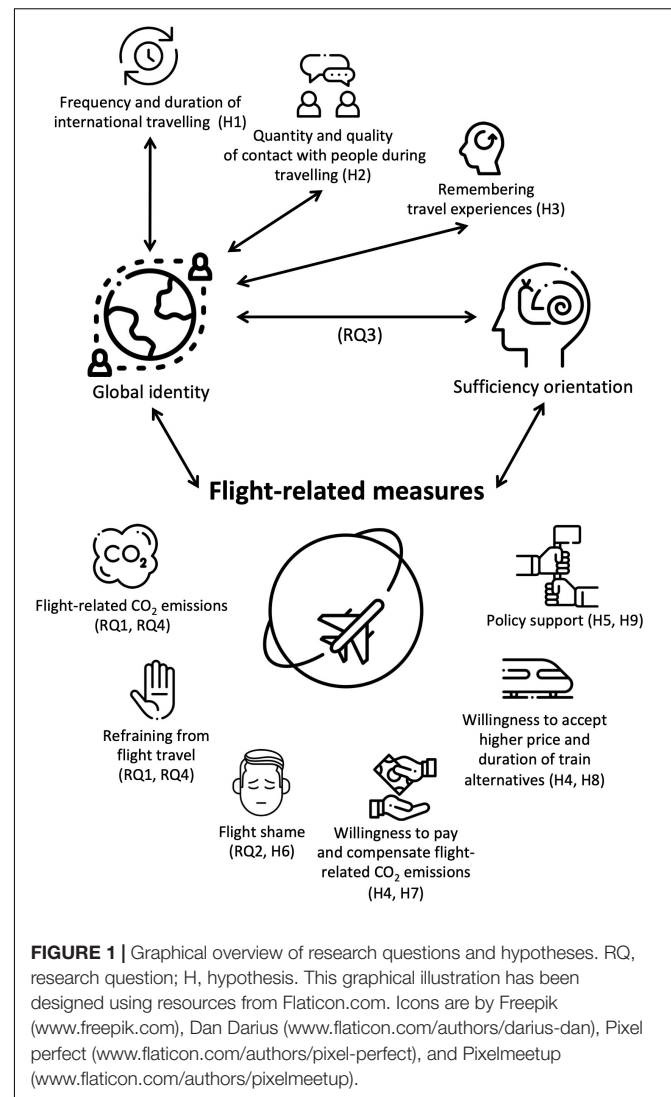
Previous research suggests that an identification with all humanity as an inclusive ingroup (i.e., *global identity*; McFarland et al., 2019) might motivate people to engage for a socio-ecological transformation (e.g., Reese, 2016). Global identity is related to people's engagement for a socio-ecological transformation in the form of pro-environmental behaviours and policy support in various studies (e.g., Renger and Reese, 2017; Brieger, 2019; Joanes, 2019; Loy and Reese, 2019), but less is known about how people develop a global identity (see McFarland et al., 2019, for an overview). One possibility that has been discussed is travelling and meeting people from all over the world (Sparkman and Eidelman, 2018; Römpke et al., 2019). However, air travelling allowing such contact is amongst the most CO₂-intensive and unsustainable individual behaviours. At the same time, it is strongly embedded within the current socio-technical system: flying is comparably cheap, readily available, and often faster than other means of transport.

The overarching goal of our research is thus to investigate the relation between global identity, travel behaviour and experiences, as well as the support of political measures that transform and decarbonise the mobility system. In addition, we test whether global identity is compatible with *sufficiency orientation* (i.e., the attitudinal stance to refrain from consumption; Verfuert et al., 2019), and whether one or the other is more strongly related to people's willingness to refrain from flying and to support a socio-ecological transformation of the mobility system. **Figure 1** provides a graphical overview of our research.

THEORETICAL BACKGROUND

Travelling in the Current Mobility System

Mobility is a human need, but within our (affluent western) society, being on the move is often coupled with climate-damaging CO₂ emissions. In 2010, transportation caused an estimated 14% of the global greenhouse gas emissions (IPCC, 2015). Air travelling produces far more emissions compared to other forms of mobility. For instance, one air trip from Berlin



to Paris causes approximately 260 kg CO₂ equivalents; taking the train would produce only 40 kg (KlimAktiv, 2020). In 2019, international aviation contributed 2.4% to global greenhouse gas emissions (Crippa et al., 2019). Moreover, recent research suggests that aviation's contribution to atmospheric warming is even larger, namely "three times the rate of that associated with aviation CO₂ emissions alone when calculated as net effective radiative forcing" (Lee et al., 2021, p. 2). These emissions, however, seem to be caused by a relatively small share of the most frequent travellers who have the means to fly (i.e., money, social status, see e.g., Gössling et al., 2017). Hence, if the majority of humankind flew, this would increase flight emissions drastically: Predictions for the year 2050 suggest that commercial aircraft emissions might triple (EESI, 2019) and account for a quarter of the global carbon budget (Graver et al., 2019). A decarbonisation of the mobility system and a change in the way we are travelling is essential in order to limit climate change (Urry, 2008; European Commission, 2011; Zipori and Cohen, 2015). Given the current technological infrastructure, people can deliberately

reduce their mobility-related CO₂ footprint by simply travelling less and/or by choosing less CO₂-intensive means of transport such as trains. Moreover, they can support policy measures that make CO₂-intensive travel options comparably less attractive (e.g., carbon pricing, investment in public transport network; Maestre-Andrés et al., 2019).

Many people are aware of the climate crisis and express willingness to contribute to climate change mitigation (UBA, 2019; European Commission, 2020). Two thirds of the European population state that they are ready for a shift to more environmentally friendly modes of transport (e.g., public transport; European Commission, 2020). However, these intentions often do not translate into actual behaviour change (Lassen, 2010; Alcock et al., 2017; Geiger et al., 2018). One reason for this might be that infrastructural and political incentives are promoting non-ecological choices: Flying is judged as much faster, more convenient, and less expensive compared to alternative options (European Commission, 2020). Flight travelling has become an essential part of the western globalised culture (Castillo-Manzano and López-Valpuesta, 2014; McDonald et al., 2015). Moreover, global interconnectedness and long distance travelling are perceived requirements in many professions, although they are not necessarily related to professional success (e.g., in academia, Wynes et al., 2019). At the same time, travelling with resource-intensive means is increasingly seen as contradictory to ecological values within our society and calls for a socio-ecological transformation of the mobility system become louder (Gössling et al., 2020).

Understanding how this mobility system may transform requires a perspective that accounts for the different layers of a complex system. According to the multilevel perspective outlined by Geels (2004), a system that determines societal functioning comprises three levels. The level of the *regime* consists of current institutions (e.g., governmental agencies), infrastructures (e.g., airports and public transport system), technologies (e.g., drive technologies), and policies (e.g., regulations regarding carbon pricing), but also normative behavioural practices (e.g., frequent flying). The regime is embedded in the *landscape*, which consists of “the technical, physical and material backdrop that sustains society” (Geels and Schot, 2007, p. 403), such as the climatic conditions or the availability of fossil resources. While regime and landscape are seen as rather stable, new technologies, behavioural practices, and ideas for policy change can evolve on the level of *niches*. Here, networks of individuals emerge, who promote societal change through changing their own behaviour or through supporting political change. Our research is situated on this level of niches. We examine psychological predictors of people’s mobility behaviour and their support of policy measures toward a socio-ecological transformation of the mobility system. Specifically, we investigate the role of global identity and sufficiency orientation as drivers for transition processes.

Global Identity and Travel Experiences

Different conceptualisations of a *global identity* exist (see McFarland et al., 2019; Carmona et al., 2020, for an overview). In our research, we refer to the concept labelled identification with all humanity, introduced by McFarland et al. (2012)

and further differentiated by Reese et al. (2015, see also Reysen and Hackett, 2016; Hamer et al., 2020). It comprises a *global self-definition* (i.e., a definition of oneself as part of a community consisting of people all over the world) and a *global self-investment* (i.e., a concern for and solidarity with people all over the world). The concept is rooted in social identity theory (SIT, Tajfel and Turner, 1979), which states that a substantial part of who we are is defined by our group memberships. We identify with our so-called ingroups and differentiate ourselves from outgroups. Self-categorisation theory (SCT, Turner et al., 1987) further assumes that we can define our identity on three levels, namely personal identity, social group identity, and – on the highest level – human identity. Identifying on this highest level goes along with perceiving oneself as part of an ingroup encompassing all humanity. A further theoretical basis comprises theories of personal growth, which assume that caring for all humans characterises a mature person (Adler, 1927/1954; Maslow, 1954; see McFarland et al., 2012, 2013; Reese et al., 2015, for an in-depth discussion). Identities can be understood as traits we develop over time. Hence, individuals differ in how strongly they identify with all humanity (McFarland et al., 2012). However, resonating with SIT/SCT, different parts of our identity, including our global identity, can be more or less salient in a context and guide our perceptions and actions (Turner et al., 1987; Reese et al., 2015; McFarland et al., 2019; Loy and Spence, 2020; Sparkman and Hamer, 2020).

Past research has discussed how a global identity could emerge (see McFarland et al., 2019, for an overview). One plausible reasoning based on intergroup contact theory (Pettigrew and Tropp, 2006; Pettigrew et al., 2011) was that personal contact with people all over the world might strengthen global identification (see e.g., Sparkman and Eidelman, 2018; Römpke et al., 2019). Supporting this rationale, Römpke et al. (2019, Study 1) found that German participants who had come into (fictitious) contact with a person from another continent through a simulated Internet chat program reported higher levels of global identity compared to a control group. Moreover, the amount of international contacts students reported in a questionnaire predicted their global identity in a follow-up assessment 6 months later Römpke et al. (2019, Study 2). Sparkman and Eidelman (2018, Study 2) found that what they labelled as “contact with cultural members” was positively related to United States citizens’ global identity. Sparkman and Hamer (2020) found positive correlations of a similar composite measure with global identity in a Polish sample. None of these studies particularly addressed travel experiences abroad. In our research, we aimed to extend prior findings in this regard and predicted:

H1: The more international travel experiences people have made (frequency and duration of staying abroad), the stronger their global identity.

In another study, Sparkman and Eidelman (2018, Study 3) asked United States participants about the “quantity and quality of one’s intercultural contact” (see also Römpke et al., 2019). Both aspects were positively related to global identity. We transferred this idea to experiences with local people met during travelling and predicted:

H2: The higher the contact quantity (H2a) and quality (H2b) with local people during travelling, the stronger people's global identity.

Beyond examining correlations between global identity and travel experiences, we aimed to gain causal insights. SCT (Turner et al., 1987) supposes that a global identity may be triggered by cues that evoke associations with it (McFarland et al., 2019; Loy and Spence, 2020). We reasoned that thinking about past travel experiences might be such a cue and experimentally varied whether participants in our study first answered questions on travel experiences or on global identity, respectively. Even though this cannot give firm causal evidence that travelling impacts global identity, it could be a first hint that (remembering) respective experiences make(s) global identity more salient. We predicted:

H3: Remembering travel experiences raises the salience of global identity.

Global Identity and Decarbonised Travelling

Past research has reasoned that a global identity might be related to people's motivation to address global environmental crises (e.g., Batalha and Reynolds, 2012; Reese, 2016). Positive relations were found with pro-environmental attitudes (e.g., Reysen and Katzarska-Miller, 2013; Lee et al., 2015; Reysen and Hackett, 2016; Assis et al., 2017), pro-environmental behavioural intentions and behaviours (e.g., Der-Karabetian et al., 2014; Lee et al., 2015; Rosenmann et al., 2016; Renger and Reese, 2017; Joanes, 2019; Leung and Koh, 2019; Loy and Reese, 2019), and the support of pro-environmental policies and organisations (e.g., Leung et al., 2015; Brieger, 2019; Loy and Reese, 2019).

Some of these previous studies included items on mobility behaviour that were, however, only investigated as part of an overall lifestyle. Alcock et al. (2017) reported results of a United Kingdom survey study, in which pro-environmental attitudes were related to household behaviours but not to people's non-work-related flights (see also Lassen, 2010; McDonald et al., 2015). Hence, flight-reduction might constitute a particularly difficult behaviour regardless or despite of its high CO₂-saving potential – especially for people highly identified on a global level. Travelling to distant locations might be particularly attractive for them so that they rather focus on other pro-environmental behaviours (e.g., a plant-based diet) to express their motivation to address climate change. Accordingly, Römpke et al. (2019, Study 2) found that global identity was positively related to the intention to avoid animal products but not air travel. In other words, the empirical evidence on a relation between global identity and pro-environmental outcomes might lead to the supposition that flight reduction is also a likely goal pursued by globally identified people. However, their global orientation might conflict with this goal. In line with the latter supposition, Oswald and Ernst (2020) found that a cosmopolitan identity (i.e., a multidimensional concept including one dimension similar to our global identity conceptualisation) was positively related to flight kilometres in the last year. Due to little empirical evidence

and opposing plausible theoretical rationales, we examined the relationship between global identity and flight behaviour in terms of past flight-related CO₂ emissions and how often people refrained from flying:

RQ1: Is global identity related to past flight-related CO₂ emissions (RQ1a) and refraining from flight travel (RQ1b)?

Recent media coverage on the Fridays for Future movement coined the term *flight shame* in order to grasp people's reaction to protesters' frequent appeal that global jet setting is one of the most CO₂-intensive behaviours and should be reduced (Gössling et al., 2020). Moral emotions such as shame and guilt have been found to be related with pro-environmental behavioural intentions and behaviours (Mallett, 2012; Harth et al., 2013; Rees et al., 2015). We therefore additionally assessed flight shame and asked:

RQ2: Is global identity related to flight shame?

Beyond flying behaviour, we also examined how willing people were to compensate flight-related CO₂ emissions (i.e., carbon offsetting) and switch to alternative train options. As these behaviours do not oppose long-distance travelling *per se*, we expected, in line with the results on a relation between global identity and pro-environmental behaviours cited above:

H4: The stronger people's global identity, the higher their willingness to compensate flight-related CO₂ emissions (H4a) at higher costs (H4b), pay more for alternative train options (H4c) and accept longer travel durations of alternative train options (H4d).

Finally, we aimed to go beyond individual behaviour and examined people's support of a socio-ecological transformation of the mobility system. Based on prior research that found a positive relation between global identity and climate policy support including mobility-related changes (Loy and Reese, 2019), we predicted:

H5: The stronger people's global identity, the stronger their support of policy measures that decarbonise the mobility system.

As outlined above, global identity could conflict with the willingness to fly less despite a principal willingness to reduce one's CO₂ impact. One might hope that more resource-efficient technologies will solve this conflict in the future (e.g., through electrification). However, it has become evident that technological progress alone cannot reduce carbon emissions from travelling to a satisfactory extent (Peeters and Dubois, 2010) and fundamental behaviour shifts are necessary. Therefore, the concept of sufficiency addresses the idea of absolute consumption reduction. In the following, we argue that individuals' sufficiency orientation might (additionally or even better) explain why people refrain from flying.

Sufficiency Orientation, Global Identity, and Decarbonised Travelling

Sufficiency is an increasingly discussed concept in several disciplines (Gorge et al., 2015; Spangenberg and Lorek, 2019;

Toulouse et al., 2019; Tröger and Reese, 2021). Introduced as one essential part of the sustainability strategy bundle comprising efficiency, consistency, and sufficiency, it encompasses the shrinkage of absolute resource consumption levels (Darby and Fawcett, 2018; Linz, 2004). Understanding the development and role of an attitudinal stance, namely people's so-called *sufficiency orientation*, may be a prerequisite for consumption change (Spangenberg and Lorek, 2019; Verfuërth et al., 2019). Only a few studies examined sufficiency orientation as predictor for actual behaviour (Verfuërth et al., 2019) and we know little about commonalities and differences to other concepts that predict pro-environmental behaviour.

Theoretically, sufficiency orientation and global identity might be positively related because they share strong social justice motives (see Howell, 2013; Schöpke and Rauschmeyer, 2014; McFarland et al., 2019). Both are related to pro-environmental attitudes and behaviours (e.g., Loy and Reese, 2019; Verfuërth et al., 2019). The specific case of flight behaviour, however, might reveal a difference and possible incompatibility of these two concepts. As outlined above, global identity is positively related to pro-environmental behaviour in general, but evidence with regard to flying is unclear. Globally identified people may experience a conflict between an interest to travel and the environmental damage this might cause if fossil-based travel modes are used. Sufficiency-oriented people, on the contrary, may experience such conflicts to a lesser extent. As their attitudinal stance is strongly rooted in consumption reduction, their priority might lie on refraining from behaviour that has a high ecological impact. Due to these contradicting theoretical arguments, we explored:

RQ3: Is sufficiency orientation related to global identity?

A study by Moser and Kleinhüchelkotten (2018) showed that pro-environmental identity (i.e., the self-description as a resource-saving person) positively correlated with so-called intent-oriented behaviour (i.e., self-reported estimations of personal efforts to save natural resources) but not with impact-oriented behaviour (e.g., frequency of long-distance vacations). We argue that a stronger sufficiency orientation should be related with refraining from flying because it consists of the conviction that less overall consumption is necessary to protect the climate and the environment. Qualitative research showed that people who are sufficiency-oriented in fact use fewer resources in their everyday routines (Speck and Hasselkuss, 2015). A more recent study showed that the stronger people's sufficiency orientation, the lower their carbon impact regarding food consumption, electricity consumption, and everyday mobility, while air travelling was unrelated (Verfuërth et al., 2019). Due to the fact that empirical results have so far failed to confirm the theoretical predictions, we asked:

RQ4: Is sufficiency orientation related to past flight-related CO₂ emissions (RQ4a) and refraining from flight travel (RQ4b)?

The discussion around sufficiency is conceptually grounded in justice theory and in practical sustainability science

(see Spengler, 2016, for an overview). The idea is to define and meet minimum and maximum thresholds of consumption that enable a fair and just distribution of resources now and in the future in accordance with the earth's natural limits (Syme and Nancarrow, 2012; Schöpke and Rauschmeyer, 2014; Alexander, 2019). While only few people, mainly from affluent societies, have the means to fly, environmental consequences mostly affect people not responsible for the emissions (e.g., O'Neill et al., 2018). People who are sensitive to this injustice experience moral emotions such as guilt and shame (e.g., Schmitt et al., 2010). Therefore, we predicted:

H6: The stronger people's sufficiency orientation, the more flight shame they experience.

As argued above, sufficiency-oriented people may not feel the need to travel by airplanes and therefore also no need to compensate flights in terms of carbon offsetting. Furthermore, compensation policies have been criticised as a strategy to morally licence environmentally harmful behaviour that could involve backfiring effects (i.e., flying even more; Font Vivanco et al., 2018; Sorrell et al., 2020). This should be at odds with the moral standards of sufficiency-oriented people. Instead, they might support resource-saving alternatives to flight travel. We thus predicted:

H7: The stronger people's sufficiency orientation, the lower their willingness to compensate flight-related CO₂ emissions.

H8: The stronger people's sufficiency orientation, the higher their willingness to pay more for alternative train options (H8a) and accept longer travel durations of alternative train options (H8b).

Finally, sufficiency as a sustainability strategy calls for adequate policy instruments to cut back emissions through infrastructural change (Toulouse et al., 2019; Tröger and Reese, 2021). Prior research found a positive relation between sufficiency orientation and policy support in the field of plastic consumption (e.g., taxation of plastic, Heidbreder et al., unpublished data). As sufficiency-oriented people may feel particularly responsible for their own consumption and perceive a corresponding agency (Speck and Hasselkuss, 2015), they may critically reflect on current structural constraints that hinder low-carbon individual behaviour. Therefore, we assumed that they support structural policy measures allowing people to better enact their sufficiency-oriented intentions and predicted:

H9: The stronger people's sufficiency orientation, the stronger their support of policy measures that decarbonise the mobility system.

MATERIALS AND METHODS

Design and Procedure

We followed the APA guidelines for the ethical conduct of research. Participants answered an online questionnaire programmed with SoSci Survey (Leiner, 2019). Inclusion

criterion was that they lived in Germany for at least 5 years. We raffled four 25€ vouchers as incentive. After giving informed consent, participants were randomly assigned to one of two experimental groups. They either first answered questions on global identity (see section “Global Identity,” *control condition*) or on travel experiences (see section “Travel Experiences,” *salience condition*). Then, they answered all other questions, followed by a debriefing.

Participants

We conducted an *a priori* power analysis (see **Supplementary Section “Power Analysis”**) and recruited a convenience sample of $N = 322$ participants (see **Supplementary Section “Participant Characteristics”** for socio-demographic details) through snowball sampling via personal contacts of several student assistants, mostly via Facebook and WhatsApp. We also used university Facebook groups and Facebook groups focusing on empirical research participation. Excluding $n = 5$ participants (see **Supplementary Section “Exclusion of Outliers and Implausible Values”**) resulted in a final sample of $N = 317$ used for our analyses (257 females, 58 males, 2 diverse; $M = 28.4$ years of age, $SD = 10.0$, range = 18–65). On a 5-point scale assessing the subjective income situation (Buerke, 2016), only few stated limited resources by indicating 1 (*not enough by half*, $n = 4$) or 2 (*just make ends meet*, $n = 25$). The majority evaluated their financial situation as satisfactory, indicating 3 (*overall doing well*, $n = 121$), 4 (*well looked after and can afford quite a lot*, $n = 141$), or 5 (*do not have to restrict myself in any way*, $n = 26$). We also assessed monthly household income, but could not use this variable due to a programming mistake in the online questionnaire.

Measures

In the following, we provide an overview on the self-report measures used to answer our research questions (see **Supplementary Section “Measures”** for detailed descriptions and **Supplementary Tables 1, 2** for psychometric properties)¹. It took participants on average 18.5 min to fill out the questionnaire. All variables are provided on the OSF Forum², the key scales in **Supplementary Section “Measures.”**

Global Identity

We used an adapted version (see Loy and Reese, 2019 and **Supplementary Section “Global Identity”**) of the Identification with all Humanity Scale (IWAH, McFarland et al., 2012; Reese et al., 2015). Participants stated their agreement with five

statements, respectively, on global self-definition and global self-investment on a 7-point scale.

Travel Experiences

We asked participants how often in the past 5 years they had travelled in Europe on average per year on a 7-point scale, how long their respective longest stay had been, how often in their lives they had travelled outside of Europe on a 7-point scale, and again, how long their respective longest stay had been (**Supplementary Section “Travel Experiences,”** see Sparkman and Eidelman, 2018, for a similar measure). We used a measure by Islam and Hewstone (1993) to assess the quantity and quality of contact with people met during travelling on 7-point scales with five items, respectively (**Supplementary Section “Travel Experiences,”** see also Sparkman and Eidelman, 2018).

Flight-Related Measures

Flight-related CO₂ emissions

First, people indicated if they had travelled by airplane at least once in the last 5 years. Those who had flown ($n = 291$) next indicated if they had travelled more than five times per year. We categorised those travelling less than five times as *occasional flyers* ($n = 219$) and asked them to list all their flights in the last 5 years into a provided entry mask (i.e., departure location and destination). We categorised those travelling more than five times per year as *frequent flyers* ($n = 72$) and asked them to estimate their average number of flights per year for seven distance categories. We provided reference destinations for each category. Based on this information, we calculated the individual CO₂ emissions (in tons per person) using an online footprint calculator (see **Supplementary Section “Calculation of Flight-Related CO₂ Emissions”**). The values of $n = 15$ cases were incomplete and we excluded them from further analyses (see **Supplementary Section “Exclusion of Outliers and Implausible Values”**).

Refraining from flight travel

We asked participants how often in the past 5 years they had refrained from flying on a 7-point scale and what their motives were (see **Supplementary Section “Refraining From Flight Travel”**).

Flight shame

Participants indicated their agreement to the statements “I feel ashamed/guilty that I have travelled by airplane” on 7-point scales (see **Supplementary Section “Flight Shame”**). The $n = 26$ participants who had not flown did not receive this question (missing values).

Willingness to pay and compensate flight-related CO₂ emissions

We asked participants to imagine that they travel by plane and pay 100€. They indicated whether they would pay a CO₂ compensation in terms of carbon offsetting on a 7-point scale (*not in any case* to *in any case*) and how much money they would pay on a visual analogue scale (0€ to 100€). We excluded $n = 4$ cases (missing values).

¹ We had additionally assessed multicultural experiences made in Germany based on Sparkman and Eidelman (2018). However, as it does not address our main research questions, we do not outline it here. Moreover, we had assessed a short 15-item version of the General Ecological Behaviour Scale (GEB) by Kaiser and Wilson (2000) with the main aim to give people the opportunity to express their pro-environmental engagement beyond mobility behaviour in order to reduce possible resentments. As a further addition to complement the flow of the questionnaire, we asked participants to estimate the relative CO₂ emissions of airplanes, cars, and trains and gave the solutions, before assessing their willingness to compensate flying and use alternative train options. Analyses of these additional variables can be provided on request.

² OSF Forum: <https://bit.ly/3vbEGvh>

Willingness to accept higher price and duration of train alternatives

We confronted participants with the scenario to travel within Europe, deciding whether to use the train as alternative to a 2h flight costing 100€. They indicated the maximum amount of money they would pay for the train (in €) and the maximum duration they would accept (in hours). We excluded the values of $n = 6$ cases (2 missing values, 4 outliers; see **Supplementary Section** “Exclusion of Outliers and Implausible Values”).

Policy Support

We refined and extended a policy support scale used by Loy and Reese (2019, see also Tobler et al., 2012, **Supplementary Section** “Policy Support”) to focus only on mobility-related measures. On a 7-point scale, participants rated five restrictive measures relating to cars, three restrictive measures relating to flying, and three supportive measures relating to public transport and train travelling.

Sufficiency Orientation

We measured sufficiency orientation with six items from the sufficiency orientation short scale, capturing people's attitude toward a low-carbon lifestyle (Henn, 2015; Verfuert et al., 2019) and added six items capturing people's conviction that consumption reduction is a necessary means to environmental and climate protection. Participants stated

their agreement on a 7-point scale (see **Supplementary Section** “Sufficiency Orientation”).

RESULTS

The results regarding our research questions (RQ) and hypotheses (H) in terms of bivariate correlations are summarised in **Table 1** (see **Supplementary Table 2** for all bivariate correlations).

Global Identity and Travelling

Disconfirming H1, frequency and duration of past international travelling outside of Germany in Europe and beyond were not related to either global identity dimension. However, confirming H2, the quantity and experienced quality of contact with local people met on journeys were positively related to both global self-definition and global self-investment. A regression analysis with all travel measures as parallel predictors of global identity (overall mean score), controlling for gender, age, and subjective income situation, confirmed the small relations of contact quantity and quality with global identity (see **Table 2**).

Comparing people who had answered the questions on travel experiences before and after answering questions on global identity revealed that thinking about past travelling led to higher reported levels of global self-definition (global

TABLE 1 | Bivariate correlations addressed in our research questions and hypotheses.

Variable	RQ/H global identity	1	2	RQ/H sufficiency orientation	3	4
Global identity						
1. Global self-definition ^a						
2. Global self-investment ^a		0.94*				
Sufficiency orientation						
3. Low-carbon lifestyle ^a	RQ3	0.44*	0.47*			
4. Consumption impact ^a	RQ3	0.42*	0.49*		0.80*	
Travel experiences						
5. Frequency of travelling Europe ^b	H1	0.03	0.03			
6. Duration of travelling Europe	H1	−0.05	−0.05			
7. Frequency of travelling beyond Europe ^b	H1	0.08	0.07			
8. Duration of travelling beyond Europe	H1	0.10	0.10			
9. Quantity of contact with locals ^a	H2a	0.24*	0.21*			
10. Quality of contact with locals ^a	H2b	0.27*	0.27*			
Decarbonised mobility practices and appraisals						
11. Flight-related CO ₂ emissions	RQ1a	−0.08	−0.12*	RQ4a	−0.14*	−0.15*
12. Refraining from flight travel	RQ1b	0.22*	0.25*	RQ4b	0.39*	0.31*
13. Flight shame	RQ2	0.35*	0.40*	H6	0.46*	0.45*
14. Willingness CO ₂ compensation	H4a	0.34*	0.39*	H7	0.39*	0.36*
15. Amount CO ₂ compensation	H4b	0.21*	0.22*	H7	0.20*	0.17*
16. Accepted train price	H4c	0.15*	0.16*	H8a	0.22*	0.19*
17. Accepted train travel duration	H4d	0.13*	0.12*	H8b	0.17*	0.17*
18. Policy support ^a	H5	0.43*	0.48*	H9	0.65*	0.65*

* $p < 0.05$.

We used pairwise exclusion of missing cases.

^aFactor scores resulting from CFA were used.

^bSpearman correlations were calculated for these ordinal variables, all others are Pearson correlations.

TABLE 2 | Results of regressing global identity (mean score) on travel experiences.

	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI	β	<i>R</i> ²
Constant	4.45	0.55	< 0.001	[3.23, 5.60]		0.135
Gender	−0.41	0.18	0.020	[−0.79, −0.04]	−0.13*	
Age	−0.01	0.01	0.198	[−0.02, 0.00]	−0.07	
Subjective financial situation	−0.11	0.08	0.171	[−0.28, 0.05]	−0.07	
Frequency of travelling Europe	0.00	0.04	0.911	[−0.07, 0.08]	0.01	
Duration of travelling Europe	−0.00	0.00	0.134	[−0.00, 0.00]	−0.09	
Frequency of travelling beyond Europe	−0.01	0.03	0.782	[−0.07, 0.06]	−0.02	
Duration of travelling beyond Europe	0.00	0.00	0.206	[−0.00, 0.01]	0.08	
Quantity of contact with locals ^a	0.11	0.05	0.030	[0.01, 0.24]	0.14*	
Quality of contact with locals ^a	0.28	0.08	< 0.001	[0.09, 0.46]	0.21*	

**p* < 0.05.

Confidence intervals (CI) were bootstrapped through 5,000 samples. Gender was dichotomised as 1 (female) and 2 (male); *n* = 2 participants indicating diverse were omitted in these analyses due to the low case number.

^aMean scores were used.

identity salience condition: *M* = 5.26, *SD* = 1.27; control condition: *M* = 4.87, *SD* = 1.32; *t*(315) = 2.68, *d* = 0.30, *p* = 0.008), but not to statistically significant higher levels of self-investment (*d* = 0.15, *p* = 0.170). Even though the effect size was small, this indicates that (remembering) international experiences might raise the salience of a global ingroup and partly confirms H3.

Global Identity and Decarbonised Travelling

Global self-investment but not self-definition was negatively related to past CO₂ emissions resulting from flying (RQ1a). The stronger people's global self-investment and self-definition, the more they had refrained from flying (RQ1b), the more flight shame they experienced (RQ2), the more they were willing to compensate flight-related CO₂ emissions (confirming H4a) at higher costs (confirming H4b), and to accept higher prices (confirming H4c) and durations of alternative train options (confirming H4d). The relations were small to medium. Moreover, they more strongly supported policy measures for a mobility system that restricts flying and car use and promotes public transport (confirming H5, medium to strong relations).

Global Identity, Sufficiency Orientation, and Decarbonised Travelling

Global identity was positively related to sufficiency orientation (RQ3, medium to strong relations). Sufficiency orientation showed a similar pattern of small to medium correlations

to mobility-related measures: It was negatively related to flight-related CO₂ emissions (RQ4a) and positively related to refraining from flying (RQ4b), flight shame (confirming H6), acceptance of higher train travel durations (confirming H8a) and prices (confirming H8b), and the support of mobility-related policy measures (confirming H9; strong relations). Disconfirming H7, sufficiency orientation was also positively related to the willingness to compensate flight-related CO₂ emissions at higher costs.

We additionally ran regression models with global identity and sufficiency orientation as parallel predictors of past flight-related CO₂ emissions, willingness to reduce flying, and policy support favouring a transformed mobility system to examine their relative explanatory value (see Table 3). We used mean scores because the dimensions were highly correlated, and regarding them as separate predictors would have posed the problem of collinearity. Moreover, we controlled for gender, age, and subjective income situation. These analyses showed that, when accounting for both constructs, only sufficiency orientation predicted fewer CO₂ emissions and the willingness to refrain

TABLE 3 | Results of regressing the flight-related measures and policy support on global identity and sufficiency orientation (mean scores).

	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI	β	<i>R</i> ²
Flight-related CO ₂ emissions						0.032
Constant	52.00	26.08	0.047	[−2.38, 186.81]		
Gender	−0.86	7.69	0.911	[−21.54, 15.77]	−0.01	
Age	0.09	0.30	0.768	[−0.39, 0.80]	0.02	
Subjective financial situation	4.93	3.62	0.175	[0.75, 10.33]	0.08	
Global identity	−0.83	2.94	0.777	[−18.31, 5.89]	−0.02	
Sufficiency orientation	−8.34	3.87	0.032	[−19.53, 0.39]	−0.15*	
Refraining from flight travel						0.164
Constant	−1.87	0.87	0.032	[−3.32, −0.28]		
Gender	0.25	0.26	0.337	[−0.30, 0.78]	0.05	
Age	0.01	0.01	0.538	[−0.02, 0.03]	0.03	
Subjective financial situation	0.10	0.12	0.405	[−0.16, 0.35]	0.04	
Global identity	0.13	0.10	0.182	[−0.08, 0.33]	0.08	
Sufficiency orientation	0.76	0.13	< 0.001	[0.50, 0.98]	0.36*	
Policy support						0.475
Constant	0.31	0.41	0.455	[−0.50, 1.19]		
Gender	−0.17	0.12	0.171	[−0.45, 0.10]	−0.06	
Age	−0.00	0.00	0.700	[−0.01, 0.01]	−0.02	
Subjective financial situation	0.07	0.06	0.199	[−0.04, 0.19]	0.05	
Global identity	0.16	0.05	< 0.001	[0.07, 0.26]	0.17*	
Sufficiency orientation	0.71	0.06	< 0.001	[0.59, 0.83]	0.57*	

**p* < 0.05.

Confidence intervals (CI) were bootstrapped through 5,000 samples. Gender was dichotomised as 1 (female) and 2 (male); *n* = 2 participants indicating diverse were omitted in these analyses due to the low case number.

from flying. Both global identity and sufficiency orientation predicted policy support³.

DISCUSSION

Summary of the Results and Theoretical Contribution

Our research investigated the relation between global identity, travelling, and the support of a decarbonised mobility system. In our German sample, frequency and duration of travelling outside of Germany was not related to global identity. However, frequency and quality of contact with local people met on journeys correlated positively with both global identity dimensions. Global self-investment but not self-definition was negatively related to flight-related CO₂ emissions. The stronger people's global self-definition and self-investment, the more they had refrained from flying and the more they supported policy measures that restrict flying and car use and promote public transport.

Moreover, we examined whether global identity is compatible with sufficiency orientation and found positive relations of both global identity dimensions with people's attitude favouring a low-carbon lifestyle and their conviction that consumption reduction is a necessary means to environmental and climate protection. Sufficiency orientation showed a similar pattern of correlations with flight-related outcomes. Accounting for both constructs showed that sufficiency orientation in particular predicted lower flight-related CO₂ emissions and refraining from flying. It more strongly predicted policy support.

In sum, global identity seems to profit from in-depth international contact with people, but can be decoupled from resource-intensive travel behaviour. It appears to be compatible with the willingness to consume less and with supporting political measures toward a decarbonised mobility system. However, sufficiency orientation was the statistically stronger predictor. We therefore suggest that global identity could be promoted in combination with sufficiency orientation in order to gain support for a socio-ecological transformation of the mobility system.

Our study provides three major contributions to the research field. First, it shows that a positive contact with local people during journeys is related to global identity, rather than frequent travelling. Second, it brings together research on two evolving concepts within environmental psychology that share strong relations with pro-environmental action and shows that they are compatible: global identity and sufficiency orientation. Third, it suggests a new approach to increase global identity salience in a particular situation. We experimentally varied whether participants first answered questions on global identity or on personal travel experiences. Thinking about past travelling

led to higher reported levels of global self-definition. Hence, (remembering) international experiences might raise the salience of a global ingroup, contributing to the few published studies that successfully raised global identity salience (Reese et al., 2015, Study 3; Römpeke et al., 2019).

Limitations and Future Research Directions

First, given our correlational design, we cannot draw causal conclusions whether the quantity and quality of contact with locals strengthen global identity, whether the direction is vice versa, or caused by unconsidered third variables. Experimental research involving contact situations suggests that international contact can increase global identity (Römpeke et al., 2019). However, it could also reasonably be argued that globally identified people seek and are more receptive to positive international contact. Longitudinal studies assessing political ideologies (e.g., right-wing authoritarianism) suggest bi-directional relations between such constructs and presumably dependent variables (Onraet et al., 2014). Similarly, we cannot infer causality in the relations between global identity, sufficiency orientation, and mobility behaviours and policy support. Experimental or longitudinal approaches may shed light on their mutual effects.

Second, our convenience sample was very young, mostly female, highly educated, and subjectively in a satisfactory financial situation. We suspect that the awareness regarding aviation's contribution to climate change is comparably high within this group of people and that our results should not yet be generalised. Future studies should replicate our findings within more heterogeneous and, optimally, randomly selected representative samples. We also suggest to include measures of both objective and subjective income situations. It is still an open question to which extent sufficiency orientation is related to or developed independently from people's economic status. Likewise, global identity, the willingness to pay for carbon offsetting or costly train options, and the support of certain policy measures such as taxes might depend on people's financial situation.

Third, our research involved self-report measures. Even though a recent study showed that social desirability biases do not seem to be huge in studies on pro-environmental behaviour (Vilar et al., 2020), observational measures could complement our approach in follow-up studies (Lange and Dewitte, 2019).

Related to this point, it is possible that memory retrieval of participants' flights caused some distortions in the CO₂ emission calculations. We decided to consider a period of 5 years in order to not only cover recent lifestyles (which might have changed, e.g., due to child birth), but a more representative picture. For frequent flyers, we asked for the average number of flights per year for seven distance categories instead of listing all flights separately in order to avoid frustration and drop-outs due to memory difficulties. Future studies could try to use trace data or GPS data from airlines (Graver et al., 2019). Still, we believe that our study provides a more precise measurement approach than prior studies, which often assessed self-reported frequencies of

³As a robustness check for the results on flight-related CO₂ emissions, we excluded $n = 14$ cases with values higher than two standard deviations above the median. In this reduced sample, we found neither correlations with global identity nor sufficiency orientation (see **Supplementary Section** "Supplement: Results"). Hence, these results should be treated with caution and may require future replication.

flights only (e.g., “Over the last 12 months, how many times did you travel by plane for personal reasons?”, Schubert et al., 2020).

Our experimental variation of question order (global identity measured after vs. before remembering international experiences) raised the salience of a global ingroup. Communication research could build on this finding and examine how to evoke travel memories. If this strengthens global identity, it might encourage recipients’ collective engagement for a socio-ecological transformation.

Practical Implications

Cultivating and Communicating Global Identity and Sufficiency Orientation

Our correlational results suggest that people with a strong global identity have not been abroad more often – and even fly less – than people with a lower global identity. Thus, global identity does not seem to contradict a low-carbon lifestyle. One might further ask how a global identity could be fostered in accordance with decarbonised travelling? We suggest that the focus should lie on creating opportunities that allow people from different parts of the world to meet and engage in meaningful contact.

Exchange programmes (e.g., the European Erasmus programme) can provide opportunities to establish in-depth contacts with locals through living in a foreign country. We suppose that study or working stays can bring rewarding contact with locals for both sides. Organisations that fund such stays could structurally support ecological travel modes (i.e., encourage and fund train arrival). However, it has to be kept in mind that these opportunities are not equally available to everyone as they depend on unequally distributed financial and social resources (Urry, 2012; Schubert et al., 2020). Therefore, access should be promoted for people of more diverse social backgrounds from all over the world.

In addition, extending international platforms via the Internet may provide contact opportunities even in remoter areas (Amichai-Hamburger and McKenna, 2006). Hence, “digital pen friendships” might be a further pathway to develop a global identity (Römpke et al., 2019). Moreover, playing characters and thereby virtually experiencing the lives of people all over the globe in a virtual simulation game fostered global empathy (Bachen et al., 2012). We imagine that such a game could also cultivate global identity. Finally, recent research suggests that mind-body practices (i.e., yoga, meditation) might foster global identity, because it is a goal of these techniques to strengthen the perceived connectedness of all living beings, even without meeting them in person (Brito-Pons et al., 2018; Loy and Reese, 2019).

Our findings further suggest that sufficiency orientation and global identity do not contradict each other. People holding these orientations not only share the motivation to protect the environment but also share a common lifestyle, in our case the preference for low-carbon travelling. Therefore, we suggest that both orientations could be cultivated and communicated at the same time. Practitioners could think about how global identity could be made salient through communicative means (see e.g., Loy and Spence, 2020). Our results suggest that making people think about past travel experiences might be one way to

do so. Hence, writers and journalists could try to evoke such memories with their narratives. Moreover, they could add images or information about the idea of consuming less. An applied example is the online initiative “terran”⁴. The campaign creates vivid images of low-carbon travelling through stories, pictures, and funny sayings from people all over the world. It could thus make global identity salient, while exemplifying ways of travelling in the spirit of sufficiency orientation.

Finally, our results indicate that sufficiency orientation in particular is linked to a strong desire for structural change through policy measures. It is thus possible that strengthening sufficiency orientation in our society would accelerate a socio-ecological transition. This could be achieved by arguing against the negative connotation of renunciation and the potential fear of “the less” through emphasising social and ecological benefits (Tröger and Reese, 2021). Recent evidence suggests that norms toward flying already shifted in the German society due to the global Fridays for Future movement and the European-wide flight shame debate (Koos and Naumann, 2019; Gössling et al., 2020). This might explain why we found a relation between sufficiency orientation and reduced air travelling unlike Verfürth et al. (2019), who conducted their study before these movements. This social norm shift might help to promote a sufficiency orientation in the future. Sufficiency is not a lifestyle that expresses itself through seclusion or solitude, but rather through the desire to contribute to climate protection by reducing consumption and living a frugal life within a connected and globalised world. The idea of “less is more” can be used in campaigns that promote decarbonised forms of travelling.

Toward a Sustainable Mobility System

Referring back to the multi-level model of Geels (2004), changes in the *landscape*, such as the planetary boundaries we are approaching or have already surpassed (Steffen et al., 2015), call for a system transformation to ensure a good life for all in the future. The decarbonisation of the mobility system is one goal to reach this vision (European Commission, 2011). Policy changes on the level of the *regime* (Geels, 2004) can promote changes in individual behaviour (e.g., reduced car or aviation use). These policy measures could consist of taxes (e.g., taxation of gasoline-based cars or kerosene), banning of technologies (e.g., abolition of combustion engine), or removing subsidies (e.g., reduced value added tax to fuel oil; see Kanger et al., 2020). Moreover, policy measures can establish decarbonised infrastructures and change the socio-technical system. For example, a case study in Lisbon showed that simply expanding and completing the cycling network in the city centre and the introduction of an electric bike-sharing system lead to a large increase of cyclists (Félix et al., 2020). An expansion of cycling routes is now attempted in many metropolitan areas (e.g., Paris, Berlin, and Bogotá). Similarly, the (re)introduction of attractive (night) train connections could help to replace flight travel (Baumeister and Leung, 2020; for a respective initiative, see “Back on Track”)⁵.

⁴www.terran.eco

⁵www.back-on-track.eu

Engagement on the level of *niches* (Geels, 2004) seems important to generate innovative ideas and to establish bottom-up acceptance for policy measures. Kanger et al. (2020) thus suggest to stimulate and accelerate niches, for example, through research and development funding schemes, creating innovation platforms, or market-based policy instruments. In line with this suggestion, online portals for citizen participation, in which people are asked to share their ideas for a future mobility system, or workshops in which citizens are actively involved in the development of mobility concepts could guide a transition process (e.g., Gebhardt et al., 2019). Moreover, apps for car and bike sharing (Cellina et al., 2019) or the free availability of cargo bikes (Becker and Rudolf, 2018) could be useful instruments to engage people in using alternative low-carbon modes for mobility. For non-urban areas, however, these niches require political support: While there certainly is a vast amount of mobility infrastructure available, it is often limited to promoting individual car mobility. Infrastructures allowing communal transportation, especially in terms of car and bike sharing, but also increased public transport would require public support schemes, both for users and providers of such options alike.

We argue that beyond these measures to stimulate niches from the “outside,” it is a key to understand people (in those niches and beyond) as essential part of the socio-technical system and ask: What motivates them to support a system change? Which psychological prerequisites does a change need? Our research shows that global identity and sufficiency orientation are psychological correlates of people’s support of a decarbonised mobility system in terms of concrete actions and the support of structural changes.

Conclusion

Our study suggests that a global identity benefits from international contact and is nevertheless compatible with the willingness to consume less, including carbon-intensive forms of travelling. Given the extent and drastic development of the climate crisis, CO₂ emissions from travelling need to be reduced and decarbonised alternative travel models should be promoted in the future (e.g., slow travel, Dickinson et al., 2011). Global identity and sufficiency orientation seem to be compatible with these goals. Although our correlational data cannot claim causality, we still cautiously suggest that cultivating these orientations might be paths toward a society that practices

more sustainable forms of mobility. How they evolve and how they can stimulate each other are questions for future research.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: OSF Forum (<https://bit.ly/3vbEGvh>).

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LL, JT, PP, and GR developed the idea, theoretical background, and research design. PP programmed the questionnaire and recruited participants. LL and JT analysed the data and wrote the manuscript. LL specifically focussed on global identity. JT specifically focussed on sufficiency orientation. PP and GR revised and edited the manuscript. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

We thank Alisa Scheuermann and Ida Wagner for their help with coding the data. Moreover, we thank the two reviewers and the editor, as well as a third anonymous reviewer, for their helpful and constructive feedback on earlier drafts of this manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.622842/full#supplementary-material>

REFERENCES

- Abson, D. J., Fischer, J., Leventon, J., Newig, J., Schomerus, T., Vilsmaier, U., et al. (2017). Leverage points for sustainability transformation. *Ambio* 46, 30–39. doi: 10.1007/s13280-016-0800-y
- Adler, A. (1927/1954). *Understanding Human Nature*. London: Fawcett.
- Alcock, I., White, M. P., Taylor, T., Coldwell, D. F., Gribble, M. O., Evans, K. L., et al. (2017). green’ on the ground but not in the air: pro-environmental attitudes are related to household behaviours but not discretionary air travel. *Global Environ. Change* 42, 136–147. doi: 10.1016/j.gloenvcha.2016.11.005
- Alexander, S. (2019). “What would a sufficiency economy look like?,” in *Just Enough. The History, Culture and Politics of Sufficiency*, Vol. 12, eds M. Ingleby and S. Randalls (London: Palgrave Macmillan), 117–134. doi: 10.1057/978-1-137-56210-4_8
- Amichai-Hamburger, Y., and McKenna, K. Y. A. (2006). The contact hypothesis reconsidered: interacting via the internet. *J. Comput. Mediat. Commun.* 11, 825–843. doi: 10.1111/j.1083-6101.2006.00037.x
- Assis, N., Reysen, S., and Katzarska-Miller, I. (2017). Being global is being green: associations between global citizenship identification and measures of environmental motivations and attitudes. *Int. J. Energy Pol. Manag.* 2, 13–19.
- Bachen, C. M., Hernández-Ramos, P. F., and Raphael, C. (2012). Simulating REAL LIVES: promoting global empathy and interest in learning through simulation games. *Simulat. Gam.* 43, 437–460. doi: 10.1177/1046878111432108
- Batalha, L., and Reynolds, K. J. (2012). ASPIRIng to mitigate climate change: superordinate identity in global climate negotiations. *Pol. Psychol.* 33, 743–760. doi: 10.1111/j.1467-9221.2012.00896.x
- Baumeister, S., and Leung, A. (2020). The emissions reduction potential of substituting short-haul flights with non-high-speed rail (NHSR): the case

- of Finland. *Case Stud. Transport Pol.* 9, 40–50. doi: 10.1016/j.cstp.2020.07.001
- Becker, S., and Rudolf, C. (2018). Exploring the potential of free cargo-bikesharing for sustainable mobility. *GAIA - Ecol. Perspect. Sci. Soc.* 27, 156–164. doi: 10.14512/gaia.27.1.11
- Brieger, S. A. (2019). Social identity and environmental concern: the importance of contextual effects. *Environ. Behav.* 51, 828–855. doi: 10.1177/0013916518756988
- Brito-Pons, G., Campos, D., and Cebolla, A. (2018). Implicit or explicit compassion? Effects of compassion cultivation training and comparison with mindfulness-based stress reduction. *Mindfulness* 9, 1494–1508. doi: 10.1007/s12671-018-0898-z
- Buerke, A. (2016). *Nachhaltigkeit und Consumer Confusion am Point of Sale. [Sustainability and consumer confusion at the point of sale]*. Berlin: Springer, doi: 10.1007/978-3-658-15201-7
- Carmona, M., Sindic, D., Guerra, R., and Hofhuis, J. (2020). Human and global identities: different prototypical meanings of all-inclusive identities. *Pol. Psychol.* 41, 961–978. doi: 10.1111/pops.12659
- Castillo-Manzano, J. I., and López-Valpuesta, L. (2014). Living “up in the air”: meeting the frequent flyer passenger. *J. Air Transport Manag.* 40, 48–55. doi: 10.1016/j.jairtraman.2014.06.002
- Cellina, F., Bucher, D., Veiga Simão, J., Rudel, R., and Raubal, M. (2019). Beyond limitations of current behaviour change apps for sustainable mobility: insights from a user-centered design and evaluation process. *Sustainability* 11:2281. doi: 10.3390/su11082281
- Crippa, M., Oreggioni, G., Guizzardi, D., Muntean, M., Schaaf, E., Lo Vullo, E., et al. (2019). *Fossil CO2 and GHG Emissions of all World Countries: 2019 Report*. Luxembourg: Publications Office of the EU. doi: 10.2760/687800
- Darby, S., and Fawcett, T. (2018). *Energy Sufficiency: an Introduction: Concept Paper*. France: Eceee
- Der-Karabetian, A., Cao, Y., and Alfaro, M. (2014). Sustainable behavior, perceived globalization impact, world-mindedness, identity, and perceived risk in college samples from the United States, China, and Taiwan. *Ecopsychology* 6, 218–233. doi: 10.1089/eco.2014.0035
- Dickinson, J. E., Lumsdon, L. M., and Robbins, D. (2011). Slow travel: issues for tourism and climate change. *J. Sustainable Tour.* 19, 281–300. doi: 10.1080/09669582.2010.524704
- EESI (2019). *The Growth in Greenhouse Gas Emissions from Commercial Aviation*. Washington, DC: EESI
- European Commission (2011). *White Paper on Transport: Roadmap to a Single European Transport Area: Towards a Competitive and Resource-efficient Transport System*. Brussels: European Union.
- European Commission (2020). *Special Eurobarometer 495: Mobility and Transport*. Brussels: European Union.
- Félix, R., Cambra, P., and Moura, F. (2020). Build it and give ‘em bikes, and they will come: the effects of cycling infrastructure and bike-sharing system in Lisbon. *Case Stud. Transport Pol.* 8, 672–682. doi: 10.1016/j.cstp.2020.03.002
- Fischer, J., and Riechers, M. (2019). A leverage points perspective on sustainability. *People Nat.* 1, 115–120. doi: 10.1002/pan3.13
- Font Vivanco, D., Sala, S., and McDowall, W. (2018). Roadmap to rebound: how to address rebound effects from resource efficiency policy. *Sustainability* 10:2009. doi: 10.3390/su10062009
- Gebhardt, L., Brost, M., and König, A. (2019). An inter- and transdisciplinary approach to developing and testing a new sustainable mobility system. *Sustainability* 11:7223. doi: 10.3390/su11247223
- Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems. *Res. Pol.* 33, 897–920. doi: 10.1016/j.respol.2004.01.015
- Geels, F. W., and Schot, J. (2007). Typology of sociotechnical transition pathways. *Res. Pol.* 36, 399–417. doi: 10.1016/j.respol.2007.01.003
- Geiger, S. M., Fischer, D., and Schrader, U. (2018). Measuring what matters in sustainable consumption: an integrative framework for the selection of relevant behaviors. *Sustainable Dev.* 26, 18–33. doi: 10.1002/sd.1688
- Gorge, H., Herbert, M., Özçaglar-Toulouse, N., and Robert, I. (2015). What do we really need? questioning consumption through sufficiency. *J. Macromarket.* 35, 11–22. doi: 10.1177/0276146714553935
- Gössling, S., Humpe, A., and Bausch, T. (2020). Does ‘flight shame’ affect social norms? Changing perspectives on the desirability of air travel in Germany. *J. Cleaner Prod.* 266:122015. doi: 10.1016/j.jclepro.2020.122015
- Gössling, S., Lohmann, M., Grimm, B., and Scott, D. (2017). Leisure travel distribution patterns of Germans: insights for climate policy. *Case Stud. Transport Pol.* 5, 596–603. doi: 10.1016/j.cstp.2017.10.001
- Graver, B., Zhang, K., and Rutherford, D. (2019). *CO2 Emissions from Commercial Aviation, 2018*. Washington, D.C.: The International Council on Clean Transportation.
- Hamer, K., Penczek, M., McFarland, S., Włodarczyk, A., Łuźniak-Piecha, M., Golińska, A., et al. (2020). Identification with all humanity-A test of the factorial structure and measurement invariance of the scale in five countries. *Int. J. Psychol.* 56, 157–174. doi: 10.1002/ijop.12678
- Harth, N. S., Leach, C. W., and Kessler, T. (2013). Guilt, anger, and pride about in-group environmental behaviour: different emotions predict distinct intentions. *J. Environ. Psychol.* 34, 18–26. doi: 10.1016/j.jenvp.2012.12.005
- Henn, L. (December 2015). *Suffizienz – eine kleine Metaanalyse. (Über)Zuverlässigkeit, Vorhersagekraft und zusätzlichen Nutzen der Suffizienz-Skala. .Colloquium Personality and Social Psychology*. Magdeburg: Otto-von-Guericke University.
- Howell, R. A. (2013). It’s not (just) “the environment, stupid!” values, motivations, and routes to engagement of people adopting lower-carbon lifestyles. *Global Environ. Change* 23, 281–290. doi: 10.1016/j.gloenvcha.2012.10.015
- IPCC (2015). *Climate Change 2014: Mitigation of Climate Change: Working group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: IPCC.
- Islam, M. R., and Hewstone, M. (1993). Dimensions of contact as predictors of intergroup anxiety, perceived out-group variability, and out-group attitude: an integrative model. *Personal. Soc. Psychol. Bull.* 19, 700–710. doi: 10.1177/0146167293196005
- Joanes, T. (2019). Personal norms in a globalized world: norm-activation processes and reduced clothing consumption. *J. Cleaner Prod.* 212, 941–949. doi: 10.1016/j.jclepro.2018.11.191
- Kaiser, F. G., and Wilson, M. (2000). Assessing people’s general ecological behavior: a cross-cultural measure. *J. Appl. Soc. Psychol.* 30, 952–978. doi: 10.1111/j.1559-1816.2000.tb02505.x
- Kanger, L., Sovacool, B. K., and Noorköiv, M. (2020). Six policy intervention points for sustainability transitions: a conceptual framework and a systematic literature review. *Res. Policy* 49:104072. doi: 10.1016/j.respol.2020.104072
- KlimAktiv. (2020). *CO2 Rechner. [Computer software]*. Tübingen: KlimAktiv.
- Koos, S., and Naumann, E. (2019). Vom Klimastreik zur Klimapolitik. Die gesellschaftliche Unterstützung der Fridays for Future“-Bewegung und ihrer Ziele. [From climate strike to climate policy. The societal support of the, Fridays for Future“ movement and their goals]. Exzellenzcluster Politics of Inequality & Sonderforschungsbereich Political Economy of Reforms. https://kops.uni-konstanz.de/bitstream/handle/123456789/46901/Koos_2-1jdetkrk6b9yl4.pdf?sequence=1&isAllowed=y (accessed January 26, 2021).
- Lange, F., and Dewitte, S. (2019). Measuring pro-environmental behavior: review and recommendations. *J. Environ. Psychol.* 63, 92–100. doi: 10.1016/j.jenvp.2019.04.009
- Lassen, C. (2010). Environmentalist in business class: an analysis of air travel and environmental attitude. *Transport Rev.* 30, 733–751. doi: 10.1080/01441641003736556
- Lee, D. S., Fahey, D. W., Skowron, A., Allen, M. R., Burkhardt, U., Chen, Q., et al. (2021). The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018. *Atmospheric Environ.* 244:117834. doi: 10.1016/j.atmosenv.2020.117834
- Lee, K., Ashton, M. C., Choi, J., and Zachariassen, K. (2015). Connectedness to nature and to humanity: their association and personality correlates. *Front. Psychol.* 6:1003. doi: 10.3389/fpsyg.2015.01003
- Leiner, D. J. (2019). *SoSci Survey .(Version 3.1.06) [Computer software]*. <https://www.sosicisurvey.de>
- Leung, A. K. Y., and Koh, B. (2019). Understanding pro-environmental intentions by integrating insights from social mobility, cosmopolitanism, and social dominance. *Asian J. Soc. Psychol.* 22, 213–222. doi: 10.1111/ajsp.12348

- Leung, A. K. -Y., Koh, K., and Tam, K.-P. (2015). Being environmentally responsible: cosmopolitan orientation predicts pro-environmental behaviors. *J. Environ. Psychol.* 43, 79–94. doi: 10.1016/j.jenvp.2015.05.011
- Linz, M. (2004). *Weder Mangel noch Übermaß: Über Suffizienz und Suffizienzforschung. [Neither shortages nor excess: About sufficiency and sufficiency research]*. Wuppertal: Wuppertal Institute
- Loy, L. S., and Reese, G. (2019). Hype and hope? mind-body practice predicts pro-environmental engagement through global identity. *J. Environ. Psychol.* 66:101340. doi: 10.1016/j.jenvp.2019.101340
- Loy, L. S., and Spence, A. (2020). Reducing, and bridging, the psychological distance of climate change. *J. Environ. Psychol.* 67:101388. doi: 10.1016/j.jenvp.2020.101388
- Maestre-Andrés, S., Drews, S., and van den Bergh, J. (2019). Perceived fairness and public acceptability of carbon pricing: a review of the literature. *Climate Policy* 19, 1186–1204. doi: 10.1080/14693062.2019.1639490
- Mallett, R. K. (2012). Eco-guilt motivates eco-friendly behavior. *Ecopsychology* 4, 223–231. doi: 10.1089/eco.2012.0031
- Maslow, A. H. (1954). *Motivation and Personality*. New York, NY: Harper & Row.
- McDonald, S., Oates, C. J., Thyne, M., Timmis, A. J., and Carlile, C. (2015). Flying in the face of environmental concern: why green consumers continue to fly. *J. Market. Manag.* 31, 1, 1503–1528. doi: 10.1080/0267257X.2015.1059352
- McFarland, S., Brown, D., and Webb, M. (2013). Identification with all humanity as a moral concept and psychological construct. *Curr. Direct. Psychol. Sci.* 22, 194–198. doi: 10.1177/0963721412471346
- McFarland, S., Hackett, J., Hamer, K., Katzarska-Miller, I., Malsch, A., Reese, G., et al. (2019). Global human identification and citizenship: a review of psychological studies. *Pol. Psychol.* 40, 141–171. doi: 10.1111/pops.12572
- McFarland, S., Webb, M., and Brown, D. (2012). All humanity is my ingroup: a measure and studies of identification with all humanity. *J. Personal. Soc. Psychol.* 103, 830–853. doi: 10.1037/a0028724
- Moser, S., and Kleinhüchelkotten, S. (2018). Good intents, but low impacts: diverging importance of motivational and socioeconomic determinants explaining pro-environmental behavior, energy use, and carbon footprint. *Environ. Behav.* 50, 626–656. doi: 10.1177/0013916517710685
- O'Neill, D. W., Fanning, A. L., Lamb, W. F., and Steinberger, J. K. (2018). A good life for all within planetary boundaries. *Nat. Sustainability* 1, 88–95. doi: 10.1038/s41893-018-0021-4
- Onraet, E., Dhont, K., and van Hiel, A. (2014). The relationships between internal and external threats and right-wing attitudes: a three-wave longitudinal study. *Personal. Soc. Psychol. Bull.* 40, 712–725. doi: 10.1177/0146167214524256
- Oswald, L., and Ernst, A. (2020). Flying in the face of climate change: quantitative psychological approach examining the social drivers of individual air travel. *J. Sustainable Tour.* 25, 1–19. doi: 10.1080/09669582.2020.1812616
- Peeters, P., and Dubois, G. (2010). Tourism travel under climate change mitigation constraints. *J. Transport Geography* 18, 447–457. doi: 10.1016/j.jtrangeo.2009.09.003
- Pettigrew, T. F., and Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *J. Personal. Soc. Psychol.* 90, 751–783.
- Pettigrew, T. F., Tropp, L. R., Wagner, U., and Christ, O. (2011). Recent advances in intergroup contact theory. *Int. J. Int. Relat.* 35, 271–280. doi: 10.1016/j.ijintrel.2011.03.001
- Rees, J. H., Klug, S., and Bamberg, S. (2015). Guilty conscience: motivating pro-environmental behavior by inducing negative moral emotions. *Climatic Change* 130, 439–452. doi: 10.1007/s10584-014-1278-x
- Reese, G. (2016). Common human identity and the path to global climate justice. *Climatic Change* 134, 521–531. doi: 10.1007/s10584-015-1548-2
- Reese, G., Proch, J., and Finn, C. (2015). Identification with all humanity: the role of self-definition and self-investment. *Eur. J. Soc. Psychol.* 45, 426–440. doi: 10.1002/ejsp.2102
- Renger, D., and Reese, G. (2017). From equality-based respect to environmental activism: antecedents and consequences of global identity. *Pol. Psychol.* 38, 867–879. doi: 10.1111/pops.12382
- Reysen, S., and Hackett, J. (2016). Further examination of the factor structure and validity of the identification with all humanity scale. *Curr. Psychol.* 35, 711–719. doi: 10.1007/s12144-015-9341-y
- Reysen, S., and Katzarska-Miller, I. (2013). A model of global citizenship: antecedents and outcomes. *Int. J. Psychol.* 48, 858–870. doi: 10.1080/00207594.2012.701749
- Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F., Stuart, et al. (2009). A safe operating space for humanity. *Nature* 461 472–475. doi: 10.1038/461472a
- Römpke, A.-K., Fritsche, I., and Reese, G. (2019). Get together, feel together, act together: international personal contact increases identification with humanity and global collective action. *J. Theoret. Soc. Psychol.* 3, 35–48.
- Rosenmann, A., Reese, G., and Cameron, J. E. (2016). Social identities in a globalized world: challenges and opportunities for collective action. *Perspect. Psychol. Sci.* 11, 202–221. doi: 10.1177/1745691615621272
- Schäpke, N., and Rauschmeyer, F. (2014). Going beyond efficiency: including altruistic motives in behavioral models for sustainability transitions to address sufficiency. *Sustainability: Sci. Pract. Pol.* 10, 29–44.
- Schmitt, M., Baumert, A., Gollwitzer, M., and Maes, J. (2010). The justice sensitivity inventory: factorial validity, location in the personality facet space, demographic pattern, and normative data. *Soc. Just. Res.* 23, 211–238. doi: 10.1007/s11211-010-0115-2
- Schubert, I., Sohre, A., and Ströbel, M. (2020). The role of lifestyle, quality of life preferences and geographical context in personal air travel. *J. Sustainable Tour.* 28 1519–1550. doi: 10.1080/09669582.2020.1745214
- Sorrell, S., Gatersleben, B., and Druckman, A. (2020). The limits of energy sufficiency: a review of the evidence for rebound effects and negative spillovers from behavioural change. *Energy Res. Soc. Sci.* 64:101439. doi: 10.1016/j.erss.2020.101439
- Spangenberg, J. H., and Lorek, S. (2019). Sufficiency and consumer behaviour: from theory to policy. *Energy Policy* 129, 1070–1079. doi: 10.1016/j.enpol.2019.03.013
- Sparkman, D. J., and Eidelman, S. (2018). We are the “human family”: multicultural experiences predict less prejudice and greater concern for human rights through identification with humanity. *Soc. Psychol.* 49, 135–153. doi: 10.1027/1864-9335/a000337
- Sparkman, D. J., and Hamer, K. (2020). Seeing the human in everyone: multicultural experiences predict more positive intergroup attitudes and humanitarian helping through identification with all humanity. *Int. J. Int. Relat.* 79, 121–134. doi: 10.1016/j.ijintrel.2020.08.007
- Speck, M., and Hasselkuss, M. (2015). Sufficiency in social practice: searching potentials for sufficient behavior in a consumerist culture. *Sustainability: Sci. Pract. Policy* 11, 14–32. doi: 10.1080/15487733.2015.11908143
- Spengler, L. (2016). Two types of ‘enough’: sufficiency as minimum and maximum. *Environ. Pol.* 25, 921–940. doi: 10.1080/09644016.2016.1164355
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., et al. (2015). Planetary boundaries: guiding human development on a changing planet. *Science* 347:1259855. doi: 10.1126/science.1259855
- Syme, G. J., and Nancarrow, B. E. (2012). “Justice and the allocation of natural resources: Current concepts and future directions,” in *The Oxford Handbook of Environmental and Conservation Psychology*, ed. S. D. Clayton (Oxford: Oxford University Press), 1–12. doi: 10.1093/oxfordhb/9780199733026.013.0006
- Tajfel, H., and Turner, J. C. (1979). “An integrative theory of intergroup conflict,” in *The Social Psychology of Intergroup Relations*, eds W. G. Austin and S. Worchel (Boston, MA: Brooks Cole), 33–47.
- Tobler, C., Visschers, V. H. M., and Siegrist, M. (2012). Addressing climate change: determinants of consumers’ willingness to act and to support policy measures. *J. Environ. Psychol.* 32, 197–207. doi: 10.1016/j.jenvp.2012.02.001
- Toulouse, E., Sahakian, M., Lorek, S., Bohnenberger, K., Bierwirth, A., and Leuser, L. (2019). Energy sufficiency: how can research better help and inform policy-making?,” in *Proceedings of the Eceee Summer Study*. France: Eceee
- Tröger, J., and Reese, G. (2021). Talkin’ bout a revolution: an expert interview study exploring barriers and keys to engender change towards societal sufficiency orientation. *Sustainability Sci.* doi: 10.1007/s11625-020-00871-1
- Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., and Wetherell, M. S. (1987). *Rediscovering the Social Group: A self-Categorization Theory*. Hoboken, NJ: Basil Blackwell.
- UBA (2019). *Umweltbewusstsein in Deutschland 2018. [Environmental awareness in Germany 2018]*. Lagos: UBA.

- Urry, J. (2008). Climate change, travel and complex futures. *Br. J. Soc.* 59, 261–279. doi: 10.1111/j.1468-4446.2008.00193.x
- Urry, J. (2012). Social networks, mobile lives and social inequalities. *J. Trans. Geography* 21, 24–30. doi: 10.1016/j.jtrangeo.2011.10.003
- Verfuert, C., Henn, L., and Becker, S. (2019). Is it up to them? individual leverages for sufficiency. *GAIA - Ecol. Perspect. Sci. Soc.* 28, 374–380. doi: 10.14512/gaia.28.4.9
- Vilar, R., Milfont, T. L., and Sibley, C. G. (2020). The role of social desirability responding in the longitudinal relations between intention and behaviour. *J. Environ. Psychol.* 70:101457. doi: 10.1016/j.jenvp.2020.101457
- Wynes, S., Donner, S. D., Tannason, S., and Nabors, N. (2019). Academic air travel has a limited influence on professional success. *J. Clean. Prod.* 226, 959–967. doi: 10.1016/j.jclepro.2019.04.109
- Zipori, E., and Cohen, M. J. (2015). Anticipating post-automobility: design policies for fostering urban mobility transitions. *Int. J. Urban Sustainable Dev.* 7, 147–165. doi: 10.1080/19463138.2014.991737

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Loy, Tröger, Prior and Reese. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Resolving Conflicts Between People and Over Time in the Transformation Toward Sustainability: A Framework of Interdependent Conflicts

Johann M. Majer^{1*}, Matthias Barth², Hong Zhang¹, Marie van Treek¹ and Roman Trötschel¹

¹Department of Social, Organizational, and Political Psychology, Faculty of Education, Institute of Psychology, Leuphana University Lüneburg, Lüneburg, Germany, ²Education for Sustainable Development, Faculty of Sustainability, Institute of Sustainable Development and Learning, Leuphana University Lüneburg, Lüneburg, Germany

OPEN ACCESS

Edited by:

Sonja Maria Geiger,
Justus Liebig University, Germany

Reviewed by:

Julia Reif,
Ludwig Maximilian University of
Munich, Germany
Sebastian Bamberg,
Bielefeld University of Applied
Sciences, Germany

*Correspondence:

Johann M. Majer
johann.majer@leuphana.de

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 30 October 2020

Accepted: 22 March 2021

Published: 15 April 2021

Citation:

Majer JM, Barth M, Zhang H,
van Treek M and Trötschel R (2021)
Resolving Conflicts Between People
and Over Time in the Transformation
Toward Sustainability: A Framework
of Interdependent Conflicts.
Front. Psychol. 12:623757.
doi: 10.3389/fpsyg.2021.623757

Transformative and mutually beneficial solutions require decision-makers to reconcile present- and future interests (i.e., intrapersonal conflicts over time) and to align them with those of other decision-makers (i.e., interpersonal conflicts between people). Despite the natural co-occurrence of intrapersonal and interpersonal conflicts in the transformation toward sustainability, both types of conflicts have been studied predominantly in isolation. In this conceptual article, we breathe new life into the traditional dialog between individual decision-making and negotiation research and address critical psychological barriers to the transformation toward sustainability. In particular, we argue that research on intrapersonal and interpersonal conflicts should be tightly integrated to provide a richer understanding of the interplay between these conflicts. We propose a novel, unifying framework of interdependent conflicts that systematically structures this interplay, and we analyze how complex interdependencies between the social (i.e., conflict between decision-makers) and temporal (i.e., conflict within a decision-maker) dimensions pose fundamental psychological barriers to mutually beneficial solutions. Since challenges to conflict resolution in the transformation toward sustainability emerge not only between individual decision-makers but also frequently between groups of decision-makers, we scale the framework up to the level of social groups and thereby provide an interdependent-conflicts perspective on the interplay between intra- and intergenerational conflicts. Overall, we propose simple, testable propositions, identify intervention approaches, and apply them to transition management. By analyzing the challenges faced by negotiating parties during interdependent conflicts and highlighting potential intervention approaches, we contribute to the transformation toward sustainability. Finally, we discuss implications of the framework and point to avenues for future research.

Keywords: conflict, transformation, sustainability, negotiation, intrapersonal conflict, intergenerational conflict, transition management

INTRODUCTION

Human civilization stands at a crossroads. Avoiding a decline of the human species and ensuring its long-term survival requires scaling up human cooperation at all levels, from individual to global (Dreber and Nowak, 2008; Ostrom, 2009; Dannenberg and Barrett, 2018). Sustainability issues such as climatic change, biodiversity loss, and resource depletion can result in a conflict of interests between individuals, groups, organizations, and nations (Hsiang et al., 2013; Mach et al., 2019). These challenges inevitably require collaborative decision-making processes (i.e., negotiations) to coordinate different interests and reach conflict solutions (Barrett and Dannenberg, 2012; Ehrlich and Ehrlich, 2013). Negotiation is a pervasive communication process that is most-widely used to plan for the future, allocate resources, resolve conflicts of interests, and solve complex problems *via* mutually satisfying agreements (Jang et al., 2018).

“[Negotiations] can dramatically reshape the social and physical environments we occupy” (Jang et al., 2018, p. 318). The transformative potential of collaborative decision-making processes to lead to new practices (Asara et al., 2015) has long been recognized by scholars of social conflict. Indeed, Pruitt and Carnevale (1993, p. 15) concluded that “...[negotiation] presides over much of the change that occurs in human society. Conflict often results from dissatisfaction with the status quo, and it often leads to negotiation about how to do things differently. [...] [S]ociety usually prospers if negotiation goes well and the agreements reached are mutually satisfying to the parties. Conversely, society is often harmed when negotiation goes poorly and fails to produce a mutually satisfying outcome.”

Negotiation processes can trigger change at different societal levels (the Multi-level perspective; Geels and Schot, 2007; Geels, 2011). At the micro-level (i.e., niches), at which individual actors operate, negotiation processes can promote sustainability transitions. At the meso-level (i.e., regimes), diverse stakeholders and representatives of social groups (e.g., communities, firms, private and public organizations, political parties, governmental institutions) incrementally transform the current state of society *via* negotiations (Geels, 2020). Across both levels, negotiation processes constitute an essential element of collective sense-making processes and can foster societal change (Geels, 2020).

It is important to note that “the structure and processes of negotiation are fundamentally the same at the personal level as they are at the diplomatic and corporate level” (Lewicki and Litterer, 1985). Indeed, negotiations are interactive human decision-making processes. In line with this reasoning, our conceptual article stands in the tradition of psychological and behavioral decision-making research in assuming that negotiators depart from rationality in systematic ways (e.g., Raiffa, 1982; Neale and Bazerman, 1985; Trötschel et al., 2015). In the transformation toward sustainability, negotiators are confronted with so-called “wicked problems,” which are characterized by systemic complexities, including the involvement of multiple, interdependent actors (Rittel and Webber, 1973). Beyond these social interdependencies, negotiators are also confronted with the critical element of time and temporal interdependencies,

as has been emphasized in the extended conceptualization of “super wicked problems” (Levin et al., 2012; Peters, 2017).

Previous research has revealed that negotiations on sustainability issues are often ineffective and end in suboptimal solutions (Van der Gaast, 2015; Weber and Johnson, 2016; Dannenberg and Barrett, 2018) and that the involved parties, external stakeholders, and – most often – societies would benefit from more-mutually beneficial solutions (Bazerman et al., 1999). We argue that negotiation aimed at the transformation toward sustainability faces fundamental psychological barriers grounded in the conglomeration of social and temporal interdependencies. Given these conflicting interests both between people and over time, exactly how such transformation can be promoted remains unclear. In the psychological literature, two major lines of research have contributed significantly to our understanding of complex decision-making processes: first, the negotiation-research perspective (i.e., how parties resolve conflicts of interests between decision-makers), and second, the individual decision-making perspective (i.e., how decision-makers resolve conflicts between present- and future interests). These two research perspectives have been the focus of a long-standing dialog that has spurred innovation across and beyond lines of research (Raiffa, 1982; for a review, see Tsay and Bazerman, 2009). In the present contribution, we seek to reinvigorate this traditional dialog between the two psychological research areas and address key barriers and drivers in the transformation toward sustainability.

Given that the transformation toward sustainability faces super wicked problems (Levin et al., 2012), including conflicts between people and over time, these conflicts should be considered jointly rather than in isolation. We posit the existence of an interplay between inter- and intrapersonal conflicts (see Thompson and Gonzalez, 1997). Politicians, for instance, “[must] navigate political conflict over climate policy in Congress [...] and within themselves” (Van Boven et al., 2018). Importantly, we believe that the web of interplay between conflicts is difficult to disentangle because negotiators must simultaneously integrate their own interests with those of their counterparts and reconcile their present- and future interests. The interplay between conflicts therefore acts as a significant barrier to the transformation toward sustainability (e.g., Weber and Johnson, 2016). To explicitly delineate the concrete challenges that arise from this interplay between inter- and intrapersonal conflicts, we introduce the concept of interdependent conflicts. We propose that a solution to one conflict (e.g., between decision-makers) impacts the solution to concurrent conflicts (e.g., within decision-makers). Consequently, interdependent conflicts can only be resolved efficiently by considering them simultaneously (see super wicked problems, Levin et al., 2012).

By developing a framework of interdependent conflicts, we contribute to existing research on decision-making and negotiation in the transformation toward sustainability in various ways. First, we provide a unifying structure for complex and interdependent decision-making processes. Second, taking the negotiation perspective, we seek to expand existing research by introducing a temporal dimension (i.e., negotiation agreements

with short-term and long-term consequences). Third, from a multi-level perspective, we offer a systematic link between psychological negotiation research and transition management and highlight negotiation processes at different societal levels. Fourth, from an applied perspective, we aim to provide a more-comprehensive understanding of psychological conflicts in the transformation toward sustainability and to offer potential leverage points with hands-on tools for interventions that foster sustainable solutions. In essence, we seek to encourage future research to further examine human decision-making processes in the context of interdependent conflicts with the goal of fostering the transformation toward sustainability.

THE FRAMEWORK OF INTERDEPENDENT CONFLICTS

Based on the assumption that conflict resolutions depend on one another in the social and temporal dimensions, we derive a basic structure for the framework by distinguishing between three psychological conflicts. The involved parties may experience (1) *present interpersonal conflict* between their own and their counterparts' present interests. This type of conflict has traditionally been investigated by social-conflict- and negotiation research (e.g., De Dreu et al., 2000). Simultaneously, each party may experience (2) *intrapersonal conflict* between their present- and future interests (i.e., the conflict emerges for each party individually). This type of conflict has predominantly been studied by individual decision-making research (e.g., Frederick et al., 2002). Finally, the two parties may also experience (3) *future interpersonal conflict* between their own and their counterparts' future interests. Very few studies have investigated outcome delays and the efficiency of negotiated agreements found in this type of conflict (e.g., Okhuysen et al., 2003; Henderson et al., 2006). The parsimonious framework focuses explicitly on dyadic, two-party conflicts of interests and on

two instances over time (i.e., present- and future interests).¹ **Figure 1** illustrates the proposed framework of interdependent conflicts for individual decision-makers.

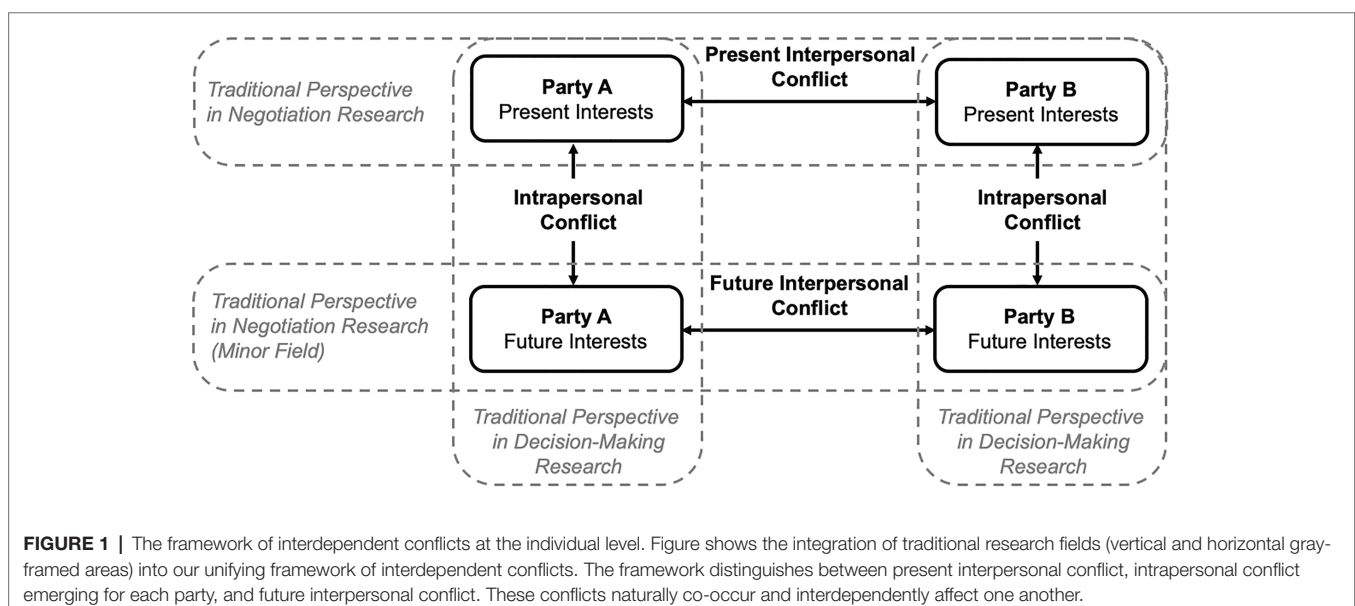
Our paper is structured as follows: To establish our framework, we first introduce interdependent conflicts at the individual level. In so doing, we review the existing literature, outline characteristic psychological processes, derive propositions, and conclude with an intervention approach to addressing the proposed problems at the individual level. Second, we scale up our framework from the individual-group to the social-group level to establish interdependent conflicts as an interplay between inter- and intragenerational conflicts. We then follow the same structure as at the individual level.

INTRODUCING INTERDEPENDENT CONFLICTS AT THE INDIVIDUAL LEVEL

Interpersonal Conflicts

Interpersonal conflicts emerge whenever two or more parties perceive their views or interests as being incompatible (Jehn, 1995), and negotiation is the decision-making process

¹Besides the specified psychological conflicts in the framework, two other psychological conflicts might emerge for each party (i.e., an interpersonal conflict over time in which one party's present interests conflict with the counterpart's future interests and an interpersonal conflict over time in which one party's future interests conflict with the counterpart's present interests). These interpersonal conflicts over time directly reflect the unique characteristic of interdependent conflicts. Since conflicts are interdependent, the specified three different types of psychological conflicts in our framework can determine the parties' interpersonal conflicts over time. Therefore, the framework of interdependent conflicts implicitly integrates these interpersonal conflicts over time. For conciseness reasons, the presented version of the framework of interdependent conflicts offers the most parsimonious version that may be extended in future research on interdependent conflicts in the transformation toward sustainability. Our reasoning also applies to interdependent conflicts at the level of social groups that we address in the latter part of the article.



that parties with divergent interests use to reconcile their differences (Pruitt and Carnevale, 1993). Traditionally, the interest structure of interpersonal conflicts has been a central element of theorization and research (e.g., Gelfand et al., 2011). In general, the literature distinguishes between convergent- and divergent-interest structures: (1) When parties have convergent interests, these interests are compatible, and no interpersonal conflict emerges. By contrast, when parties have divergent interests, these interests can be (2a) diametrically opposed, resulting in a distributive-interest structure (i.e., a zero-sum structure without opportunities for exploring integrative, win-win solutions). In zero-sum negotiations, the best solution for both parties is a compromise (Pruitt and Carnevale, 1993). When parties have divergent interests, these interests can also be (2b) opposed, but since the parties have different priorities, they form an integrative-interest structure, which includes mutually beneficial trade-off opportunities and allows the parties to explore integrative agreements (i.e., win-win agreements; Pruitt and Carnevale, 1993). In contrast to compromise agreements, integrative agreements create value for both parties and therefore leave them better off than would a compromise (e.g., Bazerman et al., 1985). Importantly, in order to exploit integrative potential and reach mutually beneficial, transformative solutions, parties must consider their own and their counterparts' underlying interests and coordinate them *via* negotiations.

In interpersonal conflicts, negotiators typically display the detrimental psychological tendency to devalue their counterparts' interests (Thompson and Hastie, 1990; Babcock and Loewenstein, 1997; Curhan et al., 2004). Parties therefore have a biased idea of how to resolve a social conflict in favor of their own interests. Pinkley et al. (1995) demonstrated that negotiators devalue their counterparts' interests and thus create suboptimal agreements even though the parties have complete information on their counterparts' interests. As parties have a basic propensity toward interpersonal devaluation, resolving interpersonal conflicts is difficult and often leads to suboptimal agreements (Schelling, 1958; Bazerman and Neale, 1992).

Intrapersonal Conflicts Over Time

The Individual Decision-Making Perspective

Decision-makers who experience intrapersonal conflict must make a choice between different alternatives that entail consequences that occur at different times (e.g., Soman et al., 2005). People must weigh immediate against future utility (Loewenstein, 1988) and thus make "trade-offs among costs and benefits occurring at different times" (Frederick et al., 2002). In the transformation toward sustainability, intrapersonal conflicts are ubiquitous and challenging to decision-makers, for instance, when choosing between maintaining the status quo or developing an alternative with substantial long-term benefits (Weber, 2017).

Research has demonstrated that people tend to temporally devalue their own future interests relative to their immediate ones (for a review, see Frederick et al., 2002). As individuals put a premium on immediate benefits, they often prefer smaller, immediate benefits over larger, later ones (Weber, 2017).

Hardisty and Weber (2009, p. 329) describe this human tendency as a "strong desire, all things being equal, to get things now." Decision-makers therefore have a biased idea in favor of their present interests in terms of how to resolve the temporal conflict.

The Negotiation Perspective

Social-conflict research metaphorically describes intrapersonal conflicts as two psychological states with opposing interests in which one party seeks to protect present interests and the other to protect future interests (Bazerman et al., 1998). Schelling (1984, p. 58) describes this situation with the following metaphor: "Everybody behaves like two people, one who wants clear lungs and long life and the other who adores tobacco, or one who wants a lean body and the other who wants dessert... the 'straight' one often in command... but the wayward one needing only to get occasional control to spoil the other's best-laid plans."

Read et al. (1999) indicate that such intrapersonal conflict can have similar interest structures to interpersonal conflict. (1) When a decision-maker has convergent interests, present- and future interests are compatible, and no intrapersonal conflict emerges. When one decision-maker has divergent interests, present- and future interests can be (2a) diametrically opposed, resulting in a distributive-interest structure over time. In this case, the decision-maker prefers the diametrically opposed option now as opposed to later. Alternatively, the decision-maker's present- and future interests can also be (2b) opposed but have different priorities, resulting in an integrative-interest structure over time. Preference-consistent trade-offs can therefore also reconcile a party's interests over time in individual decision-making. Read et al. (1999, p. 184) suggest that "analogously [to interpersonal conflicts], individual decision-makers can reach integrative agreements with themselves, if they consider the possibility of trade-offs across the many choices that they face." To reach efficient solutions in an intrapersonal conflict, decision-makers must consider their own present- and future interests and reconcile them by negotiating with themselves over time (Bazerman et al., 1998). Therefore, researchers argue that intrapersonal conflicts are as difficult to resolve as interpersonal conflicts (Bazerman et al., 1998).

Characteristic Psychological Processes in Inter- and Intrapersonal Conflicts

In the following sections, we highlight the central psychological processes involved in the interplay between interdependent conflicts based on the reviewed literature. We remain fully aware that other cognitive, motivational, and affective processes may also contribute to inefficient conflict resolution.

Interpersonal and Intertemporal Devaluation

As parties are prone to devalue others' present interests and their own future interests (Babcock and Loewenstein, 1997; Frederick et al., 2002), we conclude that devaluing interests is likely the dominant psychological tendency in interdependent conflicts. Decision-makers face three distinct interests in addition to their own present interests: their counterparts' present interests, their own future interests, and their counterparts'

future interests. Solutions to interdependent conflicts are hence impaired by either interpersonal devaluation, intertemporal devaluation, or both: In a present interpersonal conflict, a party socially devalues their counterparts' present interests. In an intrapersonal conflict, a party temporally devalues their own future interests. In a future interpersonal conflict, a party interpersonally and intertemporally devalues their counterparts' future interests. In line with previous research (Wade-Benzoni and Tost, 2009; Charlton et al., 2013), devaluation should be strongest in future interpersonal conflicts due to the duality of interpersonal and intertemporal devaluation.

Outcome Interdependence and Decisional Control

In addition to the processes of interpersonal and intertemporal devaluation, outcome interdependence and decisional control play an important role in interdependent conflicts. Following Interdependence Theory (Kelley and Thibaut, 1978), the structure of any given interdependence situation can be described in terms of specific features that aid in the understanding of psychological processes (Rusbult and Van Lange, 1996). Outcome interdependence and decisional control differ systematically across types of psychological conflicts. Specifically, the degree of outcome interdependence varies across inter- and intrapersonal conflicts. Whereas Party A's outcomes are interdependent on Party B's outcomes (interpersonal conflict), Party A's future outcomes are purely dependent on its present outcomes (intrapersonal conflict). Consequently, parties' decisional control also ranges across conflicts, from joint control in interpersonal conflicts to actor control in intrapersonal conflicts.²

In intrapersonal conflict, decision-makers face a situation with outcome dependence and full actor control and can decide how to resolve a conflict between their own present- and future interests independently of their counterparts. Herrnstein and Prelec (1991) describe actor control with a metaphor from the courtroom: The moment that a temporal decision is made, the actor functions as both "judge and jury." In intrapersonal conflicts, parties have full actor control to simply overrule their own future interests and only serve their present interests, or vice-versa (see also Loewenstein, 1996).

By contrast, in interpersonal conflicts, parties face a situation with outcome interdependence and joint control – that is, both parties' outcomes are mutually dependent on the decisions and actions of their counterparts. Parties thus have joint control and must therefore coordinate their decisions with those of their counterparts. Joint control has been metaphorically described by conflict scholars as the "negotiation dance" (Raiffa, 1982) to highlight the coordination of decisions and actions in interpersonal conflicts.

Based on the distinction between full actor and joint control, parties could perceive of having different degrees of freedom in resolving their conflicts of interests over time and between people. Specifically, conflicts over time (i.e., outcome dependence) may be resolvable *via* actor control. By contrast, conflicts between people (i.e., outcome interdependence) may only

be resolvable *via* joint control. Due to these differences across conflicts, parties may experience more constraints in resolving conflicts of interests with their counterparts (i.e., joint control) compared with resolving conflicts of interests with themselves (i.e., actor control). We therefore conclude that negotiators tend to prioritize the resolution of inter- over intrapersonal conflicts because solutions between people require interpersonal coordination, whereas solutions over time are less constrained by coordination with other parties.

Parties' Consideration of Interdependent Conflicts

Building on the above-mentioned research, our framework of interdependent conflicts postulates how parties cognitively process the interplay between different psychological conflicts. In contrast to a rational approach in which parties cognitively process interdependent conflicts in a comprehensive, unbiased way (i.e., by considering all the consequences of their actions equally), we hypothesize that parties systematically prioritize the consideration of certain conflicts in a biased way.

Prioritizing the Consideration of Interdependent Conflicts

Proposition 1: In interdependent conflicts, parties prioritize the consideration of present interpersonal conflicts (first priority) over intrapersonal conflicts (second priority) and future interpersonal conflicts (third priority).

These priorities are derived both from parties' tendency to discount their future interests (Frederick et al., 2002) and to devalue their counterparts' interests (Babcock and Loewenstein, 1997) as well as from the parties' differences in decisional control (Kelley and Thibaut, 1978). When considering present interpersonal conflicts, parties devalue their counterparts' present interests only on the interpersonal dimension. When considering intrapersonal conflicts, parties devalue their future interests only on the temporal dimension. However, when considering future interpersonal conflicts, they devalue not only their own future interests on the temporal dimension but also their counterparts' future interest on the interpersonal and intertemporal dimension. This devaluation should lead to a more-pronounced consideration of the present inter- and intrapersonal conflict compared with future interpersonal conflicts. However, as detailed above, in addition to devaluation, parties also experience less decisional control and more constraints when resolving inter- over intrapersonal conflicts. Together, this observation should lead to a prioritized consideration of present interpersonal conflicts (first priority) over intrapersonal conflicts (second priority) and future interpersonal conflicts (third priority; see **Figure 2**). Consequently, parties' prioritization of interdependent conflicts should impair a balanced and comprehensive consideration of conflicts. Noteworthy, such a prioritization of conflicts should result in an unbalanced and biased way of processing interdependent conflicts.

²Another extreme is partner control (e.g., Van Lange and Balliet, 2015), which is omitted here for reasons of simplicity.

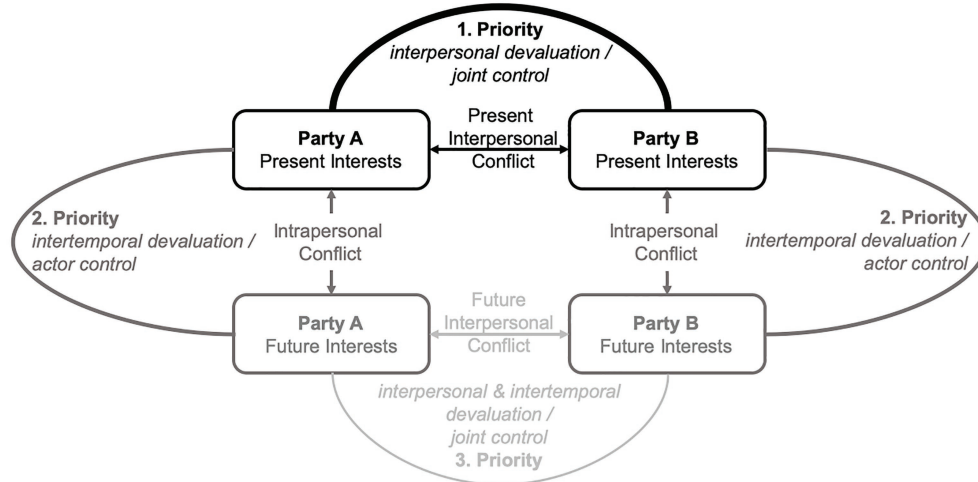


FIGURE 2 | Prioritized consideration of interdependent conflicts. We propose that parties prioritize present interpersonal conflicts (first priority) over intrapersonal conflicts (second priority) and future interpersonal conflicts (third priority).

In line with this reasoning, prioritizing the consideration of conflicts should also determine which conflict is resolved at the cost of another.³ We postulate that conflicts with a higher-order priority (e.g., a present interpersonal conflict) are likely to be resolved at the cost of resolving conflicts with a lower-order priority (e.g., an intrapersonal conflict). This biased prioritization may have important implications for resolving interdependent conflicts and threaten the transformation toward sustainability.

Initial support for our assumptions can be found in a survey study (Drory and Ritov, 1997) that investigated conflict-management strategies when parties experienced only an interpersonal conflict vs. both an interpersonal conflict and an intrapersonal conflict. Parties preferred more-cooperative strategies for resolving the present interpersonal conflict when they experienced the intrapersonal conflict simultaneously as compared with when they did not. Similarly, parties that experienced interdependent conflicts were more inclined to collaborate with their counterparts when the intrapersonal conflict between present interests and long-term adverse consequences was made explicit (vs. implicit; Ritov and Drory, 1996). This finding is in line with recent

research revealing that parties value agreements over impasses when dealing with present interpersonal conflicts, even if the impasse would lead to more-profitable outcomes than would the achieved agreement (Tuncel et al., 2016).

Effects of Priorities in the Consideration of Conflicts on the Quality of Agreements

Proposition 2: Prioritizing the consideration of conflicts determines the extent to which parties can exploit integrative potential and reach integrative agreements.

To resolve interdependent conflicts in an integrative way, decision-makers must consider their interests in a comprehensive rather than in an isolated, prioritized way. From a rational perspective, parties can maximize the utility of a solution (Raiffa, 1982) by making integrative trade-offs between their own and their counterparts' interests (i.e., interpersonal conflict) and between their present- and future interests (i.e., intrapersonal conflict). Such trade-off opportunities can only be exploited when parties consider the conflicts in a comprehensive, unbiased way. However, the predicted tendency to prioritize conflicts should lead to a biased, prioritized consideration and therefore hinder parties in exploiting integrative potential. Specifically, if integrative potential is found in the intrapersonal conflict or even in the future interpersonal conflict, parties should neglect these trade-off opportunities and instead seek to resolve the present interpersonal conflict. Consequently, prioritizing conflict consideration can be particularly detrimental because parties do not consider all trade-off opportunities in a comprehensive, unbiased way and may thus overlook mutually beneficial and transformative solutions.

O'Connor et al. (2002) showed that responders in a simulated-ultimatum game rejected more bids (i.e., forewent favorable solutions in an intrapersonal conflict) when instructed to focus on the present interpersonal conflict compared with the

³Psychological conflicts may be either independent, positively interdependent, or negatively interdependent. When conflicts are independent of one another, one conflict can be resolved without any consequences for resolving the other. In current individual- and societal challenges, conflicts are rarely independent of one another (super wicked problems; (Levin et al., 2012). By contrast, in most current social issues, interdependence between conflicts occurs: Parties' consideration of their present interests in an interpersonal conflict usually impacts their consideration of interests in the future, and vice versa. When conflicts are positively interdependent, resolving one psychological conflict also facilitates finding a solution to the other interdependent conflict. However, positive interdependence does occur in real-world settings, albeit rarely. Most importantly, though, when psychological conflicts are negatively interdependent, parties' efforts to resolve one conflict impede efficiently resolving the other interdependent conflict. We therefore only focus on negative interdependence between conflicts in our framework.

intrapersonal conflict. This finding provides initial support for our assumptions on the detrimental effects of prioritizing interdependent conflicts.

An Intervention Approach to Addressing a Prioritized Consideration of Conflicts

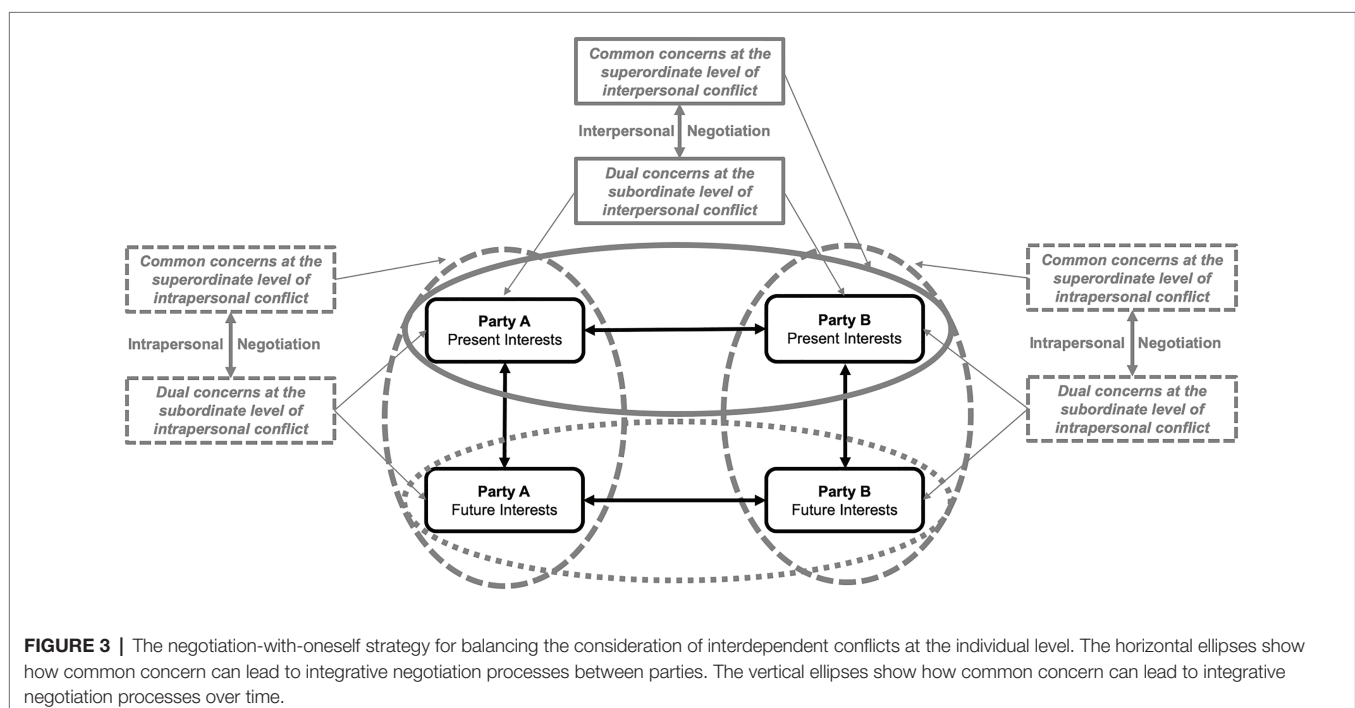
We assume that prioritizing the present interpersonal conflict is caused – in part – by constraints in decisional control. Resolving interpersonal conflicts requires negotiating between parties to overcome divergent interests, whereas resolving intrapersonal conflict does not require negotiating to overcome divergent interests in the present or future. To balance the consideration of interdependent conflicts, we propose also applying a negotiation strategy to intrapersonal conflicts over time (Bazerman et al., 1998). Negotiating “with oneself” should help parties reach integrative solutions over time and raise the priority of intrapersonal conflicts.

Social-conflict research has revealed that integrative solutions are particularly likely when each negotiator (1) has a strong concern for his or her own outcomes (dual concerns at a subordinate level; Pruitt and Carnevale, 1993; De Dreu et al., 2000) and (2) takes both parties’ common interests into consideration (common concerns at a superordinate level; Rhoades and Carnevale, 1999; De Dreu et al., 2000; Trötschel et al., 2011, 2021). Accordingly, parties should be concerned about (1) their present- and future interests (dual concerns at a subordinate level) and (2) their common interests over time (common concerns at a superordinate level). Considering dual and common concerns over time should trigger negotiating with oneself, and this strategy should raise the intrapersonal conflict to the same level of priority as the interpersonal conflict. Simultaneously, raising the priority of intrapersonal conflicts

by negotiating with oneself should also lead to an increase in the priority of future interpersonal conflicts. Overall, we posit that combining interpersonal and intrapersonal negotiation should lead to a balanced, unbiased, comprehensive consideration of interdependent conflicts (see Figure 3).

Applying the Intervention Approach to the Transformation Toward Sustainability

Negotiations play a vital role in community-led grassroots innovations that are niche spaces supporting local-scale transitions toward sustainability (e.g., Raven et al., 2008; Seyfang and Haxletine, 2012; Ornetzeder and Rohracher, 2013). Grassroots initiatives have been shown to foster change in diverse areas, such as mobility or energy (Ornetzeder and Rohracher, 2013). However, a crucial success factor for exploiting the transformative potential of grassroots innovations is the successful negotiation and mutually-beneficial conflict resolution. Conflicts emerge because local partners and stakeholders of such an initiative may have at least some common interests but may also have opposing interests in reaching their shared objectives. For instance, individual owners of cooperative housing apartments may share their interest in investing in energy-efficient buildings, but may have diverging interests in the potential pathways to reach this energy transition. Some of the owners may prefer to install solar panels on the rooftop, whereas others may prefer to maintain the rooftop accessible for the residents and to use other energy sources for powering the building energy-efficiently. As they can only reach their objectives jointly, the cooperative owners must negotiate strategies that lead to the intended transformation of existing structures. However, all involved actors may enter negotiations by positioning their interests in their immediate and local context that may hinder



the implementation of the pathway toward innovation. Both our framework of interdependent conflicts and the suggested intervention approach of intrapersonal negotiations for reconciling one's present- and future interests may help to facilitate successful negotiations in grassroots innovations. Therefore, implementing the proposed intervention approach in the context of community-led grassroots initiatives requires that individual actors are concerned with their dual interests in the present and future at a subordinate level as well as with their common interests at a superordinate level. At a subordinate level, future interests come into play when the involved actors formulate long-term goals, develop a vision, and specify their expectations for the transition toward sustainability. Present interests may guide decision-making when searching for pathways to implement the innovation. Additionally, at the superordinate level, actors should share the common concern that radical innovation will lead to the intended transformation toward sustainability. When actors consider their dual and common concerns, intrapersonal negotiation may be initiated, and a prioritized consideration of conflicts may be debiased. As a consequence, negotiation processes between local actors may be improved and lead to more-mutually beneficial and transformative solutions for the societal transformation sparked by grassroots initiatives.

Tools for Implementing the Intervention Approach

Tools for implementing the negotiation-with-oneself strategy can be derived from both decision-making- and social-conflict research. Decision-making research suggests that an increasing similarity between one's present- and future self may trigger a party's readiness to negotiate with themselves (e.g., Bartels and Urminsky, 2011; Herschfield, 2011; Urminsky, 2017). Alternatively, changing the primary default consideration from present- to future interests may also stimulate intrapersonal negotiations (Weber et al., 2007; Sunstein and Reisch, 2013). Social-conflict research suggests that perspective-taking of one's own future interests may also help induce negotiations with oneself over time and balance the consideration of interdependent conflicts (Galinsky et al., 2008; Trötschel et al., 2011). Furthermore, learning approaches that support analogous reasoning in transferring integrative insights from one type of psychological conflict to another could facilitate interdependent-conflict resolution (Thompson and DeHarrow, 1994; Gillespie et al., 1999; Nadler et al., 2003; Kim et al., 2020).

Although interventions may support negotiators in reaching mutually beneficial, transformative solutions, reaching integrative solutions at the level of social groups has been shown to be even more challenging (Loschelder and Trötschel, 2010; Trötschel et al., 2010). However, the transformation toward sustainability most-often requires negotiations between social groups, such as between larger institutions or organizations that represent certain interests (Majer et al., 2018). Compared with interpersonal conflict, intergroup conflict stands out in terms of the distinct psychological processes involved. To further elucidate the psychological barriers to and drivers of interdependent conflicts at the group level, we next scale our framework up and focus on intergenerational conflict.

Such situations include central psychological barriers that hinder us from taking dramatic action in the transformation toward sustainability (Ehrlich and Ehrlich, 2013).

INTRODUCING INTERDEPENDENT CONFLICTS AT THE LEVEL OF SOCIAL GROUPS: THE INTERPLAY BETWEEN INTRA- AND INTERGENERATIONAL CONFLICTS

At the zenith of the COVID-19 pandemic in July 2020, the European Union agreed on the largest budget and financial package in its history to address the aftermath of the once-in-a-century-pandemic crisis. This negotiation had implications not only for member states within the present generation but also for their successor generations to come. The talks lasted almost 100 h because the member states' contributions were heavily disputed. After an agreement had been reached, Chancellor Merkel was relieved that Europe had shown that it can come together after all (Erlanger and Stevis-Gridneff, 2020). However, other European politicians criticized the fact that the funds for important future EU projects had been cut back to reach a deal between the member states (DLF, 2020).

This example can be systematically structured using the framework of interdependent conflicts. Conflicts in the transformation toward sustainability include a social dimension between groups (i.e., intragenerational conflict between different groups within a current generation) and a temporal dimension between generations over time (i.e., intergenerational conflict between the predecessor and successor generation of a single group; Sherstyuk et al., 2016; Bosetti et al., 2020). In line with our framework, scholars have proposed that "many real-world intergenerational dilemmas [i.e., over time] are confounded by intragenerational social dilemmas [i.e., between groups]" (Wade-Benzoni et al., 2008). Following this reasoning, we systematically differentiate between three types of psychological conflicts (**Figure 4**): (1) *present intragenerational conflict* (i.e., between different groups within the present generation); (2) *intergenerational conflict* (i.e., between the predeceasing present generation and succeeding future generation of a single group); and finally, (3) *future intragenerational conflict* (i.e., between different groups within the future generation; see Footnote 1).⁴

Intergroup Conflicts (i.e., Intragenerational Conflict)

A group consists of two or more individuals connected by social relationships (Forsyth, 2014). These relationships can be established objectively *via* outcome interdependence between

⁴We are aware that different constellations between present- and future generations can be conceived (e.g., generations living at the same time, group representations). However, we follow the standard definition and focus explicitly on the basic situation in which the present generation (as predecessors) has no contact with the future generation (as their successors; Wade-Benzoni and Tost, 2009; Bosetti et al., 2020).

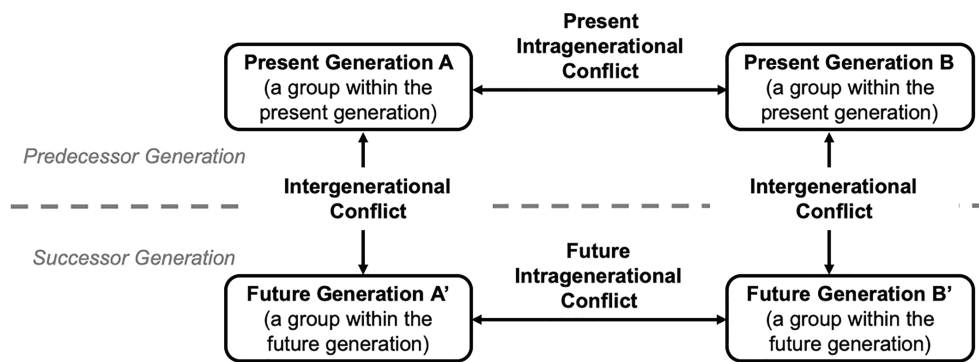


FIGURE 4 | The framework of interdependent conflicts in the intergenerational context. Figure 4 displays the interplay between the arising present intragenerational conflict (i.e., the conflict between different groups within the present generation), the intergenerational conflict (i.e., the conflict between the predecessor and successor generation of a group), and the future intragenerational conflict (i.e., the conflict between different groups within the future generation).

individuals, which induces the formation of groups (Lewin, 1948). Alternatively, relationships can also be established subjectively by assigning memberships to in-groups or out-groups to oneself and others based on similarity (Tajfel, 1981). The conflicts between groups can be described as incompatibilities in the different groups' values and/or goals, which may be caused by outcome interdependence and/or perceived similarity (Boehm et al., 2020). This idea implies that intergroup conflict may involve not only economic interests but also categorization as an in- or out-group. In the transformation toward sustainability, the two foundations of intergroup conflict often arise in combination (e.g., Majer et al., 2018; Schuster et al., 2020).

Early theorizations on the causes of intergroup conflict focused on economic interests in (scarce) resources as the root of competition in intergroup conflict (Sherif and Sherif, 1953; Sherif, 1961; Campbell, 1965). When comparing interpersonal and intergroup interactions, research found that intergroup relations are more competitive than are interpersonal relations (Wildschut and Insko, 2007) and suggested that fear and greed explain this discontinuity effect in intergroup interactions (Wildschut and Insko, 2007). Specifically, fear is based on the expectation that the other group will maximize its outcome, which poses a threat to the given group and increases competition. By contrast, greed is based on the expectation that the other group will tend to cooperate, which makes the other group vulnerable to the given group's greed and increases competition.⁵

However, another line of research suggests that merely categorizing oneself and others as members of an in- and out-group, respectively, is sufficient to induce intergroup conflict (Tajfel and Turner, 1979, 1986). Specifically, Self-Categorization Theory posits that individuals are motivated to make themselves positively distinct from others by comparing themselves to others on relevant dimensions (Turner et al., 1987). If comparisons are favorable for the in-group relative to the out-group, people

can make themselves positively distinct, with beneficial and direct consequences for their self-concept and self-esteem. Evidence shows that people strive for positive distinctiveness (for an overview, see Boehm et al., 2020), which can be obtained *via* different strategies, including social competition, for instance, by discriminating the out-group.

Overall, greed and fear as well as the need for positive distinctiveness all contribute to intergroup devaluation. Greed and fear are particularly pronounced when outcome interdependence exists. However, the need for positive distinctiveness can be explained by the psychological process of self-categorization as an in- or out-group member.

Intragroup Conflicts Over Time (i.e., Intergenerational Conflict)

In contrast to intergroup conflicts within a generation (e.g., Barrett and Dannenberg, 2012), much-less work has focused on intergenerational conflicts over time (e.g., Hauser et al., 2014). From a psychological perspective, intergenerational conflicts (Wade-Benzoni and Tost, 2009) are characterized as decisions in which the interests of present decision-makers stand in conflict with those of future others. Such intergenerational conflicts have distinctive features as compared with intergroup (i.e., intragenerational) conflicts (Wade-Benzoni and Tost, 2009).

Specifically, outcomes are not reciprocally interdependent in intergenerational conflicts. Instead, the outcomes of the future generation are fully determined by the present generation. Present generations therefore have complete actor control without the need to coordinate their interests with future others. Consequently, future generations have no voice in intergenerational conflicts (see outcome interdependence; Kelley and Thibaut, 1978). In addition, present generations do not have to bear the long-term consequences of their decisions and actions because they are not part of the generation that experiences the consequences. Furthermore, no direct or indirect reciprocity between the present- and future generation is possible (Wade-Benzoni and Tost, 2009). The future generation cannot give anything back or punish the present generation. This lack of direct or indirect reciprocity also implies a lack of

⁵Various explanatory mechanisms are discussed in the fear- and greed perspective for situations in which groups' outcomes are interdependent, but these mechanisms lie beyond the scope of this article.

communication between the present- and future generations. Importantly, in intergroup conflicts between different groups within a current generation, reciprocity, and communication have been shown to increase cooperation and lead to more-mutually beneficial solutions (e.g., Tavoni et al., 2011; Yoeli et al., 2013). However, as the direct experience of consequences, reciprocity, and communication are ruled out in intergenerational conflict, cooperation, and integrative solutions between the present- and future generation are further exacerbated. In intergenerational conflicts, the future generation's outcomes depend on the present generation's beneficence (i.e., intergenerational beneficence), which is often lacking (Sherstyuk et al., 2016; Bosetti et al., 2020). To increase intergenerational beneficence, it is therefore necessary for a perceived similarity between the present- and future generation to exist and for the present generation to identify with the future generation.

Characteristic Psychological Processes in Intra- and Intergenerational Conflicts

Intergroup Devaluation

Intergroup devaluation can be explained by the processes of greed and fear in intergroup relations as well as by the need for positive distinctiveness in comparison with the out-group. Intergroup devaluation has been found to be particularly prominent in present- and future intragenerational conflicts, which renders these conflicts difficult to resolve.

Intergenerational Devaluation (i.e., Intergroup- and Intertemporal Devaluation)

Intergenerational conflicts are difficult to resolve because intergroup- and intertemporal devaluation jointly impede integrative conflict resolution. The future generation's interests are devalued temporally. In addition, intergroup devaluation arises because the present- and future generations are typically not part of the same collective. Both intergroup- and intertemporal devaluation are additive components of intergenerational devaluation, which is the major barrier to integrative solutions in intergenerational conflicts (Wade-Benzoni and Tost, 2009). Although the degree of intergenerational devaluation should depend on perceived similarities between the present- and future generation, in general, the need for positive distinctiveness should be more-pronounced in intragenerational conflicts between distinct groups within the present generation. However, in the case of intergenerational conflicts, intergroup- and intergenerational devaluation can accumulate and lead to severe devaluation against the opposing groups' successor generation in the future.

Outcome Interdependence and Decisional Control

Outcome interdependence in intragenerational conflict only exists between the two different groups within the present generation. In intergenerational conflict over time, however, future generations outcomes fully depend on the present generation. Concerning decisional control (Kelley and Thibaut, 1978), intragenerational conflict can only be resolved *via* joint control because one group within the present generation must coordinate its interests with another group of the same generation. By contrast, the

present generation has full actor control in intergenerational conflicts because this generation fully determines the consequences for the succeeding future generations.

Parties' Consideration of Interdependent Conflicts Across Generations

In line with the general assumption of our framework of interdependent conflicts, we postulate that social groups cognitively process different psychological conflicts in a biased way. This idea stands in contrast to a rational approach in which groups cognitively process interdependent conflicts in a comprehensive, unbiased way (i.e., they equally consider all consequences of their actions).

Prioritizing Interdependent Conflicts Within and Between Generations

Proposition 3: In interdependent conflicts at the social-group level (i.e., generations), parties prioritize the consideration of present intragenerational conflicts (first priority) over intergenerational conflicts (second priority) and future intragenerational conflicts (third priority).

Social groups have a tendency to prioritize present intragenerational conflicts because joint control with the other group within the present generation places constraints on the decision-making process and requires coordination between groups. This joint control stands in contrast to intergenerational conflicts over time, which should be given second priority because the present generation has full actor control when it comes to resolving these conflicts. In line with this reasoning, future intragenerational conflicts should be given third priority because in addition to intergenerational devaluation, the need for positive distinctiveness from the other group (i.e., intergroup devaluation) also contributes to the prioritization of these conflicts.

These priorities also determine which conflict will be resolved at the cost of another. Conflicts of higher priority may be resolved at the cost of lower-priority conflicts because present intragenerational conflicts should receive more consideration than intergenerational conflicts or future intragenerational conflicts. Prioritizing the consideration of interdependent conflicts thus has important implications for the transformation toward sustainability.

Recent research has found initial support for Proposition 3 (Sherstyuk et al., 2016) by showing that adding the dimension of intergenerational conflict over time to the dimension of intragenerational conflict renders conflict resolution between parties more short-sighted.

Effects of Priorities in the Consideration of Conflicts on the Quality of Agreements

Proposition 4: A prioritized consideration of conflicts determines the extent to which social groups (i.e., generations) can exploit the integrative potential and reach integrative agreements.

To achieve mutually beneficial, transformative solutions at the group level, a balanced and unbiased consideration of all conflicts (rather than a prioritized consideration) is necessary. However, we assume that the involved groups prioritize conflicts with detrimental consequences. Specifically, parties consider the coordination of diverging interests in higher-priority conflicts to a greater extent than in lower-priority conflicts. Integrative potential and the trade-off opportunities embedded within lower-priority conflicts are therefore less-likely to be discovered. A prioritized, biased consideration of conflicts should thus result in suboptimal solutions for involved groups. In other words, resolving interdependent conflicts should be transformative and mutually beneficial if future generations' interests are considered in an unbiased and balanced way.

Jacquet et al. (2013) provided initial evidence for Proposition 4 by experimentally demonstrating that when a temporal dimension is introduced in intergroup conflicts, conflict resolution is less optimal than when the intergroup conflict has no long-term consequences.

An Intervention Approach to Addressing a Prioritized Consideration of Interdependent Conflicts Across Generations

Based on research on social conflict and negotiation (e.g., De Dreu et al., 2000) and on intergroup conflict (e.g., Dovidio et al., 2000), we develop an intervention approach tailored to balance the consideration of interdependent conflicts between social groups. Research has shown that the perception of belonging to distinct, opposed groups ("us" vs. "them") can be changed *via* interventions (Dovidio et al., 2000). Specifically, by re-categorizing one's own group and the other group into subgroups of one superordinate, common in-group identity (the new "we" – i.e., two subgroups within one group; Gaertner et al., 1993, 1994), intergroup conflict can be reduced. Importantly, managing intragenerational conflict *via* negotiations requires that (1) the two subgroups consider their common concerns by creating a new superordinate, common in-group identity and (2) that each subgroup maintain its distinct group membership and consider its dual concerns (i.e., creating a common in-group identity, while maintaining dual identities). If the groups consider their superordinate, common in-group identity and common concerns, while simultaneously considering their dual identities and dual concerns, intragenerational conflicts can be resolved in an integrative, unbiased way (Gaertner et al., 2016).

To balance the consideration of interdependent conflicts across social groups and time, we transfer the intervention approach from intra- to intergenerational conflict. We find the classic, common in-group-identity approach particularly suitable for stimulating negotiations with future others in an integrative way. As a prerequisite, the present generation should (1) create a common in-group identity with their succeeding future generation that includes common concerns shared by the present- and future generations and (2) acknowledge their distinct dual identities over time – including dual concerns of the present- and future generations – in order to stimulate negotiations with future others.

However, in intergenerational conflict, future generations have no voice to stand up for their concerns. As communication between present- and future generations is ruled out, a shift toward future generations' interests is necessary to elicit negotiations with future others. We propose that present generations be held responsible for resolving intergenerational conflicts *via* negotiations. Contemporary representatives of the future generation may take responsibility for speaking up for their generations' interests (Kamijo et al., 2017). This negotiating-with-future-others strategy combines a common in-group-identity approach with a representation of future generations in order to foster integrative solutions. Negotiating with future others also raises the priority of the intergenerational conflict compared with that of the present intragenerational conflict, thereby leading to a more-balanced consideration of interdependent conflicts. If each present generation uses the negotiating-with-future-others strategy, a more-balanced consideration of the future intragenerational conflict should also be reached. Overall, negotiating with future others should be a particularly suitable approach to balancing the consideration of interdependent conflicts and fostering mutually beneficial and transformative solutions (Figure 5).

Applying the Intervention Approach to the Transformation Toward Sustainability

Negotiations are also an integral part of the transition management approach (Meadowcroft, 2009; Loorbach, 2010; Schreuer et al., 2010), which typically seeks to regulate and govern fundamental processes of societal change that may take generations to realize (Frantzeskaki et al., 2012). During this transition, the sustainability value of intergenerational justice must be protected. However, the involved societal groups of the present generation may enter negotiations by positioning their interests in their direct and immediate context, thereby leading to suboptimal solutions (Loorbach, 2010). In particular, the different interest groups within the present generation may experience short-term need for compromises, whereas succeeding future generations need long-term ambitions for radical change (Frantzeskaki et al., 2012). Traditionally, transition management distinguishes between four types of circular-governance activities to facilitate sustainability transitions: strategic, tactical, operational, and reflexive activities (Loorbach, 2010). The strategic and tactical activities in the transition-management cycle are largely interest-driven and require negotiation between representatives and delegates of larger societal interest groups, organizations, or institutions that have the capacity to contribute to the vision of the transition. Particularly during the tactical-activity phase of the transition-management cycle, the development of a concrete transition agenda requires the negotiation and coordination of interests between groups within the present generation and the alignment of these interests with those of future generations. In an exemplary innovation program on future urban mobility (e.g., urban-living labs, von Wirth et al., 2018), stakeholder groups of the present generation such as local residents, public transportation services, private mobility providers, and city authorities develop transition scenarios (Sondeijker et al., 2006), which are descriptions of

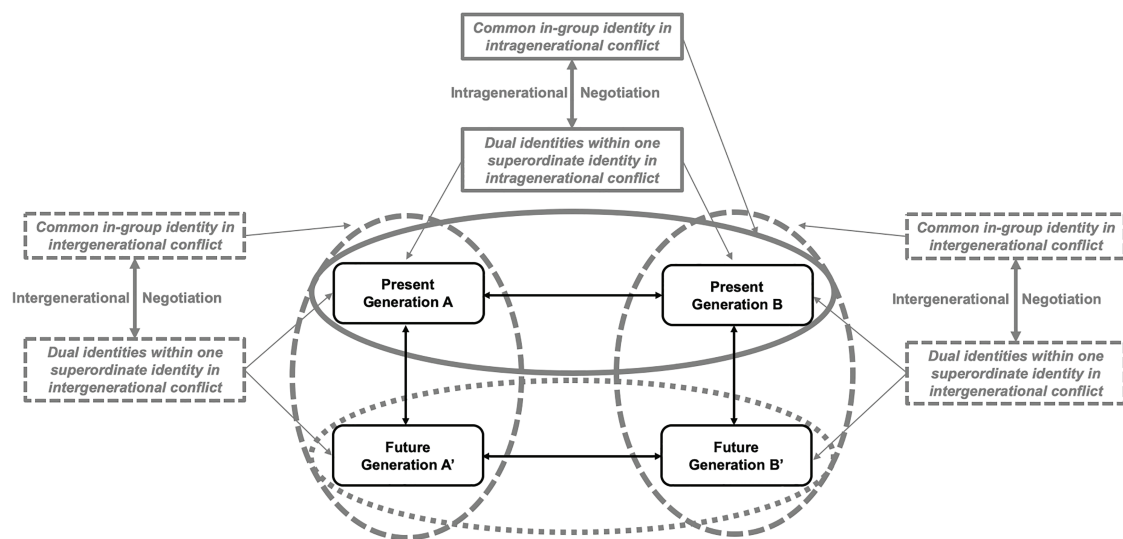


FIGURE 5 | The negotiating-with-future-others strategy for balancing the consideration of interdependent conflicts at the generational level. The horizontal ellipses show how common in-group identity leads to integrative negotiation processes at the intragenerational level between groups. The vertical ellipses show how common in-group identity leads to integrative negotiation processes at the intergenerational level over time. If both groups engage in such intergenerational negotiation processes, they should also be able to balance the consideration of future intragenerational conflicts.

desirable future states that include alternative pathways for reaching them (i.e., backcasting). However, the interests of future generations should be aligned with these transition scenarios created by the delegates of the stakeholder groups within the present generation. According to our intervention approach, present delegates should create a common in-group identity with the succeeding future generation and also consider the dual identities of the present- and the future generations when developing the scenario for the urban mobility transition. In addition, a representative of the future generation could be assigned to safeguard the future generation's interests during the development of scenarios for the urban mobility transition. Our proposed intervention approach may be particularly suitable for generating more mutually beneficial and transformative solutions in the management of transitions when interests within and between generations must be negotiated. As a result, the negotiation-with-future-others strategy may help to overcome a biased and unbalanced consideration of interdependent conflicts between societal interest groups and their successor generations.

Tools for Implementing the Intervention Approach

Potential tools for creating common in-group identities include placing focus on superordinate-group memberships (e.g., nations, organizations, and communities), increasing affinity with future generations (Wade-Benzoni, 2008; Arora et al., 2016), and emphasizing factors that are shared by the groups (e.g., values, fate, and goals). Alternative tools exist that may further trigger intergenerational negotiations over time by forecasting future generations' beneficence (Bosetti et al., 2020), priming present generations with the inevitability of their own mortality (Wade-Benzoni et al., 2012), or providing advice to future generations (Sherstyuk et al., 2016). However, these tools often

neglect common in-group identities and the representation of future generations, both of which are required to elicit negotiations with future others.

GENERAL DISCUSSION

We developed and introduced a framework of interdependent conflicts for stimulating novel research that examines individual- and joint decision-making processes in the transformation toward sustainability. The critical relevance that negotiations entail in this transformation is undisputed (Pruitt and Carnevale, 1993; Loorbach, 2010); however, it is also unanimously accepted that "negotiation will fail to achieve fundamental change unless there is a commitment to long-term change [...]" (Kemp et al., 2007, p. 316). Despite this conclusion, the existing literature on negotiations and decision-making treats sustainability challenges rather unidimensionally. While negotiation- and social-conflict research primarily focus on conflict resolution in the present (Jang et al., 2018), individual decision-making often neglects the social interdependencies against which deep structural change must be negotiated and coordinated.

Typically, decision-makers must simultaneously consider their own interests and those of other decision-makers in addition to long-term future consequences for themselves and future others. We aimed to provide a novel perspective on why agreements reached *via* negotiations are often not in favor of our own or others' long-term interests. One of the key contributions of our novel framework is that it enables an analysis of decision-making settings in the transformation toward sustainability in a more-comprehensive, unifying, and systematic way. Moreover, our framework provides a parsimonious structure

for disentangling these complex conflict situations, analyzing the arising psychological phenomena, and designing interventions that tap into the psychological barriers that impede transformative solutions. At best, agreements create integrative solutions for all parties involved – not only in the present, but also over longer timespans. Our framework offers a systematic integration of the social and temporal dimensions and thereby helps in reaching these transformative and mutually beneficial solutions.

Sustainability challenges represent the largest collective-action problem ever faced by humanity (Ostrom, 2009). Joint decision-making and negotiation, cooperation, and conflict resolution are therefore inevitable in making collective progress toward sustainable living in our societies. Taking the proposed psychological barriers into account, these negotiation processes may be biased toward solutions in the present. To overcome this crucial barrier, a better understanding of the underlying psychological processes may help in guiding negotiation processes that promote forward-looking conflict resolution. The European Union's financial and budget deal closed by the different member states is exemplary in demonstrating interdependent conflicts. On the one hand, various member states of the European Union have repeatedly shown that they can come together to jointly resolve issues of the present generation that they could not deal with individually. On the other hand, resolving conflicts between member states within the present generation may lead to costs for member states' very own long-term interests and for those of their succeeding future generations.

The described tensions may lead to a rather skeptical view of the transformative potential of negotiations. Indeed, the challenges for parties in creating transformative solutions are difficult. However, we hope that our framework and the proposed intervention approaches might help negotiators navigate toward more-transformative solutions across different societal levels and contexts. In grassroots initiatives, small groups of societal frontrunners may initiate negotiations over innovations and, in the management of the transition, representatives of larger societal-interest groups, institutions, or organizations may negotiate their interests in contributing to the transition pathway. Thereby, negotiations may also help to bridge structural changes across societal levels. We believe that existing and potential future tools for implementing intervention approaches should be tested, adapted, and refined depending on the interdependent-conflict situation. Nevertheless, we wish to emphasize the idea

that interdependent conflicts are negotiable not only between individual actors and societal groups but also within ourselves and across generations. Making use of the transformative potential of these negotiation processes may open new transition pathways toward sustainability. We, therefore, remain optimistic that negotiations as collaborative decision-making approaches are most promising for reaching transformative solutions and are our only true alternative to collaboratively achieving long-term societal prosperity (Pruitt and Carnevale, 1993). In acknowledging this belief, the framework of interdependent conflicts may provide innovative impulses for integrating and reconciling interests within planetary boundaries.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material; further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

JM developed the theory, created the figures, and drafted the manuscript. MB, HZ, MT, and RT contributed to theory development, structuring, and revising the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This research was funded by a grant from the German Research Foundation (DFG; MA 8577/1-1) and by a seed-money grant from Leuphana University, both of which were awarded to JM.

ACKNOWLEDGMENTS

We would like to thank Immo Fritsche, Michel Handgraaf, and Poonam Arora for their helpful and valuable comments on an earlier version of the framework. We would also like to thank Lucas Rosenbusch for creating the reference list for this article.

REFERENCES

- Arora, P., Logg, J., and Larrick, R. (2016). Acting for the greater good: identification with group determines choices in sequential contribution dilemmas. *J. Behav. Decis. Mak.* 29, 499–510. doi: 10.1002/bdm.1892
- Asara, V., Otero, I., Demaria, F., and Corbera, E. (2015). Socially sustainable degrowth as a social–ecological transformation: repoliticizing sustainability. *Sustain. Sci.* 10, 375–384. doi: 10.1007/s11625-015-0321-9
- Babcock, L., and Loewenstein, G. (1997). Explaining bargaining impasse: the role of self-serving biases. *J. Econ. Perspect.* 11, 109–126. doi: 10.1257/jep.11.1.109
- Barrett, S., and Dannenberg, A. (2012). Climate negotiations under scientific uncertainty. *Proc. Natl. Acad. Sci. U. S. A.* 109, 17372–17376. doi: 10.1073/pnas.1208417109
- Bartels, D. M., and Urminsky, O. (2011). On intertemporal selfishness: how the perceived instability of identity underlies impatient consumption. *J. Consum. Res.* 38, 182–198. doi: 10.1086/658339
- Bazerman, M. H., Magliozzi, T., and Neale, M. A. (1985). Integrative bargaining in a competitive market. *Organ. Behav. Hum. Decis. Process.* 35, 294–313. doi: 10.1016/0749-5978(85)90026-3
- Bazerman, M. H., Moore, D. A., and Gillespie, J. J. (1999). The human mind as a barrier to wiser environmental agreements. *Am. Behav. Sci.* 42, 1277–1300. doi: 10.1177/00027649921954868
- Bazerman, M. H., and Neale, M. A. (1992). *Negotiating rationally*. New York, NY: Free Press.
- Bazerman, M. H., Tenbrunsel, A. E., and Wade-Benzoni, K. (1998). Negotiating with yourself and losing: making decisions with competing internal preferences. *Acad. Manag. Rev.* 23:225. doi: 10.5465/amr.1998.533224

- Boehm, R., Rusch, H., and Baron, J. (2020). The psychology of intergroup conflict: a review of theories and measures. *J. Econ. Behav. Organ.* 178, 947–962. doi: 10.1016/j.jebo.2018.01.020
- Bosetti, V., Dennig, F., Liu, N., Tavoni, M., and Weber, E. (2020). Forward-looking belief elicitation enhances inter-generational beneficence. *SSRN Electron. J.* doi: 10.2139/ssrn.3648287
- Campbell, D. T. (1965). "Ethnocentric and other altruistic motives" in *Nebraska symposium on motivation*. ed. D. Levine (Lincoln: University of Nebraska Press), 283–311.
- Charlton, S. R., Yi, R., Porter, C., Carter, A. E., Bickel, W., and Rachlin, H. (2013). Now for me, later for us? Effects of group context on temporal discounting. *J. Behav. Decis. Mak.* 26, 118–127. doi: 10.1002/bdm.766
- Curhan, J. R., Neale, M. A., and Ross, L. (2004). Dynamic valuation: preference changes in the context of face-to-face negotiation. *J. Exp. Soc. Psychol.* 40, 142–151. doi: 10.1016/j.jesp.2003.12.002
- Dannenbergh, A., and Barrett, S. (2018). Cooperating to avoid catastrophe. *Nat. Hum. Behav.* 2, 435–437. doi: 10.1038/s41562-018-0374-8
- De Dreu, C. K. W., Weingart, L. R., and Kwon, S. (2000). Influence of social motives on integrative negotiation: a meta-analytic review and test of two theories. *J. Pers. Soc. Psychol.* 78, 889–905. doi: 10.1037/0022-3514.78.5.889
- DLF (2020). "Den Planeten in vernünftigen Zustand hinterlassen." Available at: https://www.deutschlandfunk.de/philosophin-ueber-generationengerechtigkeit-den-planeten-in-694.de.html?dram:article_id=482019 (Accessed August 9, 2020).
- Dovidio, J. F., Gaertner, S. L., and Kafati, G. (2000). "Group identity and intergroup relations: the common in-group identity model" in *Advances in group processes*. Vol. 17 eds. S. R. Thye, E. J. Lawler, M. W. Macy and H. A. Walker [Bingley, UK: Emerald (MCB UP)], 1–35.
- Dreber, A., and Nowak, M. A. (2008). Gambling for global goods. *Proc. Natl. Acad. Sci. U. S. A.* 105, 2261–2262. doi: 10.1073/pnas.0800033105
- Drory, A., and Ritov, I. (1997). Intrapersonal conflict and choice of strategy in conflict management. *Psychol. Rep.* 81, 35–46. doi: 10.2466/pr0.1997.81.1.35
- Ehrlich, P. R., and Ehrlich, A. H. (2013). Can a collapse of global civilization be avoided? *Proc. Biol. Sci.* 280, 20122845. doi: 10.1098/rspb.2012.2845
- Erlanger, S., and Stevis-Gridneff, M. (2020). Angela Merkel guides the E.U. to a deal, however imperfect. The New York Times. Available at: <https://www.nytimes.com/2020/07/21/world/europe/european-union-coronavirus-aid.html> (Accessed July 21, 2020).
- Forsyth, D. R. (2014). "The psychology of groups" in *Noba textbook series: Psychology*. eds. R. Biswas-Diener and E. Diener (Champaign, IL: DEF Publishers).
- Frantzeskaki, N., Loorbach, D., and Meadowcroft, J. (2012). Governing societal transitions to sustainability. *Int. J. Sustain. Dev.* 15, 19–36. doi: 10.1504/IJSD.2012.044032
- Frederick, S., Loewenstein, G., and O'Donoghue, T. (2002). Time discounting and time preference: a critical review. *J. Econ. Lit.* 40, 351–401. doi: 10.1257/jel.40.2.351
- Gaertner, S. L., Dovidio, J. F., Anastasio, P. A., Bachman, B. A., and Rust, M. C. (1993). The common ingroup identity model: recategorization and the reduction of intergroup bias. *Eur. Rev. Soc. Psychol.* 4, 1–26. doi: 10.1080/14792779343000004
- Gaertner, S. L., Guerra, R., Rebelo, M., Dovidio, J., Hehman, E., and Deegan, M. (2016). "The common ingroup identity model and the development of a functional perspective: a cross-national collaboration" in *The social developmental construction of violence and intergroup conflict*. eds. J. Vala, S. Waldzus and M. M. Calheiros (Cham, Switzerland: Springer International Publishing), 105–120.
- Gaertner, S. L., Rust, M. C., Dovidio, J. F., Bachman, B. A., and Anastasio, P. A. (1994). The contact hypothesis: the role of a common ingroup identity on reducing intergroup bias. *Small Group Res.* 25, 224–249. doi: 10.1177/1046496494252005
- Galinsky, A. D., Wang, C. S., and Ku, G. (2008). Perspective-takers behave more stereotypically. *J. Pers. Soc. Psychol.* 95, 404–419. doi: 10.1037/0022-3514.95.2.404
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: responses to seven criticisms. *Environ. Innov. Soc. Transit.* 1, 24–40. doi: 10.1016/j.eist.2011.02.002
- Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technol. Forecast. Soc. Change* 152:119894. doi: 10.1016/j.techfore.2019.119894
- Geels, F. W., and Schot, J. (2007). Typology of sociotechnical transition pathways. *Res. Policy* 36, 399–417. doi: 10.1016/j.respol.2007.01.003
- Gelfand, M. J., Fulmer, C. A., and Seaverance, L. (2011). "The psychology of negotiation and mediation" in *APA handbook of industrial and organizational psychology*, Vol. 3: *Maintaining, expanding, and contracting the organization*. ed. S. Zedeck (American Psychological Association), 495–554.
- Gillespie, J. J., Thompson, L. L., Loewenstein, J., and Gentner, D. (1999). Lessons from analogical reasoning in the teaching of negotiation. *Negot. J.* 15, 363–371. doi: 10.1111/j.1571-9979.1999.tb00734.x
- Hardisty, D. J., and Weber, E. U. (2009). Discounting future green: money versus the environment. *J. Exp. Psychol. Gen.* 138, 329–340. doi: 10.1037/a0016433
- Hauser, O. P., Rand, D. G., Peysakhovich, A., and Nowak, M. A. (2014). Cooperating with the future. *Nature* 511, 220–223. doi: 10.1038/nature13530
- Henderson, M. D., Trope, Y., and Carnevale, P. J. (2006). Negotiation from a near and distant time perspective. *J. Pers. Soc. Psychol.* 91, 712–729. doi: 10.1037/0022-3514.91.4.712
- Herrnstein, R. J., and Prelec, D. (1991). Melioration: a theory of distributed choice. *J. Econ. Perspect.* 5, 137–156. doi: 10.1257/jep.5.3.137
- Hershfield, H. E. (2011). Future self-continuity: how conceptions of the future self transform intertemporal choice. *Ann. N. Y. Acad. Sci.* 1235, 30–43. doi: 10.1111/j.1749-6632.2011.06201.x
- Hsiang, S. M., Burke, M., and Miguel, E. (2013). Quantifying the influence of climate on human conflict. *Science* 341:1235367. doi: 10.1126/science.1235367
- Jacquet, J., Hagel, K., Hauert, C., Marotzke, J., Röhl, T., and Milinski, M. (2013). Intra- and intergenerational discounting in the climate game. *Nat. Clim. Chang.* 3, 1025–1028. doi: 10.1038/nclimate2024
- Jang, D., Elfenbein, H. A., and Bottom, W. P. (2018). More than a phase: form and features of a general theory of negotiation. *Acad. Manag. Ann.* 12, 318–356. doi: 10.5465/annals.2016.0053
- Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of intragroup conflict. *Adm. Sci. Q.* 40:256. doi: 10.2307/2393638
- Kamijo, Y., Komiya, A., Mifune, N., and Saijo, T. (2017). Negotiating with the future: incorporating imaginary future generations into negotiations. *Sustain. Sci.* 12, 409–420. doi: 10.1007/s11625-016-0419-8
- Kelley, H. H., and Thibaut, J. W. (1978). *Interpersonal relations: A theory of interdependence*. New York, NY: Wiley.
- Kemp, R., Loorbach, D., and Rotmans, J. (2007). Transition management as a model for managing processes of co-evolution towards sustainable development. *Int. J. Sustain. Dev. World Ecol.* 14, 78–91. doi: 10.1080/13504500709469709
- Kim, J., Thompson, L., and Loewenstein, J. (2020). Open for learning: encouraging generalization fosters knowledge transfer in negotiation. *Negot. Confl. Manag. Res.* 13, 3–23. doi: 10.1111/ncmr.12163
- Levin, K., Cashore, B., Bernstein, S., and Auld, G. (2012). Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change. *Policy. Sci.* 45, 123–152. doi: 10.1007/s11077-012-9151-0
- Lewicki, R. J., and Litterer, J. A. (1985). *Negotiation*. Homewood, IL: R.D. Irwin.
- Lewin, K. (1948). *Resolving social conflicts; selected papers on group dynamics*. New York, NY: Harper.
- Loewenstein, G. (1988). Frames of mind in intertemporal choice. *Manag. Sci.* 34, 200–214. doi: 10.1287/mnsc.34.2.200
- Loewenstein, G. (1996). Out of control: visceral influences on behavior. *Organ. Behav. Hum. Decis. Process.* 65, 272–292. doi: 10.1006/obhd.1996.0028
- Loorbach, D. (2010). Transition management for sustainable development: a prescriptive, complexity-based governance framework. *Governance* 23, 161–183. doi: 10.1111/j.1468-0491.2009.01471.x
- Loschelder, D. D., and Trötschel, R. (2010). Overcoming the competitiveness of an intergroup context: third-party intervention in intergroup negotiations. *Group Process. Intergr. Relat.* 13, 795–815. doi: 10.1177/1368430210374482
- Mach, K. J., Kraan, C. M., Adger, W. N., Buhaug, H., Burke, M., Fearon, J. D., et al. (2019). Climate as a risk factor for armed conflict. *Nature* 571, 193–197. doi: 10.1038/s41586-019-1300-6
- Majer, J. M., Loschelder, D. D., Windolph, L. J., and Fischer, D. (2018). How sustainability-related challenges can fuel conflict between organizations and external stakeholders: a social psychological perspective to master value

- differences, time horizons, and resource allocations. *Umweltpsychol.* 22, 53–70.
- Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy. Sci.* 42:323. doi: 10.1007/s11077-009-9097-z
- Nadler, J., Thompson, L., and Boven, L. V. (2003). Learning negotiation skills: four models of knowledge creation and transfer. *Manag. Sci.* 49, 529–540. doi: 10.1287/mnsc.49.4.529.14431
- Neale, M. A., and Bazerman, M. H. (1985). The effects of framing and negotiator overconfidence on bargaining behaviors and outcomes. *Acad. Manag. J.* 28, 34–49. doi: 10.2307/256060
- O'Connor, K. M., De Dreu, C. K. W., Schroth, H., Barry, B., Lituchy, T. R., and Bazerman, M. H. (2002). What we want to do versus what we think we should do: an empirical investigation of intrapersonal conflict. *J. Behav. Decis. Mak.* 15, 403–418. doi: 10.1002/bdm.426
- Okhuysen, G. A., Galinsky, A. D., and Uptigrove, T. A. (2003). Saving the worst for last: the effect of time horizon on the efficiency of negotiating benefits and burdens. *Organ. Behav. Hum. Decis. Process.* 91, 269–279. doi: 10.1016/S0749-5978(03)00023-2
- Ornetzeder, M., and Rohrer, H. (2013). Of solar collectors, wind power, and car sharing: comparing and understanding successful cases of grassroots innovations. *Glob. Environ. Chang.* 23, 856–867. doi: 10.1016/j.gloenvcha.2012.12.007
- Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science* 325, 419–422. doi: 10.1126/science.1172133
- Peters, B. G. (2017). What is so wicked about wicked problems? A conceptual analysis and a research program. *Polic. Soc.* 36, 385–396. doi: 10.1080/14494035.2017.1361633
- Pinkley, R. L., Griffith, T. L., and Northcraft, G. B. (1995). “Fixed pie” a la mode: information availability, information processing, and the negotiation of suboptimal agreements. *Organ. Behav. Hum. Decis. Process.* 62, 101–112. doi: 10.1006/obhd.1995.1035
- Pruitt, D. G., and Carnevale, P. J. (1993). *Negotiation in social conflict*. Belmont, CA: Thomson Brooks/Cole Publishing Co.
- Raiffa, H. (1982). *The art and science of negotiation*. Cambridge, MA: Belknap Press of Harvard University Press.
- Raven, R. P., Heiskanen, E., Lovio, R., Hodson, M., and Brohmman, B. (2008). The contribution of local experiments and negotiation processes to field-level learning in emerging (niche) technologies: meta-analysis of 27 new energy projects in Europe. *Bull. Sci. Technol. Soc.* 28, 464–477. doi: 10.1177/0270467608317523
- Read, D., Loewenstein, G., Rabin, M., Keren, G., and Laibson, D. (1999). “Choice bracketing” in *Elicitation of preferences*. eds. B. Fischhoff and C. F. Manski (Dordrecht, Netherlands: Springer), 171–202.
- Rhoades, J. A., and Carnevale, P. J. (1999). The behavioral context of strategic choice in negotiation: a test of the dual concern model 1. *J. Appl. Soc. Psychol.* 29, 1777–1802. doi: 10.1111/j.1559-1816.1999.tb00152.x
- Ritov, I., and Drory, A. (1996). Ambiguity and conflict management strategy. *Int. J. Confl. Manag.* 7, 139–155. doi: 10.1108/eb022779
- Rittel, H. W., and Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy. Sci.* 4, 155–169. doi: 10.1007/BF01405730
- Rusbult, C. E., and Van Lange, P. A. M. (1996). “Interdependence processes” in *Social psychology: Handbook of basic principles* eds. E. T. Higgins and A. W. Kruglanski (New York: The Guilford Press), 564–596.
- Schelling, T. C. (1958). The strategy of conflict. Prospectus for a reorientation of game theory. *J. Confl. Resolut.* 2, 203–264. doi: 10.1177/002200275800200301
- Schelling, T. C. (1984). *Choice and consequence*. Cambridge, MA: Harvard University Press.
- Schreuer, A., Ornetzeder, M., and Rohrer, H. (2010). Negotiating the local embedding of socio-technical experiments: a case study in fuel cell technology. *Tech. Anal. Strat. Manag.* 22, 729–743. doi: 10.1080/09537325.2010.496286
- Schuster, C., Majer, J. M., and Trötschel, R. (2020). Whatever we negotiate is not what I like: how value-driven conflicts impact negotiation behaviors, outcomes, and subjective evaluations. *J. Exp. Soc. Psychol.* 90:103993. doi: 10.1016/j.jesp.2020.103993
- Seyfang, G., and Haxeltine, A. (2012). Growing grassroots innovations: exploring the role of community-based initiatives in governing sustainable energy transitions. *Environ. Plan. Govern. Pol.* 30, 381–400. doi: 10.1068/c10222
- Sherif, M. (1961). *Intergroup conflict and cooperation: The robbers cave experiment*. Vol. 10. OK: University Book Exchange Norman.
- Sherif, M., and Sherif, C. W. (1953). *Groups in harmony and tension; An integration of studies of intergroup relations*. New York, NY: Harper & Brothers.
- Sherstyuk, K., Tarui, N., Ravago, M.-L. V., and Saijo, T. (2016). Intergenerational games with dynamic externalities and climate change experiments. *J. Assoc. Environ. Resour. Econ.* 3, 247–281. doi: 10.1086/684162
- Soman, D., Ainslie, G., Frederick, S., Li, X., Lynch, J., Moreau, P., et al. (2005). The psychology of intertemporal discounting: why are distant events valued differently from proximal ones? *Mark. Lett.* 16, 347–360. doi: 10.1007/s11002-005-5897-x
- Sondeijker, S., Geurts, J., Rotmans, J., and Tukker, A. (2006). Imagining sustainability: the added value of transition scenarios in transition management. *Foresight* 8, 15–30. doi: 10.1108/14636680610703063
- Sunstein, C. R., and Reisch, L. A. (2013). Green by default. *Kyklos* 66, 398–402. doi: 10.1111/kykl.12028
- Tajfel, H. (1981). *Human groups and social categories: Studies in social psychology*. Cambridge, MA: Cambridge University Press.
- Tajfel, H., and Turner, J. C. (1979). “An integrative theory of intergroup conflict” in *The social psychology of intergroup relations*. eds. W. G. Austin and S. Worchel (Monterey, CA: Brooks/Cole), 33–37.
- Tajfel, H., and Turner, J. C. (1986). “The social identity theory of intergroup behavior” in *Psychology of intergroup relations*. eds. S. Worchel and W. G. Austin (Chicago: Nelson-Hall), 7–24.
- Tavoni, A., Dannenberg, A., Kallis, G., and Loschel, A. (2011). Inequality, communication, and the avoidance of disastrous climate change in a public goods game. *Proc. Natl. Acad. Sci. U. S. A.* 108, 11825–11829. doi: 10.1073/pnas.1102493108
- Thompson, L., and DeHarpport, T. (1994). Social judgment, feedback, and interpersonal learning in negotiation. *Organ. Behav. Hum. Decis. Process.* 58, 327–345. doi: 10.1006/obhd.1994.1040
- Thompson, L., and Gonzalez, R. (1997). “Environmental disputes: competition for scarce resources and clashing of values” in *Environment, ethics, and behavior: The psychology of environmental valuation and degradation* eds. M. H. Bazerman, D. M. Messick, A. E. Tenbrunsel and K. A. Wade-Benzoni (San Francisco: The New Lexington Press/Jossey-Bass Publishers), 75–104.
- Thompson, L., and Hastie, R. (1990). Social perception in negotiation. *Organ. Behav. Hum. Decis. Process.* 47, 98–123. doi: 10.1016/0749-5978(90)90048-E
- Trötschel, R., Hüffmeier, J., and Loschelder, D. D. (2010). When yielding pieces of the pie is not a piece of cake: identity-based intergroup effects in negotiations. *Group Process. Intergr. Relat.* 13, 741–763. doi: 10.1177/1368430210374608
- Trötschel, R., Hüffmeier, J., Loschelder, D. D., Schwartz, K., and Gollwitzer, P. M. (2011). Perspective taking as a means to overcome motivational barriers in negotiations: when putting oneself into the opponent's shoes helps to walk toward agreements. *J. Pers. Soc. Psychol.* 101, 771–790. doi: 10.1037/a0023801
- Trötschel, R., Loschelder, D. D., Höhne, B. P., and Majer, J. M. (2015). Procedural frames in negotiations: how offering my resources versus requesting yours impacts perception, behavior, and outcomes. *J. Pers. Soc. Psychol.* 108, 417–435. doi: 10.1037/pspi0000009
- Tsay, C. J., and Bazerman, M. H. (2009). A decision-making perspective to negotiation: a review of the past and a look to the future. *Negot. J.* 25, 467–480. doi: 10.1111/j.1571-9979.2009.00239.x
- Tuncel, E., Mislin, A., Kesebir, S., and Pinkley, R. L. (2016). Agreement attraction and impasse aversion: reasons for selecting a poor deal over no deal at all. *Psychol. Sci.* 27, 312–321. doi: 10.1177/0956797615619200
- Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., and Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory*. Oxford, England: Basil Blackwell.
- Urmitsky, O. (2017). The role of psychological connectedness to the future self in decisions over time. *Curr. Dir. Psychol. Sci.* 26, 34–39. doi: 10.1177/0963721416668810
- Van Boven, L., Ehret, P. J., and Sherman, D. K. (2018). Psychological barriers to bipartisan public support for climate policy. *Perspect. Psychol. Sci.* 13, 492–507. doi: 10.1177/1745691617748966
- Van der Gaast, W. (2015). *International climate negotiation conditions: Past and future*. Groningen: University of Groningen, SOM research school.
- Van Lange, P. A. M., and Balliet, D. (2015). “Interdependence theory” in *APA handbook of personality and social psychology*, Vol. 3: *Interpersonal relations*.

- eds. M. Mikulincer, P. R. Shaver, J. A. Simpson and J. F. Dovidio (Washington, DC: American Psychological Association), 65–92.
- von Wirth, T., Gislason, L., and Seidl, R. (2018). Distributed energy systems on a neighborhood scale: reviewing drivers of and barriers to social acceptance. *Renew. Sust. Energ. Rev.* 82, 2618–2628. doi: 10.1016/j.rser.2017.09.086
- Wade-Benzoni, K. A. (2008). Maple trees and weeping willows: the role of time, uncertainty, and affinity in intergenerational decisions. *Negot. Confl. Manag. Res.* 1, 220–245. doi: 10.1111/j.1750-4716.2008.00014.x
- Wade-Benzoni, K. A., Hernandez, M., Medvec, V., and Messick, D. (2008). In fairness to future generations: the role of egocentrism, uncertainty, power, and stewardship in judgments of intergenerational allocations. *J. Exp. Soc. Psychol.* 44, 233–245. doi: 10.1016/j.jesp.2007.04.004
- Wade-Benzoni, K. A., and Tost, L. P. (2009). The egoism and altruism of intergenerational behavior. *Pers. Soc. Psychol. Rev.* 13, 165–193. doi: 10.1177/1088868309339317
- Wade-Benzoni, K. A., Tost, L. P., Hernandez, M., and Larrick, R. P. (2012). It's only a matter of time: death, legacies, and intergenerational decisions. *Psychol. Sci.* 23, 704–709. doi: 10.1177/0956797612443967
- Weber, E. U. (2017). Breaking cognitive barriers to a sustainable future. *Nat. Hum. Behav.* 1:13. doi: 10.1038/s41562-016-0013
- Weber, E. U., and Johnson, E. J. (2016). “Can we think of the future? Cognitive barriers to future-oriented thinking” in *Global cooperation and the human factor* eds. D. Messner and S. Weinlich (New York, NY: Routledge), 139–154.
- Weber, E. U., Johnson, E. J., Milch, K. F., Chang, H., Brodscholl, J. C., and Goldstein, D. G. (2007). Asymmetric discounting in intertemporal choice: a query-theory account. *Psychol. Sci.* 18, 516–523. doi: 10.1111/j.1467-9280.2007.01932.x
- Wildschut, T., and Insko, C. A. (2007). Explanations of interindividual—intergroup discontinuity: a review of the evidence. *Eur. Rev. Soc. Psychol.* 18, 175–211. doi: 10.1080/10463280701676543
- Yoeli, E., Hoffman, M., Rand, D. G., and Nowak, M. A. (2013). Powering up with indirect reciprocity in a large-scale field experiment. *Proc. Natl. Acad. Sci. U. S. A.* 110, 10424–10429. doi: 10.1073/pnas.1301210110

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Majer, Barth, Zhang, van Treek and Trötschel. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Rebound and Spillovers: Prosumers in Transition

Elisabeth Dütschke^{1*}, Ray Galvin² and Iska Brunzema¹

¹ Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany, ² Institute for Future Energy Consumer Needs and Behavior, Aachen, Germany

OPEN ACCESS

Edited by:

Sebastian Bamberg,
Bielefeld University of Applied
Sciences, Germany

Reviewed by:

Jed J. Cohen,
Energy Institute at Johannes Kepler
University, Austria
Anke Blöbaum,
Otto von Guericke University
Magdeburg, Germany

*Correspondence:

Elisabeth Dütschke
elisabeth.duetschke@isi.fraunhofer.de

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 30 November 2020

Accepted: 01 March 2021

Published: 15 April 2021

Citation:

Dütschke E, Galvin R and Brunzema I
(2021) Rebound and Spillovers:
Prosumers in Transition.
Front. Psychol. 12:636109.
doi: 10.3389/fpsyg.2021.636109

Generating energy by renewable sources like wind, sun or water has led to the emergence of “clean” energy that is generally available at low cost to the environment and is generated from seemingly unbounded resources. Many countries have implemented schemes to support the diffusion of renewable energies. The diffusion of micro-generation technologies like roof-top photovoltaics is one of the success stories within the energy transition and has been significantly driven—at least in countries such as Germany—by households. As these households usually not only generate energy but also consume it they are often called “prosumers.” How does it influence the energy behavior of households if they become prosumers? Are these behavioral changes in line with further goals of the energy transition, e.g., reducing demand? What shapes individual behaviors of prosumers? The paper introduces a conceptual framework based on the existing literature on rebound and spillover effects. It systematizes possible behavioral consequences as well as mechanisms behind them. This framework is then used to code and analyze data from 48 in-depth interviews with prosumer households. These interviews reveal a broad variety of behavioral responses which have their roots in economic conditions and their evaluation by the prosumers, psychological mechanisms like central guiding principles and a clear conscience as well as sociotechnical context and legislative frameworks.

Keywords: prosuming, rebound, spillover, psychological and economic drivers, socio-technical context

HIGHLIGHTS

- Private energy prosumers are a relevant group of active agents in the energy system
- To support the energy transition their behavior needs to align with demand reduction goals
- This interview-based study explores self-reported behaviors and how it emerges
- Behavioral response is heterogeneous and driven by individual and systemic factors.

INTRODUCTION

The transformation of conventional energy systems that heavily rely on fossil fuels is a crucial element in strategies to solve humanity’s current major challenge of achieving climate change mitigation goals and enhancing sustainability in order to stay within the limits of planetary boundaries. Increasing the shares of renewable energy, i.e., energy that is gained from resources like wind, water, and sun is one of the main pathways in the energy system transformation. Most prominent so far is the transition of the electricity sector by installing windfarms, biomass power plants, hydroelectric power stations, and photovoltaic (PV) panels. However, in addition to such

a supply side oriented approach, all prominent scenarios for the transformation of the energy system also encompass the reduction of the demand for current energy services by increasing energy efficiency (e.g., IEA and IRENA, 2017). A well-known example for such a combined strategy is the 20-20-20-goals of the European Union (EU) which foresaw a 20% cut in greenhouse gas emissions (from 1990 levels), 20% of EU energy from renewables, and a 20% improvement in energy efficiency by 2020; the EU goals for 2030 were again defined in a similar way. Citizens and their investment decisions as well as their daily behaviors play an important role for the success of these scenarios. Micro-generation technologies have become available at decreasing prices and have found considerable support from policies like Feed-In-Tariffs (FITs) which made them a safe and profitable investment for many. Consequently, private investors including households are playing a significant role in this field and these households have become so-called “prosumers” who generate and use their own electricity in addition to feeding it into the grid. Thus, the role of households in the energy system has been enlarged and at the same time is subject to expectations with regard to system contributions, i.e., keeping their demand stable or reducing it while contributing to supply.

The main topic of this paper is to take a closer look at the interplay between households’ understanding of their role in the energy system and their experiences and perceptions. Therefore, this paper takes a close look at prosuming households, i.e., households owning a photovoltaic (PV) system and their energy lifestyle. More specifically, we analyze how being a prosumer influences households’ energy-related behaviors. As a frame of reference to address this question we draw on current streams of literature that analyze rebound and spillover effects. While mainstream *rebound effects* literature describes unexpected shortfalls in reductions in energy demand following an increase in energy efficiency of an energy service (Chitnis et al., 2014), the literature on *spillover* refers to broader behavioral changes when an environmental behavior triggers further changes in other behaviors (Nash et al., 2017). Thus, the two concepts describe two sides of the same coin as they both account for how prior behavior—in our case becoming a prosumer—influences later behaviors. From a normative perspective, spillover refers to the positive side of further increases in environmental behaviors, while rebound captures the downside of more demand and resource-use. In a first step, this paper investigates behavioral consequences using the rebound-spillover dimension as a normative anchor. Furthermore, as outlined in more detail below, both literatures have identified possible mechanisms underlying such behavioral consequences. Traditionally, economic approaches emphasizing changes in prices and available income have featured prominently in the literature (Dimitropoulos et al., 2018), but further researchers have also emphasized psychological mechanisms (Peters and Dütschke, 2016; Dütschke et al., 2018; Seebauer, 2018) and socio-technical configurations (Galvin, 2020).

A body of literature that investigates behavioral consequences of using renewable energy sources or more specifically installing PV systems has recently begun to emerge (Wittenberg and Matthies, 2016; Oberst et al., 2019; Qiu et al., 2019; Li et al.,

2020). To build on this new stream this paper firstly advances a conceptual framework within which prosumer energy behavior can be evaluated. Secondly, it applies this empirically by drawing on 48 in-depth interviews with prosumer households in Germany. The interview data is analyzed with respect to (i) behavioral consequences of being a prosumer and (ii) underlying mechanisms to these behaviors.

The next sections first further develop the conceptual background by defining relevant terms and describing possible outcomes of being a prosumer. This includes a categorization of possible underlying mechanisms. We then present the empirical data, describing the methods for data collection and analysis before presenting findings. In the concluding discussion we refer back to the broader embeddedness of prosumers in the energy system as a system under transition.

CONCEPTUAL APPROACH AND STATE OF RESEARCH

Behavioral Consequences of PV Use

Energy behavior refers to broad categories, ranging from everyday routines which are usually mainly shaped by habits, social practices, learned schemata and situational cues and performed without much cognitive effort (e.g., turning on the lights) to conscious decision making processes of much lower frequency that involve more extensive evaluation of potential risks, benefits, and probable outcomes (e.g., buying a home, installing a PV). In comparison to the habitual daily behaviors such investment behavior is sometimes called one-shot behavior. Potential behavioral consequences of PV use refer to all these different types of behavior. With regard to the energy transition, all these behavior types could be beneficial in the sense that, for example, they could contribute to reducing energy consumption or the level of demand management by synchronizing supply with demand, or have adverse effects by increasing consumption.

Defining Rebound and Spillover

Research on rebound effects has traditionally mainly emerged from studying the effects of increases in energy efficiency. It refers to the phenomenon that often the implementation of an energy efficiency measure does not lead to the expected level of energy savings but these remain at lower levels (Sorrell, 2015). Quantifications of rebound effects are usually estimated by subtracting the ratio of actual savings to expected savings from one, or alternately expressed: they are the ratio between the shortfall in savings and the expected savings. Psychological approaches to the rebound effect agree with this definition in principle, but emphasize behavioral aspects and determinants (Dütschke et al., 2018). From their perspective the increase in energy efficiency is understood “as an intervention that interrupts previous routines and thereby leads to behavioral change in how the relevant product or service is used” (Dütschke et al., 2018, p. 5). If this behavioral change intensifies the use of an energy service, this is observed as a rebound effect. Often authors differentiate between direct and indirect rebounds depending on whether the increase in demand occurs in the same or another behavioral domain (Chitnis et al., 2014).

Domain / energy carrier of behaviour change	Change in how energy is provided or exploited		
	↙ ↓ ↘		
Same	Direct rebound	No change in behaviour	Conservation
Other	Indirect rebound		(positive) Spillover

FIGURE 1 | Overview of potential behavioral consequences of the way how energy is used or supplied.

May also occur in an opposite direction, and this is also supported by the literature reporting further reduction in demand or more broadly rising efforts of environmental behaviors (Truelove et al., 2014). The term (positive)¹ spillover is used for effects in different domains (Galizzi and Whitmarsh, 2019), e.g., if the installation of a more efficient heating system is followed by electricity saving measures or triggers the purchase of a more efficient car. The rebound and spillover literatures have developed independently of each other, but have acknowledged each other's respective phenomena. For example, rebound literature has defined terms like reverse rebound (Chenavaz et al., 2021), prebound (Sunikka-Blank and Galvin, 2012), or super-conservation (Saunders, 2008; Li et al., 2020) to refer to situations where the actual energy demand falls below the expected. Similarly, research also refers to "permitting" or "negative" spillover to describe rebound-type effects (Galizzi and Whitmarsh, 2019). Taking the learnings from these literatures together, this paper combines the notion of rebound and spillover to describe the two sides of the same coin. To differentiate between effects in the same or other domains analogously to direct and indirect rebound effects, we will use the term conservation for effects in the same domain and spillovers for effects in other behavioral domains (see **Figure 1** for an overview on the terms).

Transferring the definition of rebound effects to the field of renewable energy, a direct rebound effect in renewable energy use occurs if there is a higher demand for the same energy carrier when renewable energy is involved, compared to when no or less renewable energy is involved. In the case of household prosumers this would mean that the demand for electricity increases after installing a PV system, for example by buying additional appliances or using existing appliances more extensively. An indirect rebound effect of renewable energy use would occur if the demand for energy or other resources increases in other domains, e.g., an increase in travel or heating after installing a PV system.

In a similar vein, the concepts of spillover and conservation can also be transferred to the area of renewable energy use. The change to renewable energy would be said to trigger conservation if the demand is lower than before, e.g., if, after installing a PV, everyday usage behavior is changed such that lower electricity demand results (for example by turning lights off more frequently). Finally, there could be spillover to other domains,

e.g., thinking about and actually implementing home insulation after installing a rooftop-PV.

Figure 1 takes up the notion that either increases in energy efficiency or a change to renewable energy supply could trigger behavioral responses, and summarizes the different effects.

Mechanisms Behind Rebound and Spillover

Economists have often associated rebound effect with price effects, i.e., if the usage of a service gets cheaper due to lower energy demand, then the demand for this service will increase (Dimitropoulos et al., 2018). These approaches usually do not consider the upfront investment but focus on the costs for obtaining the energy service. Applying this to the case of electricity generation with rooftop PV without considering the initial investment, the economics for the lifetime of the PV system strongly depend on the policy framework. In Germany, where our empirical case studies are situated, payments for renewable energy are governed by the Renewable Energy Law [Erneuerbare-Energien-Gesetz (EEG)]; the EEG has been revised several times and now incentivizes households to use the electricity from their PV themselves as this is cheaper than buying it from the grid. This can be maximized by households if they shift their consumption to times of (higher) generation. Thus, similar to the case of efficiency rebounds, prosumer households pay less for electricity services compared to non-prosumer households.

In addition to economic influences on behavior, the literature also suggests that psychological factors can foster or limit the emergence of rebound effects. This has to do with the degree to which needs are already satisfied (Hofstetter et al., 2006; Wörsdorfer, 2010), and norms and attitudes toward the relevant behavior and toward the environment (Haan et al., 2007; Matiaske et al., 2012). Peters and Dütschke (2016) proposed and empirically explored a conceptual model covering these concepts. Recently, moral licensing and consistency as explanatory factors have emerged in the literature (Dütschke et al., 2018). The moral licensing concept assumes that past morally positive behavior increases the probability that people will subsequently show potentially less moral behavior (Mazar and Zhong, 2010; Mullen and Monin, 2016). For behavioral spillovers, social and environmental identity have also been investigated (Elf et al., 2018; van der Werff and Steg, 2018; Verfuëth et al., 2019). Overall empirical research on these types of factors is rare so far, even more so in respect of renewable energy. From a conceptual point of view, all of the concepts under discussion seem highly applicable to also trigger rebound or spillovers in the case of renewables or more specifically the installation of a PV system. For example, studies have shown that investments in PV are likely to be regarded as environmental behaviors (Palm and Tengvard, 2011; Korcaj et al., 2015). These investments could thus provide a basis for a moral license, i.e., less environmentally friendly behavior and therefore lead to higher consumption. Alternatively, they could trigger consistent behavior, i.e., curtailment of consumption, by making an environmental identity or energy-related topics more salient.

While psychological approaches put a strong emphasis on individual control, they partly neglect the socio-cultural habitual

¹Sometimes the literature differentiates between positive and negative spillover. Negative spillover effects are conceptually identical to the concept of indirect rebound effects (Nash et al., 2017).

embedding of behavior (e.g., learned behavioral patterns) (Galvin and Gubernat, 2016; Sonnberger and Gross, 2018) as well as socio-structural factors. Galvin (2013) elaborates on this for the example of windows: Most German windows are very badly designed for efficient manual ventilation by opening inwards in combination with the cultural habit of decorating window sills—thus this limits behavior that is ideal for energy efficient ventilation. In case of solar PV, the influence of such socio-technical structures is highly relevant in relation to the synchronization of supply and demand. Technical devices and ICT can support the synchronization which is otherwise limited to everyday heuristics by weather observations. However, such supporting technology is also likely to bring very specific conditions regarding practicalities that encourage or impede certain behaviors (cf. for example Wittenberg and Matthies, 2016 on the visibility in everyday life). The current German regulation on peak load prevention is an example of such a configuration for the case under study: it sets an incentive to use this electricity that prosumers otherwise perceive to be wasted. This could trigger households to make investments in, for example, electric mobility (bikes, cars) to make use of this electricity, and this could lead to higher demand overall (Galvin, 2020).

Other sources of rebound include lack of knowledge and technical or design failures. For example if PV modules are not set at an optimal angle, system components not optimally combined or settings of control units are wrong, this could lead to other energy demand patterns than anticipated. This can be due to lack of knowledge by users or installers, as well as the complexity of systems. A qualitative study by Peters and Dütschke (2016) found some evidence in this direction with regard to heating systems but also for lighting.

Figure 2 summarizes the list of mechanisms identified from the literature.

Empirical Findings in the Literature

The body of literature that examines potential consequences of small-scale PV on individual energy demand or more broadly of renewable energy use has only recently been emerging (cf. Luthander et al., 2015 for a review on earlier literature). The findings published so far cover a variety of samples studied by qualitative and quantitative approaches in different contexts and, thus, heterogeneous political and contextual factors. Consequently, the results vary substantially: Studies by Wittenberg and colleagues (Wittenberg and Matthies, 2016, 2018) used a German sample of more than 400 PV owners recruited by spreading the questionnaire through dedicated webpages. They obtained self-reported meter readings as well as questionnaire data. However, the quantitative analyses were limited in places due to missing data and small size of subgroups. Overall these two studies do not detect significant differences in consumption compared to general consumption in the population as reported in official statistics, but reveal support for a relationship between self-reported energy saving behaviors and positive environmental attitudes. Palm et al. (2018) interviewed 44 prosumer households in Sweden. These were recruited through a variety of sources, e.g., contacts from the energy agency, solar installers and advertisement on a

blog. Participants were interviewed twice and reported their consumption data based on their entries in the web user interfaces of their electricity retailers. The researchers observed no major changes in consumption and hardly any indications of shifting demand according to electricity generation, but increasing energy awareness.

Qiu et al. (2019) obtained data from a utility company in the US including electricity meter data and survey data. In contrast to the studies cited before they estimated a solar rebound as high as 18 % by comparing the energy consumption of prosumer households with non-prosumers, and of 15% by comparing pre- and post-installation consumption (Qiu et al., 2019). The study also found effects of moderating variables, i.e., consumers from a neighborhood with more green/left wing voters showed smaller rebound effects. In a recent study, Li et al. (2020) who also combine metering and survey data find a small conservation effect for US PV prosumers who are financially incentivized to feed as much of their self-produced electricity into the grid as possible. Finally, Oberst et al. (2019) investigate energy use more broadly by analyzing self-reported heating costs for PV prosumer households and find no differences to non-prosumers.

Thus, the overall literature gives little or no consistent indication as to what (quantitative) extent the issue of rebound or spillover effects is relevant to PV households. The few studies available point out that there is variety among prosumers, and this appears to lead back to the categories of factors as identified in **Figure 2**. To enhance the state of knowledge we therefore explore the topic further through an analysis of 48 interviews with German prosumer households.

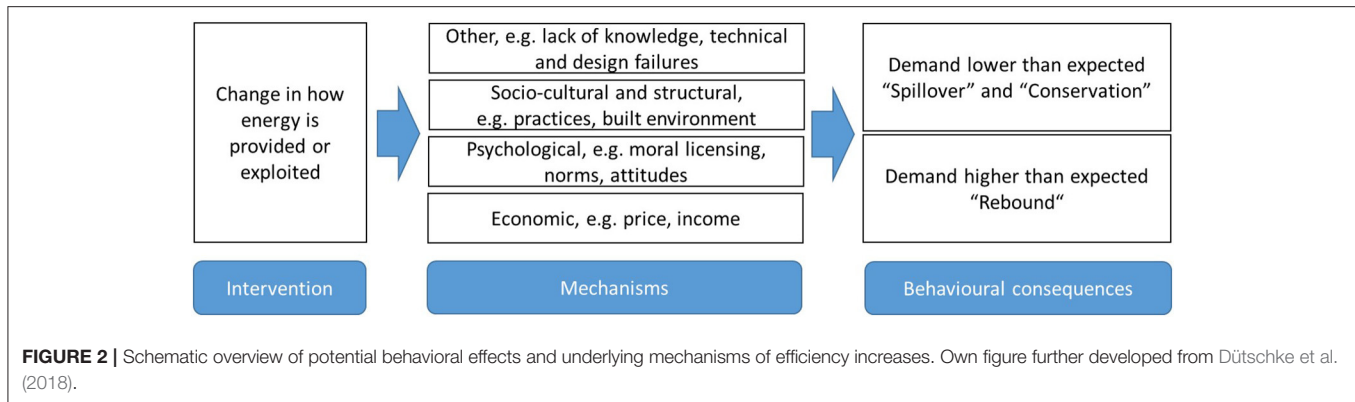
DATA AND METHODS

Contextual Background

The study presented here is situated in Germany. PV panels are the dominant technology in this country for private self-generation of electricity. In 2016, around 8% of residential buildings in Germany were already equipped with a PV system, with the proportion particularly high for newer buildings, detached houses and buildings in southern Germany (Cischinsky and Diefenbach, 2018). PV generation is overall financially attractive for households, with high investments initially but very low running costs (Haar, 2020).

In 2018, around 20% of the renewable electricity generated in Germany was produced by PV, including large PV field arrays, and this contributed 7.7% to gross electricity consumption (ZSW and UBA, 2019). Of the installed capacity of German PV systems 15% falls into the category of up to 10 kWp and 34% in the range from 10 to 100 kWp (Wirth, 2020). After years of strong growth between 2005 and 2012 growth rates have slowed down (ZSW and UBA, 2019) since the policy and regulatory framework has changed.

German legislation mandates that the level of FIT at the time of installation of PV applies for 20 years. While the FIT for small-scale PV was around 57 ct/kWh for PV installed in 2004 it has constantly decreased since then and was around 11 ct/kWh for units installed in 2019 (Kelm et al., 2019). It is financially more attractive to feed PV electricity into the



grid than to consume one's own electricity for households who installed PV up to 2012. For households who have installed PV since then, self-consumption is financially more attractive as the guaranteed FIT per kWh from then on became lower than the (average) price households pay for using electricity from the grid. This difference has constantly increased since then (Wirth, 2020). Thus, depending on when the PV system was installed, it is either more attractive for households to feed all electricity to the grid or more profitable to use it themselves, though with some differences regarding the precise economic benefit.

Under current legislation that was valid for the most recent interviewees as well as at the time of writing this paper, consuming self-generated PV electricity is free from electricity taxes and levies for PV installations below 10 kWp;² but at higher capacities 40% of the regular EEG levy of a few cents must be paid per kWh consumed (EEG, 2017)³. However, the financial benefit from self-consumed electricity is subject to income taxes. Additionally, the current legislation guarantees a FIT of around 10 ct/kWh to households for the electricity they still feed to the grid if they do not use it themselves. In any case, consuming self-generated electricity is still cheaper than obtaining electricity from the grid, where prices are around 30 ct/kWh (BMW, 2020). Thus, consuming electricity from a PV system installed by a household after 2012 leads to lower costs. Furthermore, to prevent grid overloads at peak generating times (e.g., midday in summer), PV system owners in Germany are obliged to allow grid operators to regulate their system (receiving lump-sum compensation for revenue lost); alternatively, smaller systems below 30 kW can limit their feed-in to 70% of their maximum effective power (EEG, 2017). Thus, for most households with recent PV installations, there is a limit to the amount that households can feed to the grid⁴.

² Although the marginal cost of producing each extra kWh is zero (Haar, 2020), there are still maintenance costs for PV and its electrical circuit technology. Most of these are usually very low, but storage batteries and DC-AC converters are expensive to replace if they fail.

³ In 2020, this was 2,7 €ct / kWh, cf. Bundesnetzagentur (2020).

⁴ As the real output is rarely higher due to weather and technical conditions, the actual resulting loss is only about 2-5%, cf. Wirth (2020).

Description of Database

Four series of interviews serve as the database for this study. The total of 48 interviews were conducted in Germany between July 2017 and March 2019. They were obtained in four regional clusters and through a variety of recruitment procedures:

- (1) State of Hesse: The first series of interviewees was conducted between July and September 2017. The homes of the 13 respondents were mainly situated around the city of Darmstadt in the southern part of the State of Hesse which is at the center of Germany. Interviewers contacted potential participants by ringing at the door if PV systems were visible from outside or via internet maps. An earlier paper based on these interviews investigated the motivation to adopt a PV system (Köhler et al., 2019).
- (2) Wüstenrot: This small cluster was recruited at a citizen assembly and focused on inhabitants of an innovative building site at the small town of Wüstenrot, which is located in a rural area between the agglomerations of the cities Stuttgart and Heilbronn. In order to stand out and become attractive for potential citizens, the municipality has been pursuing local energy projects for some time. All houses on this newly developed housing estate were obliged to be equipped with a PV system. The homes are heated by an innovative heat network based on near-surface geothermal energy. Four households participated in the interviews which were conducted in March 2018. These were recruited at a citizen assembly for inhabitants of the housing estate.
- (3) Lower Franconia: 16 interviews with prosumer households in rural villages and towns around Schweinfurt in Lower Franconia, in the northern part of Bavaria, were conducted in February and March 2019. Interviewees were recruited through municipal newsletters, through a staff member of Schweinfurt County's energy support team and finally through local contacts of the authors. A paper focusing on other questions than those of the current paper is published by Galvin (2020) employing these interviews as a data source.
- (4) Markgräflerland around Freiburg: Finally another 15 participating households were recruited in the rural area around Freiburg in the southwest of Germany near the borders to France and Switzerland. Again, municipal newsletters were used to find interviewees, this was

complemented by pre-identifying relevant homes through internet maps and ringing doorbells. The interviews were held in March 2019.

The interviews in cluster 1 were part of a psychology student research project and conducted under close supervision of the corresponding author. In Clusters 2 and 4 interviews were conducted by experienced interviewers from the corresponding author's institution. In cluster 3 the second author, who is also an experienced interviewer, social scientist and former electrical engineer, did the interviews. Originally, series 3 and 4 also included a few additional households who owned solar-thermal panels to heat water but no PV; they were excluded for reasons of consistency in the current paper.

The motivation behind combining these different clusters was to acquire a broad sample which is heterogeneous, for example with regard to local history and context including local discourses on renewable energy. This rationale was fueled by the aim that a qualitative study is appropriate when the goal is to further develop theory and enhance the in-depth knowledge on a topic. Thus, the main goal for sample composition is to make sure the full variety of the subject under study is captured. For this reason we also combined a variety of recruitment strategies, e.g., trying to acquire both more and less eager participants. The specific recruitment strategies were outlined above. Due to their heterogeneity it is not possible to estimate response rates.

The interviews were on the household level, i.e., in some cases more than one household member participated. More specifically the 48 households were represented by 32 men, three women, eleven couples and two women with their adult sons living in the same home. The average age of interviewees was 56, ranging from 27 to 82. Average household size was three with a range from one to seven. One third of the homes were situated in a town or city, two thirds in a rural area. We asked for self-ratings regarding income: one household saw themselves as below average, 20 as average, and 27 as above average. The solar panels were installed between 1999 and 2018 and thus cover the full range of the various FITs in this period. Nineteen households solely feed their electricity into the grid while a majority of 28 combine feeding into the grid with self-consumption and one household was not sure about this. For a detailed overview of the interview partners, see **Appendix 2**.

Interview Topics and Analyses

The interviews were semi-structured, based on an interview guideline which was highly similar for clusters 1 and 2 and for clusters 3 and 4. The main difference in the interview contents of clusters 1/2 vs. 3/4 is that in the first two clusters a larger part of the interviews focused more extensively on the adoption process and how the decision for the PV system evolved; these interviews were on average also longer than in the second two clusters. The interview guideline for the second clusters is given in the **Appendix** to this paper. Besides the adoption process, the guideline featured details about the PV system and technologies, investments and systems for monitoring connected with it; the motivation and aims for the installation and discussions in the household around it; energy behavior before and after installing

the PV; and questions about the local context. All interviews were accompanied by a short written questionnaire to assemble some key data about the household and its composition, electricity consumption, and PV system. The interview conversations were digitally recorded and transcribed verbatim. The text corpus of these transcripts adds up to an amount of 280,310 words overall.

As indicated above, parts of the interviews have been analyzed for different research questions. For the research interests under study in the present paper a coding frame was developed including main codes and subcodes (see **Table 1**) by applying content analysis starting with a theory driven deductive approach and refining the coding scheme inductively where necessary (Mayring, 2015). First, the interviews from series 1 and 2 were coded by the first author using a simplified coding scheme on behavioral consequences, extracting (1) further (intended) investments, (2) behavioral changes regarding electricity use, (3) synchronicity of consumption behavior with the sun, and (4) behavioral changes in other domains like water, transport. In this first analysis the lines of arguments by which households explained their respective behaviors and the behavioral outcomes were not separated from each other but subsumed using the same main codes. In a next step, the third author of the paper coded all interviews from all four series with a focus on the behavioral consequences. The main codes in this step were the same as above excluding quotes on underlying mechanisms and extending the behavior change category also to explicit statements that behaviors have not changed. In this step the code assignment in the first cluster was also checked for diverging interpretations, and high levels of agreement emerged. Finally, the first author refined the coding on behavioral consequences by going through all interviews again and additionally coding the underlying mechanisms. In a next step, the quotes on the subcodes were extracted by the first author and densified according to themes to allow for counting frequencies where applicable, e.g., regarding the technologies the households invested in.

The main codes are based on the concepts included in **Figure 1** and displayed in **Table 1**. The coding process and the interpretation of results was also checked by the second author who was the interviewer of the (relatively large) Franconia study for consistency and plausibility. For a fuller account of issues that arise in coding to a high degree of reliability together with reviews of recent literature on this see O'Connor and Joffe (2020).

In the following, where quotes are provided from the interviews they are given by letters symbolizing the region, i.e., HE, Hesse; WÜ, Wüstenrot; FRAN, Franconia; FR, Freiburg, and a number identifying the relevant interview in the sample.

RESULTS

Behavioral Consequences

Our analysis on behavioral consequences will start by outlining the findings on energy system investments. In this category we summarize investments *in addition to the PV*, that households made to save energy, to make better use of the electricity from the PV or replace the use of less sustainable energy sources, e.g., buying an electric car instead of a conventional one. This will be followed by an analysis of daily behaviors starting with (i)

TABLE 1 | Overview on main codes and sub-codes applied to the interview data.

Main code	Sub-code
Behavioral consequences	
Energy system investments	Realized further investments Future options Denied investments
Daily behaviors: Synchronizing electricity demand with supply	
Daily behaviors: Behavioral change in electricity consumption	Reduction of demand Increased demand No change More conscious consumption
Daily behaviors: Behavioral change in other domains	Reduction of demand Increased demand No change More conscious consumption
Mechanisms behind behavioral change	
Individual level mechanisms	Economic, psychological
Socio-technical mechanisms	
Other	

issues around synchronizing demand with supply, (ii) electricity use more generally and finally (iii) behaviors around energy and resource use more broadly.

Energy System Investments

In many respondent households the PV system is not the only step toward active integration into the energy production system or the uptake of relevant innovations. Overall, three quarters of the interviewed households (36 out of 48) have made additional investments in further technologies. On average this encompasses two further investments per household, ranging from 1 to 5. Most prominent is the use of a solar thermal system (15 households), battery storage (9), or a heat pump (8). Seven report that they implemented high insulation standards, including passive house standard in some cases; seven interviewees state that they use a sustainable heating system, e.g., running on wood or as a combined heat and power unit. Overall, ten use alternative drives for their vehicles, most prominently full electric cars (5). Further investments include highly efficient household appliances and lighting, water re-use systems, and smart home equipment. The timing of these investments and how they relate to owning the PV is often not fully clear in the interviews. Many interviewees describe them as different stations of a longer journey:

HE4: As you said, it has always been important to us that we are aware of energy issues and we enjoyed having this possibility that we can contribute to exploiting the sun.

I: Has that changed over time or increased?

HE4: Well, it expanded into other areas and we are now driving a hybrid car

Even more interviewees (34) elaborate on future investments. On average interviewees had two further ideas as to what such investments could be. Among these, adding battery storage (18) and/or buying an electric vehicle (15) are the dominant

themes. For those feeding all their electricity to the grid, the next anticipated step is to move to self-consumption. Further ideas are similar to those already implemented and include sustainable heating systems, smart home elements, and micro wind turbines. The reasons these ideas have not yet been implemented are heterogeneous—in about a third of cases intentions are still vague and more in the stage of first ideas. That the necessary investment is considered as too high also plays a role. In some cases, the intention is firm but households are waiting for the right point in time, i.e., when the current car gets too old, the heating system breaks down or their guaranteed FIT is about to end.

Fourteen interviewees also excluded certain investments: five had turned down the option of buying electric cars due to restricted range, environmental reasons, or high prices; four were generally skeptical about battery storage, again due to high prices or an insufficient economic rationale as well as doubts that decentralized storage is beneficial to the energy system. Further ideas that were turned down by one of the households included more sustainable heating systems or home renovations, the main reason being too high initial investments.

Daily Behaviors: Synchronizing Electricity Demand With Supply

Many of the interviewees reported some degree of synchronizing electricity demand with sunshine. However, the majority of these are from the subgroup that is engaged in self-consumption. Of those fully feeding to the grid only two out of 19 households engage in synchronizing behaviors compared to 22 out of the 28 who do not fully feed into the grid. The main synchronizing activity is to aim at using basic household appliances like washing machines, driers, and dishwashers when the sun is shining or at least during daytime. Very few combine this with setting timers or some sort of home automation, i.e., these activities are mainly performed manually and the women in the households are often the ones implementing it, with the men often presenting themselves as the ones pushing in this direction:

I: So it is also in her blood that she [his wife] will turn on the washing machine or dishwasher in four hours or something like that?

FR11: Yes, she does that. Because that's just a requirement of the boss [i.e. the interviewee].

I: Do you urge her or does that come from her?

FR11: No, no. She already realizes that it makes sense. (...) [However,] if it doesn't fit and [she] just wants to have it done in the evening so that it is clean in the morning (...) then it must be possible to do that without the sun shining.

The quote also points out limitations that are repeatedly mentioned, i.e., that synchronicity ends where it puts too much strain on comfort or interrupts necessary activities. This also refers to activities which interviewees do not consider shifting, such as cooking.

Daily Behaviors: Changes in Electricity Consumption

Codings around possible changes in daily behaviors regarding electricity consumption fall into four groups: (i) respondents reporting that they have reduced their electricity consumption

due to or following the installation of the PV, (ii) households reporting increased consumption, (iii) statements indicating no change in consumption and finally, (iv) interviewees talking about an increase in awareness without stating or knowing the influence on actual consumption. These categories are not necessarily exclusive, i.e., the sample includes eleven people each making statements that fall into more than one group. For example, households explained about using more electricity in one case and less in another. Twenty one households only gave statements from just one of these categories. Hardly any of the interviewees were able to provide precise quantitative observations comparing the development before owning the PV and since then. Some had incidental data about yearly consumption, but, major changes were mainly due to children moving out. Some households started to constantly monitor their consumption since they own the PV. Twenty reported they used less electricity now and described themselves as frugal.

HE12: And to always check where you can save more, or where you could use an energy saving lamp, or where you can replace a device with something that uses less energy. Of course always in a reasonable manner. You also need energy to produce the device, so to buy a new refrigerator for one kilowatt, that would be nonsense.

However, many of these statements remained very general, sometimes alluding to turning off lights or reducing standby consumption.

Thirteen made statements describing perceptions that nothing has changed:

FR13: I think nothing has changed. It is not that I now for example produce electricity and say, I can then waste all the more somewhere else. (I: Yes.) My behavior has not really changed because I now produce electricity myself and do not store anything. (I: Yes.) Nothing has changed. (I: Exactly.) Definitely not.

In some cases further explanations about this lack of change go in different directions—either pointing out why reductions are not perceived to be necessary or, contrastingly, how the household just continued their always frugal lifestyle:

FRA6: I say that you have a certain quality of life, and you don't really need to restrict it because the sun makes enough energy, yes.

I: Yes. Do you think that over time, over the last 20 years, you have become more energy efficient, or about the same?

FRA16: I think I have actually always been.

R: Always?

FRA16: Yes, I think strangely enough yes.

Some (7) explain that the PV has increased their awareness:

FR5: You just perceive it much more consciously. Because I get feedback on my energy consumption every day, I am much more aware of it. And I also realize what consumes energy at all and what doesn't.

Finally, a smaller group (5) outline that their demand has increased. This is mainly bound to the acquisition of additional

appliances and gadgets like garden lights, a fountain, or a solarium to get tanned. For some, the investment in PV was a response to high demand:

FR3: So we were angry about our [electricity] bill. (...) We have a swimming pool inside and sand filter and that was close to 2000 Euro per year. And then we said: Well, that doesn't have to be. We wanted to reduce that.

Daily Behaviors: Behavioral Change in Other Domains

Statements on further behavioral change in other domains than electricity were also given. One topic that repeatedly came up was travel behavior and more specifically flying. Several interviewees were very conscious about this topic and brought it up themselves. A small group made statements that they had given up flying a long time ago and do not intend to do so now, or explain about very specific exemptions from this principle (e.g., a couple working for the church flying to Israel for once in their life). Others claimed to make very conscious decisions regarding flying. However, there was also some variety as to what “flying rarely” means:

FRA5-wife: Or, we also take a lot of vacations by bike. And often we go there by car. And if we deliberately go to vacation apartments, we have contact to the landlords. And, but we do take an airplane trip in winter (laughs).

FRA5-husband: Rarely. Every 2 years on average. But not a long distance trip, but sometimes to the Canaries or

FRA5-wife: Still little

FRA5-husband: We want to go to Crete now. Or we went to Sicily now last year.

In a similar vein, ambivalence about modes of travel extends to the choice of transport mode in daily life or the extent of car use.

Another area of resource use that is repeatedly mentioned is the use of water, with some households reporting about their installations for using rain-water or re-using e.g., water from showering for the toilet. Another topic is sparse or very conscious consumption when buying goods, reduced number of appliances, recycling, or reducing waste. Overall, interviewees give more examples of reduced or very conscious use of resources and fewer examples of high resource use levels. Of those who did speak of high resource use levels, two households reported heating over-generously.

Mechanisms Behind Behavioral Change

The underlying mechanisms that interviewees refer to are broad and heterogeneous. For some the investment in the PV system is already described as one step that was logical from what they had thought and experienced earlier and which also led them on to further investments and/or consistency in their daily behaviors (cf. quote from HE4 above). As outlined before, the PV investment is sometimes followed by behavioral changes, sometimes the PV is installed in response to behavioral change or high demand (e.g., maintaining a swimming pool FRA4). This will be described in more details in the remainder of this section. When the coding scheme was developed it also included the category “other” (cf. **Figure 1** and **Table 1**), however, this subcode did not turn out to become relevant.

Individual Level: Economic and Psychological Mechanisms

Economic vs. environmental motivations are the dominant areas of discussion (often contrasted by interviewees). Some state a clear dominance of the one or the other or emphasize both, in other cases motives and how they actually influence decision making and daily behaviors seem less clear. For some, saving money is an important mechanism that drives them to synchronize their consumption patterns with the sunshine.

In some cases, the economic outcome was not clear at the point of time of decision making, with high initial investments, and was evaluated positively when people realized that later.

However, some directly reject economic thinking:

FRA2: When you buy a Mercedes with leather seats, do you ask if the Mercedes with leather seats is profitable or if a Golf with cloth seats is profitable? Does anyone ask, if one builds a dormer, if this dormer is profitable or if a roof window would be sufficient?

In these cases, the decision on the investment for the PV and further technologies depended on the affordability, but not on anticipated financial gains.

Furthermore, the interviews indicate a variety of guiding motivations (“Leitmotif”) that some interviewees refer to, often repeatedly, during the interview and connecting different behaviors and decisions following this *Leitmotif*. One of them is autarchy, i.e., some interviewees explain their investment in PV and also additional investments like storage by their desire to become independent of the energy system, and also of changing prices.

FRA7: I think there is a high vulnerability of our systems that we are not aware of today and the idea that I can get an emergency power supply from my own - my own energy storage and my photovoltaic system - is already a motivation to invest even more money.

WÜ1: I don't care how much the oil costs (...) I always have mine somewhere and as I said, I can influence it myself, just very well by simply orienting myself a little towards the sun, so that's a great thing.

In some cases the themes of sustainability and/or environmentalism are playing an important role across different situations:

HE7: So, as I said, I wanted to do something for the environment. And of course that's one aspect, decentralized energy generation. There are many other environmental things you can do (...). Not driving a car, for example, is one. [laughs] Well, I'm also a cyclist, just by the way.

Some households are proud and enjoy what they achieved in this regard:

HE12: So the feeling is that the electricity I consume here, it is also fun with such an attitude as mine to consume as little as possible.

This goes as far that the enjoyment in everyday life is described in vivid pictures:

FRA7: I have now already told my wife that it is a completely different feeling to shower with solar heat, with solar thermal water. (...) Not a lot of oil runs down over your head but solar heat runs over your head.

Others that emphasize ecological motives focus on increasing awareness as an ongoing process as pointed out above.

Finally, in one case, frugality *per se* is described as the guiding principle.

A different psychological mechanism in addition to the leitmotif that emerges in several interviews is the idea of having a clear conscience due to using solar energy. In some cases this clear conscience is then used to justify behaviors that are not fully sustainable like traveling or using more energy/electricity.

Socio-Technical Mechanisms

The legislative framework also plays a role in shaping the behaviors of PV households. As pointed out earlier, in few cases further investments are currently held back as households still enjoy a high FIT and do not want to change the configuration before it ends. In one case, the household chose a smaller PV to stay beyond a certain limit in the regulations.

Regulatory and sociotechnical influences can sometimes be closely interwoven. One of the peculiarities of the German legislation on renewable energy is that to prevent peak loads, PV system owners in Germany are obliged to allow grid operators to regulate their system (receiving compensation for it); alternatively, smaller systems below 30 kW can limit their feed-in to 70% of their maximum effective power (EEG, 2017). Thus, there is a limit to the amount that households can feed to the grid⁵. This is only relevant to newer systems as this rule is relatively new. Those affected by it in our sample often refer to it and some are deeply concerned to find ways to use the relevant electricity and prevent it from being “wasted.”

Another topic at the interplay between technology and household behaviors is how the actual supply with electricity is monitored, if at all. Some “monitor” the system only scarcely by checking if the light of the control unit is still on when they pass by.

FRA19: So technology is—I must say—I am from the humanities. I'm really not interested in technology. Not very, huh? (...) I look at my equipment working in my basement. I can see whether the green light is on or not (laughing).

Others are in the position to access real-time information about current supply and battery status (if applicable) through smartphones and similar devices and also report that they observe this closely and also use it to educate other household members. Others have established a paper-and-pencil monitoring, often on a monthly basis to detect larger deviations.

HE3: For me, I do it in my book, in which I enter my consumption and production every month, just like with water

⁵As the real output is rarely higher due to weather and technical conditions, the actual resulting loss is only about 2-5%, cf. Wirth (2020).

and gas, and I have sensitized my children to the point that they are happy if they consume less themselves.

DISCUSSION AND CONCLUSIONS

This paper started out to take a closer look at how prosuming changes energy-related behavior of households. As a conceptual framework we drew on the literatures on rebound and spillover and as an empirical basis on 48 interviews with prosumers from four regional clusters. The focus of prosumers is motivated by the fact that prosuming households are an example how the energy transition as part of the great transformation toward sustainability manifests on the individual level. By generating electricity, households change their role in the electricity system and leave behind being passive consumers. It is against this background that we take a detailed look at how prosumers describe their interactions with the PV system, if, how and why it changes their energy behaviors.

What we found in the interviews is a broad variety of behavioral responses. Further investments, already realized or planned for the future, play a prominent role. Many households have already combined their PV with further technologies or have thought a lot about how to do so in the future. To some extent this resonates with the finding of Cohen et al. (2019) as there appears to be “q-complementarity” between investment in PV and in certain other electrical goods. Q-complementarity is said to occur when the welfare gain from adopting one good is increased by the welfare gain from adopting another good and vice versa. Becoming a prosumer is for many of our respondents not an end in itself but just one step in a longer journey. In this vein, the investment in the PV system not only impacts future investment decisions, but was often triggered by earlier experiences.

The behavioral responses in daily routines are also heterogeneous within the households. Some quite clear cases of consistent environmental concern and motivation throughout emerge, and others where environmental concern and environmentally supportive behavior were gradually amplified through their experience of having PV. Furthermore, for some the PV is a kind of compensatory investment as they perceive their consumption as exceptionally high. Finally, for some the PV is also a means to justify increases in demand or luxury investments, one of the impressive examples is probably the household that added a solarium.

The mechanisms that trigger the behavioral responses are also broad and heterogeneous, and economic, psychological and socio-technical drivers were sometimes closely interwoven. At the same time, drivers do not seem to unfold homogeneously or consistently. For example, economic mechanisms act as an important driver to some, but others highlight the relevance of affordability rather than economic viability). Psychological issues were mainly revealed in the form of guiding principles (leitmotif), and less as specific relationships between psychological variables like norms or attitudes. Having a “good conscience” was emphasized in some interviews and points to the relevance of moral issues, i.e., licensing or consistency behaviors.

The link to the energy transition shows up most via socio-structural mechanisms, and these relate most strongly in our analysis to the embeddedness of prosumers and their PV in the electricity system and its regulatory framework. We find different types of effects of the legislative context which give important signals to prosumers; however, the perceived influence of regulations seems sometimes higher than their actual relevance. For example, some of the households are concerned about the energy they are not allowed to feed to the grid due to a recent cut-off rule. However, technical estimations indicate that the actual loss is likely to be small (Wirth, 2020). Thus, it seems likely that many households cannot draw on exact economic or technical estimations (due to lack of knowledge, interest and/or data). Rather, the regulative structure provides rules of thumb which are then translated into behavioral heuristics.

Pointing to the limitations of the paper, it seems highly likely that different findings would emerge in different national contexts, e.g., where financial incentives and regulatory contexts differ. In our case this is mirrored by the differences between people fully feeding into the grid and those who consume some of electricity themselves. Another limitation is that due to the semi-structured guideline there is variation between the interviews as to which topics came to the fore and which did not. Thus, it is possible that some issues or mechanisms play a role for further households but did not enter the discussion during any of the interviews. This is especially likely to apply to behavioral consequences beyond electricity use where it might have been difficult for interviewers and interviewees to touch upon all possible topics.

This paper adds to the literature by giving a very detailed and thereby innovative account of the behavioral consequences of adopting PV and why these emerge. Some of the findings are in line with earlier literature that pointed to increases in awareness (Palm et al., 2018). Furthermore, the broad variety of behavioral responses also fits with the heterogeneity of past findings regarding the emergence and size of potential rebound or conservation/rebound effects (Oberst et al., 2019; Qiu et al., 2019; Li et al., 2020): Households brought forward a variety of logics and descriptions to explain their behaviors. This in-depth account of qualitative findings can inform the design of future quantitative studies that build on our findings. Large samples would also allow for subgroups, so that the full context could be better grasped and considered via rigorous statistical analysis.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the interview data is impossible to be anonymized. Requests to access the datasets should be directed to Elisabeth Dütschke, elisabeth.duetschke@isi.fraunhofer.de.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and

institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ED wrote a first draft of the paper and revised it based on co-authors comments and was strongly involved in the data analysis. RG conducted one of the interview series, commented extensively on earlier versions of the paper and edited the text. IB was involved in coding the data and provided comments on the paper. All authors contributed to the article and approved the submitted version.

FUNDING

This work was supported by the German Federal Ministry of Education and Research [grant number FKZ 01UT1705 A-C,

project EE-Rebound]. Parts of the data collection was supported by a grant from the German Federal Ministry for Economic Affairs and Energy [O3SIN125, project: C/sells].

ACKNOWLEDGMENTS

We thank Julius Wesche and Florian Emsmann for their support as well as the student project group around Daniel Hanss at Hochschule Darmstadt for their support in conducting the interviews. In addition we are grateful to Julika Weiß for valuable input on conceptual considerations.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.636109/full#supplementary-material>

REFERENCES

- BMWi (2020). *Energiepreise und Transparenz für Verbraucher: Der Strompreis*. Available online at: <https://www.bmwi.de/Redaktion/DE/Artikel/Energie/strompreise-bestandteile.html>.
- Bundesnetzagentur (2020). *EEG-Umlage: Was ist die EEG-Umlage und Wie Funktioniert Sie?* Available online at: <https://www.bundesnetzagentur.de/SharedDocs/FAQs/DE/Sachgebiete/Energie/Verbraucher/Energielexikon/EEGUmlage.html>.
- Chenavaz, R. Y., Dimitrov, S., and Figge, F. (2021). When does eco-efficiency rebound or backfire? An analytical model. *Eur. J. Operational Res.* 290, 687–700. doi: 10.1016/j.ejor.2020.08.039
- Chitnis, M., Sorrell, S., Druckman, A., Firth, S. K., and Jackson, T. (2014). Who rebounds most? Estimating direct and indirect rebound effects for different UK socioeconomic groups. *Ecol. Econom.* 106, 12–32. doi: 10.1016/j.ecolecon.2014.07.003
- Cischinsky, H., and Diefenbach, N. (2018). *Datenerhebung Wohngebäudebestand 2016: Datenerhebung zu den energetischen Merkmalen und Modernisierungsraten im deutschen und hessischen Wohngebäudebestand [Data collection residential building stock 2016: Data collection on the energy characteristics and modernisation rates of the German and Hessian residential building stock]*. Darmstadt. Available online at: https://www.iwu.de/fileadmin/user_upload/dateien/gebaeudebestand/prj/Endbericht_Datenerhebung_Wohngeb%C3%A4udebestand_2016.pdf.
- Cohen, J., Azarova, V., Kollmann, A., and Reichl, J. (2019). Q-complementarity in household adoption of photovoltaics and electricity-intensive goods: the case of electric vehicles. *Energy Econom.* 83, 567–577. doi: 10.1016/j.eneco.2019.08.004
- Dimitropoulos, A., Oueslati, W., and Sintek, C. (2018). The rebound effect in road transport: a meta-analysis of empirical studies. *Energy Econom.* 75, 163–179. doi: 10.1016/j.eneco.2018.07.021
- Dütschke, E., Frondel, M., Schleich, J., and Vance, C. (2018). Moral Licensing—Another Source of Rebound? *Frontiers Energy Res.* 6:393. doi: 10.3389/fenrg.2018.00038
- EEG (2017). *Gesetz für den Ausbau Erneuerbarer Energien (Erneuerbare-Energien-Gesetz - EEG 2017)*. Available online at: https://www.gesetze-im-internet.de/ee_g_2014/.
- Elf, P., Gatersleben, B., and Christie, I. (2018). Facilitating positive spillover effects: new insights from a mixed-methods approach exploring factors enabling people to live more sustainable lifestyles. *Front. Psychol.* 9:2699. doi: 10.3389/fpsyg.2018.02699
- Galizzi, M. M., and Whitmarsh, L. (2019). How to measure behavioral spillovers: a methodological review and checklist. *Front. Psychol.* 10:342. doi: 10.3389/fpsyg.2019.00342
- Galvin, R. (2013). Impediments to energy-efficient ventilation of German dwellings: a case study in Aachen. *Energy Build.* 56, 32–40. doi: 10.1016/j.enbuild.2012.10.020
- Galvin, R. (2020). I'll follow the sun: Geo-sociotechnical constraints on prosumer households in Germany. *Energy Res. Soc. Sci.* 65:101455. doi: 10.1016/j.erss.2020.101455
- Galvin, R., and Gubernat, A. (2016). The rebound effect and Schatzki's social theory: reassessing the socio-materiality of energy consumption via a German case study. *Energy Res. Soc. Sci.* 22, 183–193. doi: 10.1016/j.erss.2016.08.024
- Haar, L., de, Peters, A., and Scholz, R. W. (2007). Reducing energy consumption in road transport through hybrid vehicles: Investigation of rebound effects, and possible effects of tax rebates. *J. Cleaner Product.* 15, 1076–1084. doi: 10.1016/j.jclepro.2006.05.025
- Haar, L. (2020). "Inequality and renewable electricity support in the European Union," in *Inequality and Energy: How Extremes of Wealth and Poverty in High Income Countries Affect CO2 Emissions and Access to Energy*, ed R. Galvin (London: Academic Press), 189–220. doi: 10.1016/B978-0-12-817674-0.00009-6
- Hofstetter, P., Madjar, M., and Ozawa, T. (2006). Happiness and sustainable consumption: psychological and physical rebound effects at work in a tool for sustainable design. *Int. J. Life Cycle Assessment* 11, 105–115. doi: 10.1065/lca2006.04.018
- IEA and IRENA (2017). *Perspectives for the Energy Transition*. Investment needs for a low-carbon energy system.
- Kelm, T., Metzger, J., Jachmann, H., Günnewig, D., Püschel, M., Schicketanz, S., et al. (2019). *Vorbereitung und Begleitung bei der Erstellung eines Erfahrungsberichts gemäß § 97 Erneuerbare-Energien-Gesetz: Teilvorhaben II c: Solare Strahlungsenergie*. Abschlussbericht. Stuttgart, Hannover. Available online at: https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/bmwi_de/zsv-boschundpartner-vorbereitung-begleitung-ee.pdf?__blob=publicationFile&v=7.
- Köhler, J., Lange, J., Lohmann, V., Lemki, V., Dütschke, E., and Hanss, D. (2019). Warum investieren Haushalte (nicht) in Photovoltaik-Anlagen? Eine empirische Exploration von Motiven, Barrieren und Erwartungen. *Umweltpsychologie* 23, 12–37.
- Korcaj, L., Hahnel, U. J., and Spada, H. (2015). Intentions to adopt photovoltaic systems depend on homeowners' expected personal gains and behavior of peers. *Renew. Energy* 75, 407–415. doi: 10.1016/j.renene.2014.10.007
- Li, X., Lim, M. K., Du, N., Zhong, B., Xiao, Z., and Hao, H. (2020). Sustainability or continuous damage: a behavior study of prosumers' electricity consumption after installing household distributed energy resources. *J. Cleaner Product.* 264:121471. doi: 10.1016/j.jclepro.2020.121471

- Luthander, R., Widén, J., Nilsson, D., and Palm, J. (2015). Photovoltaic self-consumption in buildings: a review. *Appl. Energy* 142, 80–94. doi: 10.1016/j.apenergy.2014.12.028
- Matiaske, W., Menges, R., and Spiess, M. (2012). Modifying the rebound: It depends! Explaining mobility behavior on the basis of the German socio-economic panel. *Energy Policy* 41, 29–35. doi: 10.1016/j.enpol.2010.11.044
- Mayring, P. (2015). *Qualitative Inhaltsanalyse*. Grundlagen und Techniken [Qualitative content analysis] (Vol. 12). Beltz Verlag.
- Mazar, N., and Zhong, C.-B. (2010). Do green products make us better people? *Psychol. Sci.* 21, 494–498. doi: 10.1177/0956797610363538
- Mullen, E., and Monin, B. (2016). Consistency versus licensing effects of past moral behavior. *Annual Rev. Psychol.* 67, 363–385. doi: 10.1146/annurev-psych-010213-115120
- Nash, N., Whitmarsh, L., Capstick, S., Hargreaves, T., Poortinga, W., Thomas, G., et al. (2017). Climate-relevant behavioral spillover and the potential contribution of social practice theory. *Wiley Interdiscipl. Rev. Climate Change* 8:e481. doi: 10.1002/wcc.481
- Oberst, C. A., Schmitz, H., and Madlener, R. (2019). Are prosumer households that much different? Evidence from stated residential energy consumption in Germany. *Ecol. Econom.* 158, 101–115. doi: 10.1016/j.ecolecon.2018.12.014
- O'Connor, C., and Joffe, H. (2020). Intercoder reliability in qualitative research: debates and practical guidelines. *Int. J. Qualitat. Methods* 19:160940691989922. doi: 10.1177/1609406919899220
- Palm, J., Eidenskog, M., and Luthander, R. (2018). Sufficiency, change, and flexibility: critically examining the energy consumption profiles of solar PV prosumers in Sweden. *Energy Res. Soc. Sci.* 39, 12–18. doi: 10.1016/j.erss.2017.10.006
- Palm, J., and Tengvard, M. (2011). Motives for and barriers to household adoption of small-scale production of electricity: examples from Sweden. *Sustainability* 7, 6–15. doi: 10.1080/15487733.2011.11908061
- Peters, A., and Dütschke, E. (2016). “Exploring rebound effects from a psychological perspective,” in *Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon*, eds T. Santarius, H. J. Walnum, and C. Aall (Cham: Springer), 89–105. doi: 10.1007/978-3-319-38807-6_6
- Qiu, Y., Kahn, M. E., and Xing, B. (2019). Quantifying the rebound effects of residential solar panel adoption. *J. Environ. Econom. Manage.* 96, 310–341. doi: 10.1016/j.jeem.2019.06.003
- Saunders, H. D. (2008). Fuel conserving (and using) production functions. *Energy Econom.* 30, 2184–2235. doi: 10.1016/j.eneco.2007.11.006
- Seebauer, S. (2018). The psychology of rebound effects: Explaining energy efficiency rebound behaviours with electric vehicles and building insulation in Austria. *Energy Res. Soc. Sci.* 46, 311–320. doi: 10.1016/j.erss.2018.08.006
- Sonnberger, M., and Gross, M. (2018). Rebound effects in practice: an invitation to consider rebound from a practice theory perspective. *Ecol. Econom.* 154, 14–21. doi: 10.1016/j.ecolecon.2018.07.013
- Sorrell, S. (2015). Reducing energy demand: a review of issues, challenges and approaches. *Renew. Sustain. Energy Rev.* 47, 74–82. doi: 10.1016/j.rser.2015.03.002
- Sunikka-Blank, M., and Galvin, R. (2012). Introducing the prebound effect: the gap between performance and actual energy consumption. *Build. Res. Informat.* 40, 260–273. doi: 10.1080/09613218.2012.690952
- Truelove, H. B., Carrico, A. R., Weber, E. U., Raimi, K. T., and Vandenberg, M. P. (2014). Positive and negative spillover of pro-environmental behavior: an integrative review and theoretical framework. *Global Environm. Change* 29, 127–138. doi: 10.1016/j.gloenvcha.2014.09.004
- van der Werff, E., and Steg, L. (2018). Spillover benefits: emphasizing different benefits of environmental behavior and its effects on spillover. *Front. Psychol.* 9:2347. doi: 10.3389/fpsyg.2018.02347
- Verfuërth, C., Jones, C. R., Gregory-Smith, D., and Oates, C. (2019). Understanding contextual spillover: using identity process theory as a lens for analyzing behavioral responses to a workplace dietary choice intervention. *Front. Psychol.* 10:345. doi: 10.3389/fpsyg.2019.00345
- Wirth, H. (2020). *Aktuelle Fakten zur Photovoltaik in Deutschland*. Freiburg. Available online at: <https://www.ise.fraunhofer.de/content/dam/ise/de/documents/publications/studies/aktuelle-fakten-zur-photovoltaik-in-deutschland.pdf>.
- Wittenberg, I., and Matthies, E. (2016). Solar policy and practice in Germany: how do residential households with solar panels use electricity? *Energy Res. Soc. Sci.* 21, 199–211. doi: 10.1016/j.erss.2016.07.008
- Wittenberg, I., and Matthies, E. (2018). How do PV households use their PV system and how is this related to their energy use? *Renew. Energy* 122, 291–300. doi: 10.1016/j.renene.2018.01.091
- Wördsorfer, J. S. (2010). *Consumer Needs and Their Satiation Properties as Drivers of the Rebound Effect*. The case of energy-efficient washing machines (Papers on Economics and Evolution). Jena. Max-Planck-Institute of Economics.
- ZSW and UBA (2019). *Erneuerbare Energien in Zahlen: Nationale und internationale Entwicklung im Jahr 2018*. Berlin. Available online at: https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/Berichte/erneuerbare-energien-in-zahlen-2018.pdf?__blob=publicationFile&v=6.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Dütschke, Galvin and Brunzema. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Conceptualizing the Role of Individual Agency in Mobility Transitions: Avenues for the Integration of Sociological and Psychological Perspectives

Lisa Ruhrort^{1*} and Viktoria Allert²

¹Berlin Social Science Center (WZB), Berlin, Germany, ²Department of Spatial Transformation in the Digital Age, Faculty of Spatial Planning, Dortmund Technical University, Dortmund, Germany

OPEN ACCESS

Edited by:

Daniel Fischer,
Wageningen University and
Research, Netherlands

Reviewed by:

Paul Upham,
University of Sussex, United Kingdom
Melanie Jaeger-Erben,
Technical University of Berlin, Germany
Laura Henn,
University of Kassel, Germany

*Correspondence:

Lisa Ruhrort
lisa.ruhrort@wzb.eu

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 30 October 2020

Accepted: 29 March 2021

Published: 20 April 2021

Citation:

Ruhrort L and Allert V (2021)
Conceptualizing the Role of Individual
Agency in Mobility Transitions:
Avenues for the Integration
of Sociological and
Psychological Perspectives.
Front. Psychol. 12:623652.
doi: 10.3389/fpsyg.2021.623652

With the release of the latest IPCC report, the urgency to steer the transport sector toward ecological sustainability has been recognized more and more broadly. To better understand, the prerequisites for a transition to sustainable mobility, we argue that interdisciplinary mobility research needs to revisit the interaction between social structures and individual agency by focusing on social norms. While critical sociological approaches stress the structural barriers to sustainable mobility, political discourse over sustainable mobility is still largely dominated by overly individualistic approaches, which focus on individual behavior change neglecting its social embeddedness. With discursive struggles over sustainable mobility intensifying, it becomes more urgent to better understand how structural contexts condition individual travel behavior, while at the same time showing how individuals engage in processes of social change. Against this backdrop, the article seeks to deepen the cooperation between sociological and psychological research in mobility transitions research. Building on a broad body of literature, we revisit recent theoretical approaches, which conceptualize the role of individual agency in sustainability transitions. On this basis, we highlight the role of social norms in mobility transitions as a key concept bridging individual behavior and social structures. Using Strong Structuration Theory as an integrative framework, we focus on the role of individual agency in processes of re-negotiation of social norms. Our main hypothesis is that individuals can contribute to mobility transitions by influencing and re-negotiating social norms, especially in the context of windows of opportunity. We analyze how focusing on the dynamic and conflicted nature of social norms can help to illustrate leverage points for a mobility transition as well as inspire future empirical research in the field. This includes that individuals can influence social norms through changing their own travel behavior as well as through engaging in discourse on transport policies.

Keywords: sustainable mobility, transition, agency, social norms, norm conflict, interdisciplinary

INTRODUCTION

With the release of the latest IPCC report and the first indications of climate change becoming visible in central Europe, the urgency to steer the transport sector to ecological sustainability has been recognized more and more broadly (Verkehrswende, 2018). The German government has set itself the goal to reduce transport emissions by 40 percent by 2030 (BMU, 2019). As scenario studies have shown, this goal cannot be reached by switching to zero emissions vehicles alone; climate neutrality requires a modal shift from private cars to more efficient modes of transport and an overall reduction in travel demand (Zimmer et al., 2016). In this sense, a sustainability transition in the transport sector equals a disruption of current trends: for decades, the number of cars as well as overall travel demand in Germany have been growing continually (Nobis and Kuhnimhof, 2018).

To better understand the prerequisites for a large-scale modal shift to more sustainable transport modes, we argue that interdisciplinary mobility research needs to revisit the interaction between social structures and individual agency. With discursive struggles over sustainable mobility intensifying, it becomes more urgent to better understand how structural contexts influence and condition individual travel behavior, while at the same time showing how individuals engage in processes of social change. A promising way to achieve this is to deepen the cooperation between sociological and psychological research (Upham et al., 2020). Recently, critical sociological approaches have stressed the structural barriers to sustainable mobility in the context of a capitalist system of production and consumption (Dörre, 2019, 2020; Mattioli et al., 2020). Yet this perspective can obscure the role, which individuals might play in fostering a transition to sustainable mobility. By contrast, the political discourse over sustainable mobility is still dominated by overly individualistic approaches, which focus on individual behavior change, while neglecting its social embeddedness. While this perspective has been criticized extensively (Shove, 2010; Barr, 2015; Göpel, 2016), there is an ongoing tendency of mainstream political strategy to locate responsibility for a mobility transition mainly on consumer decisions. Psychological research has developed a broad array of theoretical concepts, which account for the social embeddedness of individual behavior change (section “The role of the individual in sustainability transitions”; Göpel, 2016). In this paper, we revisit some of these and look at the potential intersections with systemic accounts of socio-technical change found in sociological research. In this approach, we can build on a substantial body of literature, which has explored different avenues of cooperation between the two disciplines in the field of transition studies (Upham et al., 2015b, 2019; Bögel et al., 2019). On this ground, we propose to focus on the role of competing social norms to better understand the mutual influence of individual agency and social structures in mobility transitions. While the concept of “sustainable mobility” includes multiple dimensions (Banister, 2008), the article focusses on the goal of reducing the modal share of trips made with resource intensive modes, especially driving and air travel. The remainder of this article is structured

as follows: Section “Background and problem description: Stability and change in the socio-technical system of mobility in Germany” draws on the example of Germany to briefly show the lack of progress in achieving ecologically sustainable mobility, but also some “cracks” in the established socio-technical regime of mobility. Against this background, section “The role of the individual in sustainability transitions” presents theoretical approaches, which bridge the gap between structure and agency in sustainability transitions research (STR). In section “Connecting critical sociological theory and psychological perspectives: studying the contestation and re-negotiation of social norms,” we draw on these approaches to develop our main hypothesis: a key avenue for joint sociological and psychological research in mobility transitions lies in studying competing social norms. Section “Conclusion” points out the limitations of this article and proposes topics for further research.

BACKGROUND AND PROBLEM DESCRIPTION: STABILITY AND CHANGE IN THE SOCIO-TECHNICAL SYSTEM OF MOBILITY IN GERMANY

Reducing car-based mobility, and flying, is seen as an essential part of sustainability strategies in the transport sector (Zimmer et al., 2016; Verkehrswende, 2018). Yet, while achieving a modal shift and encouraging the use of more sustainable modes has been a long-time goal, little progress has been made so far (Schwedes, 2011). In the example of Germany, both transport demand and the number of cars on the road are growing, with roughly 75 percent of miles being traveled by car (Nobis and Kuhnimhof, 2018). Safeguarding the growth of the automobile industry, which employs around 800.000 people, is a central goal of the German federal government (Canzler and Knie, 2018). Public transport as well as cycling and walking play a major role in everyday mobility too, but are far less dominant in terms of their corresponding economic structures and political representation. Despite these strong path dependencies, recently some “cracks” in the established structures have begun to appear (Ruhrort, 2020). In many larger cities, the modal share of car trips has stagnated or has been slightly reduced, the modal share of cycling has increased, public transport demand has been stabilized, and new mobility services have emerged (Gerike et al., 2020). Also, the “cultural hegemony” (Brand and Welzer, 2019) of the car seems to have become somewhat contested: since 2016, several cities saw successful initiatives for cycling referenda (Von Schneidmesser, 2021), and the years 2018 and 2019 were marked by a growing societal awareness for climate change (Gössling et al., 2020).

From the transition research perspective, the mobility sector in Germany, while being marked by strong path dependence, has thus begun to show some signs of destabilization. Especially in the years 2018/2019, potential pathways for substantial change became visible: with large numbers of people temporarily joining climate protests or advocating for the replacement of car infrastructures with cycling infrastructure in many cities, dominant concepts of “normality” in the transport sector

temporarily appeared to be losing some ground. In the language of transition theory, this situation could be characterized as a *window of opportunity* for change in the direction of sustainability. According to Geels et al. (2018), windows of opportunity can be seen as moments of intensified struggle between established structures and alternative options. In this context, the question of the interaction between social structures and individual agency for socio-technical transitions in mobility becomes particularly relevant: can individuals play a role in intensifying change dynamics? Or are the constraints posed by dominant social structures too strong to overcome? While previous research has already identified different ways in which social psychological perspectives can be integrated into mobility transitions research (Whittle et al., 2019), we will focus specifically on the role of social norms in a recursive relationship between structure and agency. As Whittle et al. (2019) point out, individual mobility related behavior often reproduces dominant social norms, but may also contribute to shifting social norms (Whitmarsh, 2012). We draw on Strong Structuration Theory to elaborate on the way in which individual agency can contribute to shifting social norms relating to travel behavior in the context of everyday life.

THE ROLE OF THE INDIVIDUAL IN SUSTAINABILITY TRANSITIONS

Structural Barriers to Individual Behavior Change: Contributions From Critical Sociological Perspectives

As several critics have noted, mainstream political discourse tends to misconstrue the role of individuals by locating responsibility for a mobility transition mainly on the level of individual consumers' mode choice and vehicle purchase decisions (Shove, 2010; Marsden et al., 2014; Barr, 2015; Verkehrswende, 2019). This perspective refers to economic concepts of individual choice and a selective consideration of psychological research exploring the intra-individual factors, which influence the willingness to switch from less to more sustainable options. Although psychological research and interdisciplinary approaches from transition studies have developed various approaches to study the role of individual-level action in the field of sustainable mobility (Whittle et al., 2019), the dominance of individualistic models of behavior change in mainstream political discourse still often obscures the surrounding social structures like dominant societal norms and expectations, which set limits against ecological behavior (Schwanen et al., 2011). Göpel (2016) attributes this focus on an individualistic model of change to political convenience: trying to motivate individuals to make "better choices" allows political actors to avoid confrontation of powerful interests. In addition, this strategy can help to skirt conflicts between different political goals such as economic growth and ecological sustainability (Schwedes, 2011; Marsden et al., 2014; Göpel, 2016).

On the other hand, a rich body of literature from sociology and human geography, has highlighted the role of social structures, e.g., in the form of shared practices, institutional settings, and power relations to explain the persistence of

ecologically unsustainable travel behavior (Götz et al., 2016; Manderscheid, 2020; Mattioli et al., 2020). Recently, critical approaches from different social sciences have doubled down on this by stressing the structural barriers to a sustainability transition in the transport sector. For example, Dörre (2020) argues that the ecological crisis caused by growing emissions in the transport sector needs to be seen in the context of multiple crises, which are triggered by the inherent tensions of capitalist market systems. From this perspective, growing transport demand is a symptom of a system of production and consumption, which is dependent on continuous economic growth and expansion (Schwedes, 2017). Ecologically conscious behavior, e.g., buying fewer cars, would directly challenge the foundation of this model of growth, especially in Germany, where the automobile industry is focused on building luxury cars (Canzler and Knie, 2018). From the perspective of cultural sociology, Rosa (2005) sees the continuous growth of consumption (and thus the ecological "footprint") in modern societies as the expression of a culture of *acceleration*. In his view, modern society is characterized by imperatives of growth, which, at the individual level, are experienced as social norms of constant self-optimization and self-expansion (Blättel-Mink, 2020). In this perspective, growing transport demand results from societal norms, which demand individual maximization of opportunities. Individuals feel the pressure to make the most of the opportunities presented to them: consuming as much of the world as possible (Rosa, 2016). Deviating from this norm, e.g., by seeking slower modes of living or by renouncing opportunities to travel, faces high barriers (Paech, 2019).

Similarly, Brand and Wissen (2018) describe the dominant lifestyle of Western societies as an *imperialistic lifestyle*, which "normalizes" resource intensive consumption such as car use in the form of dominant social representations of "the good life." They also stress that the structures of the dominant growth-oriented economic paradigm express themselves in the form of a *hegemonic discourse*, conceptualized as a coherent set of social representations and norms explaining why the current patterns of production and consumption should be preferable to possible alternatives. This hegemonic discourse is often influenced by the interests of those social groups who benefit most from the status quo (Feola, 2020). Göpel (2016) follows up on this by exploring the role of dominant paradigms, which have shaped societal discourse regarding the role of individuals in modern capitalist societies. According to Göpel (2016), the dominant discursive paradigm of the role of individual actors in society is shaped by neo-classical economic theories, which conceptualize individuals mainly as market participants focused on maximizing their individual self-interest. Driven by potentially insatiable desire for consumption (e.g., in the form of cars, holiday trips, etc.), this discursive representation of the *homo oeconomicus* is conceptualized as a perfect match to a system of production and accumulation, which depends on unlimited growth. As Göpel (2016) points out, this paradigm has not only dominated academic economic thinking, but has also been instrumentalized politically to become the dominant conceptual framework of

understanding society and individual agency in many political fields. “Normal” behavior has thus been equated with an orientation toward ever-increasing consumption.

The critical social scientific perspectives presented here can give insights into the barriers to sustainable travel behavior. They stress that ecologically unsustainable mobility practices are deeply embedded in the fabric of “normal” consumption patterns. Instead of building on individual behavior change, these perspectives stress that a transition to sustainable mobility needs to be achieved through political processes and struggles. Following this argumentation, it can be hard to see how individual behavior can play any part in contributing to sustainability transitions. In stressing the long-term stability of social structures these approaches also do not spell out how systemic dynamics in the form of windows of opportunity can change the conditions for individual level action. To bridge this gap, the following sections present recent theoretical approaches, which identify intersections between structuralist accounts and individual level agency and seek to apply these approaches to mobility transition research.

The Multi-Level Perspective as a Framework for Connecting Analytic Levels

One of the most prominent frameworks to study interactions between different societal levels in sustainability transitions is the Multi-Level-Perspective (MLP) on socio-technical transitions (Geels, 2002). The MLP has increasingly been used to study sustainability transitions, also in the transport sector (Geels, 2012; Whitmarsh, 2012). At the center of this concept is the idea that socio-technical systems, such as the automobile system, are stabilized in the form of a socio-technical regime, which is marked by high (dynamic) stability and strong path dependencies, meaning that radical changes are difficult to achieve. Despite this high stability, socio-technical regimes can come under pressure from two sides: on the one hand, the broader societal environment, called landscape, constantly changes and can threaten the stability of regime structures (Geels et al., 2018). On the other hand, niche actors can try to challenge the regime by introducing innovations. It is often difficult for the latter to break through into mass markets, because the institutional structures of the regime are designed to support the dominant technological solutions (Geels, 2014). Under certain circumstances, multi-level dynamics can open up windows of opportunity, which allow niche innovations to gain momentum and threaten the dominant regime, leading to changes in regime structures or to the establishment of a new socio-technical regime.

Recently, MLP-scholars have specifically explored the possibilities of using the framework to study interrelations of structure and agency in change processes (Bögel et al., 2019). Elaborating the micro-structures inherent in the MLP, Geels (2020) points out that, while the framework has often been applied with a macro-level perspective of socio-technical change, it is not *per se* a structuralist approach. Having its roots in the Social Construction of Technology (SCOT) framework, it lends itself to studies of the role of individual agency in innovation processes. As Geels (2020) points out,

SCOT-approaches tend to “follow the actors” and try to understand how strategic action of social groups, firms, or individuals help to bring about the breakthrough of specific innovations. Yet, as Bögel and Upham (2018) show, in the application of the MLP, agency has often been analyzed with regard to meso-level actors such as firms or organizations, while the role of individuals as consumers or citizens has received less attention in this research tradition (Whitmarsh, 2012; Whittle et al., 2019). Recently, Göpel (2016) has proposed to expand the three levels described by the MLP by adding a dimension of individual level action highlighting how individuals can influence transition processes in multiple ways as they adopt different roles within society. She describes this “mini” level as a realm strongly structured by macro-level cultural paradigms and dominant mindsets [e.g., in the form of dominant norms of consumption such as buying a sport utility vehicle (SUV) or taking overseas holidays], which influence individual level action. Yet, she also attributes the potential to individuals to become aware of and questions these dominant paradigms (ibid.).

Psychological Approaches to Conceptualizing the Role of Individual Agency in Mobility Transition

Alongside integration of individual agency of Göpel (2016) into the MLP, several scholars underlined the importance of a differentiated view of individuals in transition processes (Whitmarsh, 2012). Nielsen et al. (2021) distinguish five roles in which individuals can contribute to societal change: as consumers, as investors or producers, as participants in organizations, as members of communities and as citizens. Psychological research can explain the intra-individual factors and group processes motivating agency associated with these different roles (Upham et al., 2020). Transition research can make use of these psychological theories to get a nuanced understanding of the actor perspective as Upham et al. (2020) have illustrated in their conceptual and empirical work (Bögel and Upham, 2018).

A key question in mobility research, focusing on the individual as a consumer, addresses mode choice. Environmental psychologists have explored the motives for choosing a particular mode of transport and potential barriers to changing it (Hoffmann et al., 2017; Taube et al., 2018). These studies draw on different approaches such as the Theory of Planned Behavior (Ajzen, 1991) describing mode choice mainly as an intentional decision process or conceive mode choice as a habitual behavior, to name only some of the prominent conceptualizations (Hunecke, 2015; Chng et al., 2018). The literature on mode choice will not be described here in further detail (see, e.g., Chng et al., 2018 or Javaid et al., 2020 for an overview), but it is important to note that some critique commonly used behavioral models of not sufficiently mirroring the context in which the individual action is embedded (Shove, 2010). However, in line with Bögel et al. (2019), we argue that there are social-psychological approaches explicitly addressing the influence of social and structural factors and thereby acknowledging the complexity of individual behavior. Through the concept of social norms,

one can study the influence of social and structural factors, assuming that power structures, cultural characteristics, and shared mind-sets are manifested in normative beliefs. Social norms are “unspoken rules” (Barth et al., 2016), typically shared within a certain referent group. One can differentiate between *descriptive norms*, which refer to “what group members commonly do” and *injunctive norms*, which refer to what is commonly approved and disapproved of a particular group. The impact of social norms in environmental behavior is well documented for, e.g., recycling and water or energy conservation behavior (Cialdini and Goldstein, 2004; Fielding and Louis, 2020). In the context of mobility research focusing on the consumer role, there is evidence for the influence of social norms on, e.g., electric vehicle adoption (Barth et al., 2016) as well as on self-reported travel behavior (Kormos et al., 2015; Bamberg et al., 2020). Whittle et al. (2019) combine these insights from social psychology with sociological approaches into a multi-level perspective, while investigating barriers and drivers of individual adoption of mobility innovations. They highlight how factors such as perceived trust in new technologies as well as social norms, but also infrastructures jointly influence user choices. At the same time, the authors point out that user can play a role as “social actors” who “embody and augment social norms around adoption and domestication of new vehicle technologies and modes” (Whittle et al., 2019, p. 313).

As stated above, social norms as a form of social influence are embedded in our social communities (Sparkman et al., 2020). Theories like the Social Identity Theory (Tajfel and Turner, 1986) help to explain normative influence and norm salience in a particular situation highlighting the importance of “behaviorally relevant ingroups” (Fielding and Louis, 2020). Fritsche et al. (2018) illustrate the significance of social norms in predicting environmental action in their Social Identity Model of Pro-Environmental Action (SIMPEA). Together with other social identity processes like ingroup identification, collective efficacy beliefs, and group-based emotions, ingroup norms and goals influence the appraisal of and the behavioral response to an environmental problem. These norms become salient in specific situations especially through social comparison, be it the comparison to another group, a temporal comparison within the in-group’s behavior or a comparison of one group member to the average group behavior. Psychological mobility research also focuses on the individuals’ roles as citizens or members of communities, e.g., when investigating the acceptability of transport policy measures as well as civic engagement for change (Schade and Schlag, 2003; Gehlert, 2008; Schuitema et al., 2010; Besta et al., 2018). Here too, social norms and a common social identity proved to be important factors in motivating action (Becker et al., 2020). The Social Identity Model of Collective Action (van Zomeren et al., 2008), which was adapted by Rees and Bamberg (2014) to study collective environmental action, focuses on civic engagement in initiatives as an important driver to reach the necessary degree of societal change. In mobility research, social identities refer mostly to mode of transport-related identities, environmental identities, or local identities explaining mode

choice as well as acceptance of transport policy measures (Murtagh et al., 2012; Götting and Becker, 2020).

As Social Identity Theory states, individuals are simultaneously part of different social groups, which might lead to conflicting norms and goals of the different referent groups of one individual. McDonald et al. (2014) investigated how individuals react when facing conflicting norms between different social groups and found that this ambiguity can highlight the need for action for individuals (signaling: “In this ambiguous situation, my contribution might actually make a difference”). Whether this motivating effect of normative conflict translates to mode choice, support for relevant traffic policy measures or civic engagement in the context of mobility transitions, still needs to be tested. Normative conflict can not only appear in competing norms between different groups, but also as a discrepancy between a dominant descriptive norm and the injunctive norm. This is particularly common for environmental issues, where the injunctive norm often is the sustainable one competing with a dominant (unsustainable) descriptive one (Sparkman et al., 2020). In a study on local mobility culture, defined as injunctive norms concerning the design of the local transport system, Bamberg et al. (2020) observe conflicting norms in a perceived consensus to support both a multimodal mobility culture as well as perceived consensus to keep privileges of a car oriented mobility culture. As these studies show, social norms are constantly competing as discrepancies between different normative beliefs can occur on multiple levels. As humans constantly seek to reduce ambiguity, the confrontation with conflicting norms opens up opportunities for an individual to choose to act in line with the marginal norm and thereby challenging the status quo. At the same time, normative conflict can also discourage behavior change, as individuals do not have to fear social sanctioning, if there is some disagreement about a certain norm (Fielding and Louis, 2020).

Evidence suggests that social influence is an important factor in both motivating different forms of agency (especially motivating collective action like, e.g., participation in a local mobility initiative) as well as hindering change (e.g., difficulties in challenging the dominant unsustainable norm of frequent car use). Focusing explicitly on how changing normative influence plays out in mobility transition processes seems crucial. Ultimately, investigating social norms allows highlighting interdependencies between individual behavior and social structures.

Strong Structuration Theory as a Bridge Between Individual Agency and Social Structure

Social scientific research on sustainable mobility transitions also has developed a range of approaches to studying the interconnections between individual travel behavior and social structures, e.g., in the concept of “mobility cultures” (Götz et al., 2016) as well as through the lens of mobility biographies (Rau and Manton, 2016). In transition research more broadly, Upham et al. (2015a) have explored theoretical approaches bridging sociological and psychological research perspectives,

including *via* Social Representations Theory as well as Social Identity Theory (Levidow and Upham, 2017). While acknowledging that interdisciplinary integration can come with tensions between underlying disciplinary paradigms, Upham et al. (2015b, 2020) have stressed the fruitfulness of such integration. To highlight that individual agency can also influence social structure in a recursive relationship, Upham et al. (2018) build on structuration theory as developed by Giddens (1986) and elaborated in the form of “Strong Structuration Theory” by Stones (2006) as a bridge between sociological and psychological approaches (see also Upham et al., 2019). Focusing on individuals in their professional roles in institutional contexts, they study the role of individual agency in niche innovation trajectories. Upham et al. (2018) study how psychological factors such as beliefs and attitudes toward niche innovation are shaped by experiences in specific policy environments and how these “internal structures” shape the individuals’ expectations and, ultimately, their actions in regard to the innovation. Following Stones (2006), they conceptualize a dualistic relationship: individual action is conditioned by external social structures such as norms, value systems, and shared social practices. These are seen as the (intended or unintended) result of previous actions. Stones (2006) stresses that external social structures match internal structures in the form of “conjunctural knowledge” and general dispositional structures (“habitus”), which individuals draw on to participate in social practices. By drawing on these structures to guide and enable their actions, individuals are constantly engaged in reproducing these structures, ensuring their stability over space and time.

Importantly, social structures, just like material infrastructures, fulfill a double function of both constraining but also enabling specific paths of action. From a transition perspective, it is important to note that both Stones (2006) and Giddens (1986) stress the potential role of individual actors in bringing about social change. While social structures are powerful in shaping individual actions, humans always have the option of switching from the *practical consciousness* of everyday life, in which underlying structures are not questioned, to a state of “reflexivity” (Giddens, 1986). In this state, individuals can act in different ways and also challenge social norms or practices (see Archer, 1995). In addition, Stones (2006) stresses that the relation between internal and external structures but also between different elements of internal structures such as normative beliefs, can be marked by substantial tensions. Individuals are constantly challenged to manage a “plurality of concerns” (Stones, 2006, p. 103), which necessitate flexible prioritization. In each situation “choice [e.g., between different norm prioritizations] is possible, even mandatory, because more than one course of action has systemic legitimacy” (Stones, 2006, p. 105). Individuals are thus not conceived as “cultural dopes” who reproduce normative expectations and rules, but as skillful actors who constantly negotiate between conflicting orientations. From the perspective of mobility transitions this concept highlights the constraints to more sustainable travel behavior in the form of dominant descriptive norms, but also points out how already existing tensions between different internal normative orientations might harbor the potential for change.

In this way, Strong Structuration Theory highlights that individual level action can contribute to changes in social structures by influencing social norms.

As this section has shown, there is a substantial body of literature, which explores intersections between sociological and psychological perspectives in transition research. In line with that research, we argue that social structures in the form of collectively shared concepts of “normality” strongly condition individual mobility-related behavior and pose substantial barriers against behavior change. At the same time, we argue that individuals have the capacity to challenge social norms and contribute to social change. In this context, we want to highlight an aspect of social norms, which may be of particular importance in the context of beginning change dynamics, namely struggles between conflicting social norms.

CONNECTING CRITICAL SOCIOLOGICAL THEORY AND PSYCHOLOGICAL PERSPECTIVES: STUDYING THE CONTESTATION AND RE-NEGOTIATION OF SOCIAL NORMS

Re-Negotiations of Social Norms of Travel Behavior in the Context of Windows of Opportunity

The analysis above has shown that one intersection between sociological and psychological approaches lies in the concept of social norms, which guide and influence both individual (travel) behavior and civic engagement in transition processes. Building on the differentiation between descriptive and injunctive norms (Kallgren et al., 2000; Barth et al., 2016), we suggest that joint research in the transport sector should focus more explicitly on social norms as conflicting and contested. In the course of transition dynamics, tension can increase between injunctive and descriptive norms as well as between descriptive norms in different social groups or between different spatial settings such as urban and rural settings. For example, recent years have seen shifts toward increased use of alternatives to the car in cities (e.g., descriptive norms relating to cycling and PT-use), while daily travel behavior in suburban communities have remained strongly car-dependent (descriptive norm of monomodal car-use; Nobis, 2019). On the level of political discourse this is expressed in intensifying political debates over the role of the car in local transport policy in many cities (Becker et al., 2020) and increasing tensions with the interests of car-users in the suburbs (Henderson and Gulsrud, 2019).

Such tensions are not unusual. Individuals in modern western societies are constantly confronted with competing norms resulting from different frames or groups of reference (Beck and Beck-Gernsheim, 1994; Stones, 2006; McDonald et al., 2014). This may especially be true for those norms, which are central to sustainability transitions. As the sociological approaches above have shown, ecological behavior is currently not the (dominant) social norm in our society. Brand and Wissen (2018) point to an “imperialistic lifestyle,” which

normalizes the consumption of energy intensive products and services such as cars or flying. Gössling (2019) shows how flying is traditionally highly “charged” with symbolic meaning as an expression of high social status. Against this backdrop, ecological behavior, if it goes beyond “low cost” behavior such as recycling, represents a deviation from dominant descriptive norms, while constituting support for a set of competing niche norms. Not buying an SUV can be deviant behavior – if all neighbors own one; not taking a flight to go on holiday can be deviant behavior – if most friends and family members regularly take overseas holidays (Gössling et al., 2020).

Especially when problems such as climate change come to the forefront in public and media discourse, individuals are increasingly confronted with tensions between contradictory norms. This has recently been the case in the transport sector in Germany. The rise of debates around climate change and the need to adapt more sustainable lifestyles (injunctive norms; Hessenschau, 2019), combined with growing levels of cycling and public transport use in some cities (descriptive norms) have strengthened alternative descriptive and injunctive transport-related norms in societal discourse (Bamberg et al., 2020; Dörre et al., 2020). From a sociological perspective, we can conceptualize these systemic dynamics as struggles between dominant norms and alternative niche norms in the context of a socio-technical transition process. As was visible in Germany in 2018/2019 key elements of a “hegemonic discourse” in mobility such as the role of the car in socially dominant concepts of “the good life” were beginning to be debated. Policy measures such as car-free city centers or congestion charges, which used to appear unacceptable for a majority, were suddenly being debated in media discourse and private settings (Andor et al., 2020). In this situation, contradictions between competing norms, such as the descriptive as well as injunctive norms of environmentally conscious lifestyles and unsustainable travel behavior (e.g., taking long-distance flights) became more salient.

From a systemic perspective, this situation can be seen as an example of a window of opportunity for change. Systemic models of socio-technical transitions suggest that the odds to achieve change are dependent on the historical and systemic context, in the form of windows of opportunity, but also positive feedback loops and tipping points (Urry, 2004; Watson, 2012; Ruhrt, 2020). With reference to the extended version of the MLP as proposed by Göpel (2016), we suggest that for individual level agency to effectively support sustainability transition processes may strongly depend on system dynamics. In a window of opportunity, norms and routines of prioritization become destabilized and contested. This effect is often mirrored in political discourse (e.g., parties scrambling to readjust their agenda to what might be changes in public opinion); but also in personal social contexts, e.g., in the interaction with work colleagues, friends, or family members. Some ideas or concepts of normality become open for re-negotiation (Whitmarsh, 2012; Nash et al., 2020).

In a window of opportunity, we argue that individuals in their role as consumers and citizens can contribute to change by engaging in the re-negotiation of social norms, both in

their everyday practices as well as in the political realm. Individuals can influence social norms by engaging in a specific behavior, especially when this behavior is visible in social context. Choosing to cycle to work once a week can influence the normative beliefs held by work colleagues regarding cycling and its acceptability as a mode choice for a commute. Choosing to bring the children to school by bike instead of by car, even though this is not the dominant norm, can initiate changes about the perceived normality of this mobility practice. When norm-conflict becomes salient, individuals can contribute to the already ongoing change dynamics by becoming vocal and active, e.g., by performing symbolic acts of consumption, which are shared in private interaction or on social media in the context of organized platforms (e.g., by stating: “I decided I will not fly to go on holiday for the next 3 years”; Gössling et al., 2020).

Conceptualizing the Recursive Relationship Between Social Norms and Agency as a Process of Structuration

Sociologically speaking, in a window of opportunity there is a heightened chance that such actions will have a cumulated effect on changing social norms or opening up pathways for the implementation of decisive policy measures. Gössling et al. (2020) find evidence that social movements, especially Fridays for Future, successfully influenced social norms regarding flying, re-defining air travel as a morally problematic social practice. While their study focuses on the role of social movements in shifting social norms, other recent examples also show how individuals as consumers can participate in reinforcing and stabilizing such ongoing shifts. For example, in 2019 thousands of individual scientists joined an international initiative by signing a public pledge to renounce air travel on academic trips below 1,000 km (Nietfeld, 2019). This type of symbolic action can help to de-legitimize a dominant social practice and re-negotiate the underlying social norms through their own behavior change (Gössling et al., 2020). It can be seen as an example of how individuals can choose to forego the reproduction of descriptive norms (flying) and thus can contribute to changing these norms themselves. Beyond air travel, similar tapes of symbolic action could be possible in the realm of every-day mobility: e.g., when car-users decide to cycle to work at least once a week even though this practice is deemed unusual among colleagues or neighbors; or when a resident in suburban community decides to express dissent about car-related norms (e.g., by stating “My child struggles navigating his way to school, when there are so many parents parking their cars in front of the school entrance”) in a conversation among neighbors.

On a theoretical level, this opportunity for re-negotiation of norms can be understood as an element of a cycle of structuration. Following Upham et al. (2018, 2020), Strong Structuration Theory can explain the reproduction of social structures through individual action, while also pointing out the often contradictory nature of social norms and highlighting

opportunities for change (Stones, 2006). Concerning beginning change dynamics in the mobility sector, we suggest to focus on the temporal dynamics of contradictory norms: individuals are regularly confronted with multiple norms and need to take decisions (reflexively or unconsciously) to prioritize some norms and expectations over others (Stones *ibid.*). The more ambiguous the normative context becomes, the more individuals may become aware of multiple courses of “normal” or “legitimate” action. Following the cycle of structuration conceptualized by Strong Structuration Theory also highlights the (intended or unintended) outcomes of the courses of action chosen by agents. Individual deviance from dominant norms can interrupt the reproduction of “normal” practices and can thereby initiate changes in social norms (see **Figure 1**). In the language of Strong Structuration Theory, individuals can decide to act in line with alternative norms.

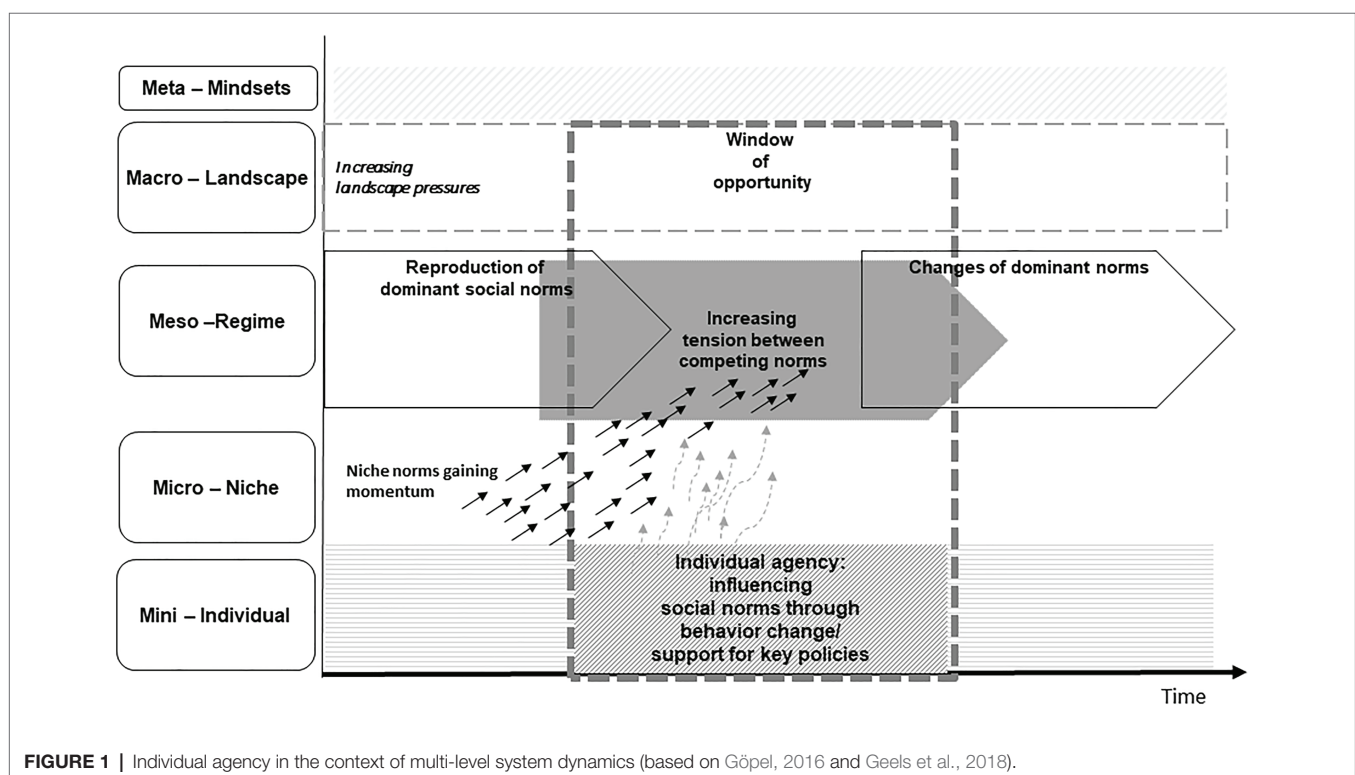
The examples mentioned above illustrate how individual behavior change can influence social norms. The main contribution individuals can make thus might not be in its direct effects (e.g., CO₂-emissions reduced) but in its indirect effect on changing descriptive norms (Whitmarsh, 2012). As we will illustrate in section “Studying contested norms and processes of re-negotiation: Open questions for empirical research,” to better understand the concrete processes of re-negotiation in the mobility sector psychological and sociological research could be integrated in the form of local case studies. Sociology can study different practices and varying contexts (i.e., social media, private conversations, symbolic acts of consumption etc.) of re-negotiation (Gössling et al., 2020). Psychology can study the determinants for individuals’ willingness

to deviate from unsustainable norms as well as the individual perception of norms and their situational salience.

Studying Individual Agency in the Collective Re-Negotiation of Social Norms

Even though individual behavior change in this way can make an important contribution by influencing social norms, it is important to note that this type of change alone will probably not suffice to bring about the level of systemic change needed. As stated earlier, for substantial changes in the mobility system, far reaching regulatory and institutional changes are also required. As Ruhrt (2020) argues, large-scale change of travel patterns can only become possible if infrastructures are re-designed to suit the needs of active travel modes, the regulatory framework is changed to roll back the privileges afforded to private cars and pricing modalities reflect external costs of different modes. Importantly, this means that sustainability transitions are not necessarily a win-win-process, but will raise the key political questions of “*who gets what, when, and how*” (Lasswell, 1936). “Pull measures,” which make transport alternatives more attractive will have to be accompanied by “push measures,” which are aimed at reducing the attractiveness of cars and other resource intensive travel modes (Ruhrt, 2019). When transport policy measures go beyond “win-win”-approaches formerly dominant injunctive norms guiding transport policy become acutely challenged (Bamberg et al., 2020).

On this level, individuals can support and initiate these change processes in their role as citizens (Whitmarsh, 2012; Nielsen et al., 2021). Policy discourse over “push measures” can be seen as a collective form of re-negotiation of what is to be considered



normal in the realm of mobility in public space. In this context, individual citizens are confronted with competing sets of norms, either gradually or suddenly. As mentioned above, Bamberg et al. (2020) found substantial ambiguity in how study participants perceived the injunctive norms regarding prioritization of car mobility vs. multimodal mobility in local transport policy. This can be seen as an indication of beginning change dynamics, which could open windows of opportunity for substantial changes. Individuals have a chance to “tip the balance” toward change by actively or discursively supporting policy measures, which challenge the status quo (Ruhrort, 2019). With regard to air travel, Gössling et al. (2020) make this connection by studying not only individuals’ willingness to refrain from flying, but also their willingness to accept, or demand, policy measures, which help to reduce air travel on a larger scale. Becker et al. (2020) have highlighted the role of norms in political negotiation over transport policy “push measures” regarding the distribution of public space. They study a local NGO successfully building public support for a referendum for cycling infrastructure. The authors describe how the initiative countered the normative status quo by changing “normative associations”: by representing cycling as normal and as equally important to car travel, the initiative did not address a narrow social identity of “committed cyclists,” but instead appealed to a more inclusive social identity. According to the authors, this strategy helped to elicit support from a broader public. As with other processes of re-negotiation of social norms, the effectiveness of changes will be strongly context-dependent. Nevertheless, collective re-negotiations like discussions about the use of public space and the elaboration of new traffic policies represent an important way how individuals can make use of their role as citizens to impact the mobility transition.

Studying Contested Norms and Processes of Re-Negotiation: Open Questions for Empirical Research

An open question regards the empirical study of the role of contested norms in enabling individual engagement in change processes. A fruitful arena for interdisciplinary research could be found in local case studies of mobility discourses and policies. As suggested by Upham et al. (2020), a sequence of disciplinary studies could trace the interactions between system dynamics and individual level action in a local context. To study how dynamics of re-negotiations of social norms play out in a local context, we suggest focusing on spaces where conflicting social norms can be expected to “clash.” Building on previous work (Bamberg et al., 2020), we propose to shift the focus to conflicting norms in a specific type of spatial setting, namely local communities at the intersection between urban and suburban spaces. Especially urban centers in Germany have seen shifts in modal shares as well as mobility related discourses, which have been identified as the emergence of a distinctive urban “mobility culture” (Ruhrort, 2019; Bamberg et al., 2020). In this context, it can be assumed that *suburban* communities, which surround the city increasingly become the locus of competing normative orientations regarding travel behavior and policy. While, we expect that in these communities, descriptive norms

regarding car driving will be stronger than in the city, these communities will also be exposed to competing norms originating in the regional urban center regarding the use of other transport modes and transport policy programs. With many people commuting, individuals are exposed to different social groups potentially sharing different sets of mobility-related norms.

In local case studies, sociological analysis of system dynamics can re-construct the locally specific discourses relating to dominant and niche mobility practices and transport policy measures. Qualitative interviews could identify specific local issues in which competing mobility related concepts of “normal” practice may be “clashing”: examples could be the local “school run” and whether or not it is deemed normal to bring children to school in cars or on a bike. In this context, local examples of re-negotiations of mobility related norms could be reconstructed (e.g., if neighbors are debating over SUVs and their contribution to climate change or over the possibility to cycle to work). Psychological approaches could study how competing descriptive norms are perceived by individuals in this community and how they influence individual willingness to support (or reject) niche norms through behavior change. Following McDonald et al. (2014), a case study could measure tensions between conflicting norms as perceived by individuals. An example would be to study to which extent individuals in a suburban community perceive the dominant descriptive norm of car ownership and driving (or, more specifically, owning and driving resource intensive cars such as SUVs) as increasingly contested: do they perceive that competing descriptive norms (such as using less resource-intensive forms of mobility such as cycling) are gaining in relevance? How does the affiliation to different social groups (e.g., neighbors in the suburban community vs. work colleagues living in the city) and the potentially conflicting norms between them influence individual mobility-related decisions, e.g., the readiness to take the children to school by bike even if this is not the locally dominant norm? To encompass the political dimension of mobility transitions, the analysis should also study the support for relevant (local) transport policy measures: how are discourses over conflicting injunctive norms, e.g., regarding the redesign of street spaces, perceived by individuals in a given local or social context? How do these perceptions influence the willingness to support or accept policy measures, which aim at reducing currently dominant unsustainable travel patterns? In combining both disciplinary approaches, local case studies could show how individual motivation to participate in re-negotiation of mobility-related (local) norms through mode choice changes or political engagement may be influenced by societal discourses and practices, which de-stabilize dominant norms. Even if such multi-disciplinary research design may entail tensions between underlying disciplinary paradigms (Upham et al., 2015b), we suggest it can be fruitful to better understand interactions between different societal levels in mobility transitions.

CONCLUSION

In this article, we presented intersections between sociological and psychological research, which could help to differentiate

the role of individual agency in mobility transitions. The role of social norms is proposed as an integrative concept to study the interplay between structure and agency in mobility transitions. The socio-psychological approaches highlighted here have the potential to shed light on barriers to sustainable travel behavior but also on the ways in which individuals can contribute to social change in the direction of sustainability. We also highlighted that the efficacy of such individual engagement to trigger large-scale change may depend on dynamics on the system level: individual agency can play a key role especially when a window of opportunity opens up and social norms become increasingly contentious. In these situations, “social norms can spark collective action and move the needle on policy” (Hackel and Sparkman, 2018). Ultimately, socio-technical change can be stabilized if political actors and social movements can seize the opportunity to institutionalize alternative social norms by making lasting changes in mobility infrastructures and regulations.

We propose that future research should study the role of social norms in overarching models of socio-technical change more systematically. Social norms have been an element of MLP-models from the start (Geels et al., 2018), but their role has not always been at the forefront of MLP-analyses. As was shown in section “Structural barriers to individual behavior change: Contributions from critical sociological perspectives,” we propose to conceptualize social norms as conflicting and contested. In the language of the MLP, this translates into tensions between dominant sets of norms on the regime level and alternatives sets of norms, especially ecological norms, on the niche level. On the landscape level, we can identify sets of norms of a more general character, which change slowly and are not necessarily directly linked to the field of mobility (Göpel, 2016). Reformulating our analysis in the language of the MLP, we can now see that individuals, with their own behavior, have the opportunity to engage in struggles between competing social norms on the regime and niche level. Future research should explore if and how individuals can also challenge the overarching discursive paradigms, which form the normative “landscape” level of socio-technical transitions.

Beyond the academic interest, we see implications of our proposed perspective in supporting different social actors in initiating sustainability transitions. Individuals could learn to see themselves as “carriers” of social norms and practices, which they actively reproduce, but can also challenge. This understanding can encourage individuals (and potentially increase self-efficacy beliefs) to actively engage in challenging and re-negotiating social norms in their own social context. The perspective developed here may encourage individuals to look out for signs of accelerating social dynamics (e.g., in media discourse), which could become windows of opportunity for

systemic change. Motivation to participate in changing social norms may be higher when individuals see themselves as effectively “pushing” a change process, which is already ongoing (Sparkman et al., 2020). At the moment, individuals in Western societies will often not be aware of these notions, a fact which can be seen as an effect of the dominance of individualistic paradigms described by Göpel (2016). Challenging these paradigms could have significant potential for triggering individual motivations to contribute to change. Ideally, socio-psychological models describing the role of the individual in sustainability transitions will become a staple in political and media discourses on climate change and mitigation strategies. There are encouraging examples of how interdisciplinary research can illustrate the role of the individual in sustainability transitions in a comprehensible way, acknowledging the interplay between individual agency and societal structures (Capstick et al., 2020). Following up on this, socio-psychological approaches could help to challenge the dominance of overly individualistic paradigms, which are in themselves a substantial barrier to social-ecological transition dynamics in the transport sector.

The article focused on the role of social norms as a concept integrating sociological and psychological approaches in mobility transitions research. One limitation of this article is that we do not spell out the empirical applications in detail, leaving this work as a task for future research. Also, our proposed research agenda strongly focuses on potential ways in which individuals can make a difference for societal and political change. Further research needs to address how these alternative sustainable “normalities” need to be supported and stabilized by changes to the institutional setting. Focusing on social norms presents an opportunity to overcome the structure-agency dualism by highlighting how individual behavior and social structure are deeply intertwined.

AUTHOR CONTRIBUTIONS

Both authors have contributed equally to the conceptualization and writing of the article.

FUNDING

The article is based on research funded by the German Ministry for Education and Research (BMBF), reference number R01UU1907B. The publication of this article was funded by the Open Access Fund of the Leibniz Association as well as the Berlin Social Science Center (WZB).

REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* 50, 179–211. doi: 10.1016/0749-5978(91)90020-T
- Andor, M. A., Frondel, M., Horvath, M., Larysch, T., and Ruhrt, L. (2020). Präferenzen und Einstellungen zu vieldiskutierten verkehrspolitischen Maßnahmen: Ergebnisse einer Erhebung aus dem Jahr 2018. *List Forum* 45, 255–280. doi: 10.1007/s41025-019-00184-x
- Archer, M. S. (1995). *Realist Social Theory: The Morphogenetic Approach*. Cambridge: Cambridge University Press.
- Bamberg, S., Rollin, P., and Schulte, M. (2020). Local mobility culture as injunctive normative beliefs – A theoretical approach and a related measurement instrument. *J. Environ. Psychol.* 71:101465. doi: 10.1016/j.jenvp.2020.101465
- Banister, D. (2008). The sustainable mobility paradigm. *Transp. Policy* 15, 73–80. doi: 10.1016/j.tranpol.2007.10.005

- Barr, S. (2015). "Beyond Behavior Change: Social Practice Theory and the Search for Sustainable Mobility," in *Putting Sustainability Into Practice: Applications and Advances in Research on Sustainable Consumption*. eds. E. H. Kennedy, M. J. Cohen and N. Krogman (Cheltenham, UK: Edward Elgar Publishing), 91–108.
- Barth, M., Jugert, P., and Fritzsche, I. (2016). Still underdetected – social norms and collective efficacy predict the acceptance of electric vehicles in Germany. *Transport. Res. F: Traffic Psychol. Behav.* 37, 64–77. doi: 10.1016/j.trf.2015.11.011
- Beck, U., and Beck-Gernsheim, E. (1994). "Individualisierung in modernen Gesellschaften: Perspektiven und Kontroversen einer subjektorientierten Soziologie," in *Riskante Freiheiten: Individualisierung in modernen Gesellschaften*. eds. U. Beck and E. Beck-Gernsheim (Frankfurt am Main: Suhrkamp), 10–39.
- Becker, S., Bögel, P., and Upham, P. (2020). The role of social identity in institutional work for sociotechnical transitions: the case of transport infrastructure in Berlin. *Technol. Forecast. Soc. Chang.* 162:120385. doi: 10.1016/j.techfore.2020.120385
- Besta, T., Jaśkiewicz, M., Kosakowska-Berezecka, N., Lawendowski, R., and Zawadzka, A. M. (2018). What do I gain from joining crowds? Does self-expansion help to explain the relationship between identity fusion, group efficacy and collective action? *Eur. J. Soc. Psychol.* 48, O152–O167. doi: 10.1002/ejsp.2332
- Blätzel-Mink, B. (2020). "Ich konsumiere also bin ich: Warum nachhaltiges Konsumverhalten so schwierig ist," in *Klimakrise*. Goethe Universität Frankfurt, Forschung Frankfurt, 44–47. Available at: <https://www.forschung-frankfurt.uni-frankfurt.de/95369622.pdf> (Accessed March 15, 2021).
- BMU (2019). Klimaschutz in Zahlen: Sektorenziele 2030. Available at: https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Klimaschutz/klimaschutz_zahlen_2019_fs_sektorenziele2030_de_bf.pdf (Accessed February 09, 2021).
- Bögel, P. M., and Upham, P. (2018). Role of psychology in sociotechnical transitions studies: review in relation to consumption and technology acceptance. *Environ. Innov. Soc. Trans.* 28, 122–136. doi: 10.1016/j.eist.2018.01.002
- Bögel, P., Upham, P., and Castro, P. (2019). Thinking about the differing contributions of (social) psychology and sociology for understanding sociotechnical transitions perspectives on energy supply and use. *Tecnoscienza* 10, 139–151.
- Brand, U., and Welzer, H. (2019). "Alltag und Situation," in *Große Transformation? Zur Zukunft moderner Gesellschaften*. eds. K. Dörre, H. Rosa and K. Becker (Wiesbaden: Springer Fachmedien Wiesbaden), 313–332.
- Brand, U., and Wissen, M. (2018). What kind of great transformation? The Imperial mode of living as a major obstacle to sustainability politics. *GAIA - ecological perspectives for. Science and Society* 27, 287–292. doi: 10.14512/gaia.27.3.8
- Canzler, W., and Knie, A. (2018). Taumelnde Giganten: Gelingt der Automobilindustrie die Neuerfindung? Bonn: Bundeszentrale für Politische Bildung (BPB).
- Capstick, S., Khosla, R., Wang, S., van den Berg, N., Ivanova, D., Otto, I. M., et al. (2020). "Bridging the Gap - the Role of Equitable Low-Carbon Lifestyles in Emissions Gap Report 2020" in *UN Environment UNEP*, 62–75.
- Chng, S., Abraham, C., White, M. P., Hoffmann, C., and Skippon, S. (2018). Psychological theories of car use: an integrative review and conceptual framework. *J. Environ. Psychol.* 55, 23–33. doi: 10.1016/j.jenvp.2017.10.009
- Cialdini, R. B., and Goldstein, N. J. (2004). Social influence: compliance and conformity. *Annu. Rev. Psychol.* 55, 591–621. doi: 10.1146/annurev.psych.55.090902.142015
- Dörre, K. (2019). "Risiko Kapitalismus," in *Große Transformation? Zur Zukunft moderner Gesellschaften*. eds. K. Dörre, H. Rosa, K. Becker, S. Bose and B. Seyd (Wiesbaden: Springer Fachmedien Wiesbaden), 3–33.
- Dörre, K. (2020). "Gesellschaft in der Zangenkrise: Vom Klassen- zum sozial-ökologischen Transformationskonflikt," in *Abschied von Kohle und Auto? Sozial-ökologische Transformationskonflikte um Energie und Mobilität*. eds. K. Dörre, M. Holzschuh, J. Köster and J. Sittel (Frankfurt), 23–71.
- Dörre, K., Holzschuh, M., Köster, J., and Sittel, J. (eds.) (2020). "Einleitung: Nach der Kohle, nach dem Auto?" in *Abschied von Kohle und Auto? Sozial-ökologische Transformationskonflikte um Energie und Mobilität*. Frankfurt: Campus, 7–22.
- Feola, G. (2020). Capitalism in sustainability transitions research: time for a critical turn? *Environ. Innov. Soc. Trans.* 35, 241–250. doi: 10.1016/j.eist.2019.02.005
- Fielding, K. S., and Louis, W. R. (2020). "The Role of Social Norms in Communicating About Climate Change," in *Research Handbook on Communicating Climate Change*. ed. D. C. Holmes (Cheltenham: Elgar), 106–115.
- Fritzsche, I., Barth, M., Jugert, P., Masson, T., and Reese, G. (2018). A social identity model of pro-environmental action (SIMPEA). *Psychol. Rev.* 125, 245–269. doi: 10.1037/rev0000090
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Res. Policy* 31, 1257–1274. doi: 10.1016/S0048-7333(02)00062-8
- Geels, F. W. (2012). A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. *J. Transp. Geogr.* 24, 471–482. doi: 10.1016/j.jtrangeo.2012.01.021
- Geels, F. W. (2014). Regime resistance against low-carbon transitions: introducing politics and power into the multi-level perspective. *Theory Cult. Soc.* 31, 21–40. doi: 10.1177/0263276414531627
- Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technol. Forecast. Soc. Chang.* 152:119894. doi: 10.1016/j.techfore.2019.119894
- Geels, F. W., Schwanen, T., Sorrell, S., Jenkins, K., and Sovacool, B. K. (2018). Reducing energy demand through low carbon innovation: A sociotechnical transitions perspective and thirteen research debates. *Energy Res. Soc. Sci.* 40, 23–35. doi: 10.1016/j.erss.2017.11.003
- Gehlert, T. (2008). *Straßenbenutzungsgebühren in Städten: Akzeptanz und Mobilitätsverhalten*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- Gerike, R., Hubrich, S., Ließke, F., Wittig, S., and Wittwer, R. (2020). "Präsentation der Ergebnisse von Mobilität in Städten – SrV 2018," in *Erhebungsjahrgang, Mobilität in Städten – SrV2018*.
- Giddens, A. (1986). *The Constitution of Society: Outline of the Theory of Structuration*. Berkeley, Los Angeles: Polity Press.
- Göpel, M. (2016). *The Great Mindshift: How a New Economic Paradigm and Sustainability Transformations Go Hand in Hand*. Springer Open.
- Gössling, S. (2019). Celebrities, air travel, and social norms. *Ann. Tour. Res.* 79:102775. doi: 10.1016/j.annals.2019.102775
- Gössling, S., Humpe, A., and Bausch, T. (2020). Does "flight shame" affect social norms? Changing perspectives on the desirability of air travel in Germany. *J. Clean. Prod.* 266:122015. doi: 10.1016/j.jclepro.2020.122015
- Götting, K., and Becker, S. (2020). "Reaktionen auf die Pop-Up-Radwege in Berlin. Ergebnisse einer explorativen Umfrage zur temporären Radinfrastruktur im Kontext der Covid-19 Pandemie," *IASS Study*.
- Götz, K., Deffner, J., and Klinger, T. (2016). "Mobilitätsstile und Mobilitätskulturen – Erklärungspotentiale, Rezeption und Kritik," in *Handbuch Verkehrspolitik*. eds. O. Schwedes, W. Canzler and A. Knie (Wiesbaden: Springer VS).
- Hackel, L., and Sparkman, G. (2018). Actually, your personal choices do make a difference in climate change. <https://slate.com/technology/2018/10/carbon-footprint-climate-change-personal-action-collective-action.html> (Accessed February 10, 2021).
- Henderson, J., and Gulsrud, N. M. (2019). *Street Fights in Copenhagen: Bicycle and Car Politics in a Green Mobility City*. Abingdon, Oxon, New York, NY: Routledge.
- Hessenschau (2019). Tausende beim Klima-Protest gegen die IAA in Frankfurt. Hessenschau. <https://www.hessenschau.de/wirtschaft/tausende-beim-klima-protest-gegen-die-iaa-in-frankfurt,iaa-demonstrationen-100.html> (Accessed April 04, 2021).
- Hoffmann, C., Abraham, C., White, M. P., Ball, S., and Skippon, S. M. (2017). What cognitive mechanisms predict travel mode choice? A systematic review with meta-analysis. *Transp. Rev.* 37, 631–652. doi: 10.1080/01441647.2017.1285819
- Hunecke, M. (2015). *Mobilitätsverhalten verstehen und verändern*. Wiesbaden: Springer Fachmedien Wiesbaden.
- Javadi, A., Creutzig, F., and Bamberg, S. (2020). Determinants of low-carbon transport mode adoption: systematic review of reviews. *Environ. Res. Lett.* 15:103002. doi: 10.1088/1748-9326/aba032
- Kallgren, C. A., Reno, R. R., and Cialdini, R. B. (2000). A focus theory of normative conduct: when norms do and do not affect behavior. *Personal. Soc. Psychol. Bull.* 26, 1002–1012. doi: 10.1177/01461672002610009
- Kormos, C., Gifford, R., and Brown, E. (2015). The influence of descriptive social norm information on sustainable transportation behavior. *Environ. Behav.* 47, 479–501. doi: 10.1177/0013916513520416
- Lasswell, H. D. (1936). Politics: who gets what, when, how. *Am. Polit. Sci. Rev.* 30, 1174–1176.
- Levidow, L., and Upham, P. (2017). Linking the multi-level perspective with social representations theory: gasifiers as a niche innovation reinforcing the energy-from-waste (EfW) regime. *Technol. Forecast. Soc. Chang.* 120, 1–13. doi: 10.1016/j.techfore.2017.03.028

- Manderscheid, K. (2020). "Antriebs-, Verkehrs- oder Mobilitätswende? Zur Elektrifizierung des Automobilitätsdispositivs," in *Baustelle Elektromobilität: Sozialwissenschaftliche Perspektiven auf die Transformation der (Auto-) Mobilität*. eds. A. Brunnengraber and T. Haas (Bielefeld: transcript), 37–68.
- Marsden, G., Mullen, C., Bache, I., Bartle, I., and Flinders, M. (2014). Carbon reduction and travel behaviour: discourses, disputes and contradictions in governance. *Transp. Policy* 35, 71–78. doi: 10.1016/j.tranpol.2014.05.012
- Mattioli, G., Roberts, C., Steinberger, J. K., and Brown, A. (2020). The political economy of car dependence: a systems of provision approach. *Energy Res. Soc. Sci.* 66:101486. doi: 10.1016/j.erss.2020.101486
- McDonald, R. I., Fielding, K. S., and Louis, W. R. (2014). Conflicting norms highlight the need for action. *Environ. Behav.* 46, 139–162. doi: 10.1177/0013916512453992
- Murtagh, N., Gatersleben, B., and Uzzell, D. (2012). Multiple identities and travel mode choice for regular journeys. *Transport. Res. F: Traffic Psychol. Behav.* 15, 514–524. doi: 10.1016/j.trf.2012.05.002
- Nash, N., Whitmarsh, L., Capstick, S., Gouveia, V., de Carvalho Rodrigues Araújo, R., Dos Santos, M., et al. (2020). Local climate change cultures: climate-relevant discursive practices in three emerging economies. *Clim. Chang.* 163, 63–82. doi: 10.1007/s10584-019-02477-8.
- Nielsen, K. S., Clayton, S., Stern, P. C., Dietz, T., Capstick, S., and Whitmarsh, L. (2021). How psychology can help limit climate change. *Am. Psychol.* 76, 130–144. doi: 10.1037/amp0000624
- Nietfeld, J. (2019). Dienstreisen an Hochschulen: 1700 Wissenschaftler verzichten auf kürzere Flugreisen. Available at: <https://www.tagesspiegel.de/wissen/dienstreisen-an-hochschulen-1700-wissenschaftler-verzichten-auf-kuerzere-flugreisen/25035912.html#> (Accessed February 09, 2021).
- Nobis, C. (2019). Mobilität in Deutschland – MiD Analysen zum Radverkehr und Fußverkehr. Available at: http://www.mobilitaet-in-deutschland.de/pdf/MiD2017_Analyse_zum_Rad_und_Fussverkehr.pdf (Accessed March 15, 2021).
- Nobis, C., and Kuhnimhof, T. (2018). Mobilität in Deutschland – MiD Ergebnisbericht: Studie von infas, DLR, IVT und infas 360 im Auftrag des Bundesministers für Verkehr und digitale Infrastruktur. Available at: http://www.mobilitaet-in-deutschland.de/pdf/MiD2017_Ergebnisbericht.pdf (Accessed March 15, 2021).
- Paech, N. (2019). *Befreiung vom Überfluss: Auf dem Weg in die Postwachstumsökonomie*. 11th Edn. München: Oekom Verlag.
- Rau, H., and Manton, R. (2016). Life events and mobility milestones: advances in mobility biography theory and research. *J. Transp. Geogr.* 52, 51–60. doi: 10.1016/j.jtrangeo.2016.02.010
- Rees, J. H., and Bamberg, S. (2014). Climate protection needs societal change: determinants of intention to participate in collective climate action. *Eur. J. Soc. Psychol.* 44, 466–473. doi: 10.1002/ejsp.2032
- Rosa, H. (2005). *Beschleunigung: Die Veränderung der Zeitstrukturen in der Moderne*. 11th Edn. Suhrkamp: Frankfurt am Main.
- Rosa, H. (2016). *Resonanz: Eine Soziologie der Weltbeziehung*. 1st Edn. Berlin: Suhrkamp.
- Ruhrort, L. (2019). *Transformation im Verkehr*. Wiesbaden: Springer Fachmedien Wiesbaden.
- Ruhrort, L. (2020). Reassessing the role of shared mobility services in a transport transition: can they contribute the rise of an alternative socio-technical regime of mobility? *Sustain. For.* 12:8253. doi: 10.3390/su12198253
- Schade, J., and Schlag, B. (2003). Acceptability of urban transport pricing strategies. *Transp. Res. Part F Traffic Psychol. Behav.* 6, 45–61. doi: 10.1016/S1369-8478(02)00046-3
- Schuitema, G., Steg, L., and Forward, S. (2010). Explaining differences in acceptability before and acceptance after the implementation of a congestion charge in Stockholm. *Transp. Res. A Policy Pract.* 44, 99–109. doi: 10.1016/j.tra.2009.11.005
- Schwanen, T., Banister, D., and Anable, J. (2011). Scientific research about climate change mitigation in transport: a critical review. *Transp. Res. A Policy Pract.* 45, 993–1006. doi: 10.1016/j.tra.2011.09.005
- Schwedes, O. (2011). The field of transport policy: an initial approach. *German Policy Stud.* 7, 7–41.
- Schwedes, O. (2017). *Verkehr im Kapitalismus*. 1st Edn. Münster: Westfälisches Dampfboot.
- Shove, E. (2010). Beyond the ABC: climate change policy and theories of social change. *Environ. Plan. A* 42, 1273–1285. doi: 10.1068/a42282
- Sparkman, G., Howe, L., and Walton, G. (2020). How social norms are often a barrier to addressing climate change but can be part of the solution. *Behav. Public Policy*, 1–28. doi: 10.1017/bpp.2020.42
- Stones, R. (2006). *Structuration Theory*. 2nd Edn. Basingstoke: Palgrave Macmillan.
- Tajfel, H., and Turner, J. C. (1986). "The Social Identity Theory of Intergroup Behaviour," in *Psychology of Intergroup Relations*. 2nd Edn. eds. W. G. Austin and S. Worchel (Chicago: Nelson-Hall), 7–24.
- Taube, O., Kibbe, A., Vetter, M., Adler, M., and Kaiser, F. G. (2018). Applying the Campbell paradigm to sustainable travel behavior: compensatory effects of environmental attitude and the transportation environment. *Transport. Res. F: Traffic Psychol. Behav.* 56, 392–407. doi: 10.1016/j.trf.2018.05.006
- Upham, P., Bögel, P., and Dütschke, E. (2020). Thinking about individual actor-level perspectives in sociotechnical transitions: a comment on the transitions research agenda. *Environ. Innov. Soc. Trans.* 34, 341–343. doi: 10.1016/j.eist.2019.10.005
- Upham, P., Bögel, P., and Johansen, K. (2019). *Energy Transitions and Social Psychology: A Sociotechnical Perspective*. Abingdon, Oxon, New York, NY: Routledge.
- Upham, P., Dütschke, E., Schneider, U., Oltra, C., Sala, R., Lores, M., et al. (2018). Agency and structure in a sociotechnical transition: hydrogen fuel cells, conjunctural knowledge and structuration in Europe. *Energy Res. Soc. Sci.* 37, 163–174. doi: 10.1016/j.erss.2017.09.040
- Upham, P., Lis, A., Riesch, H., and Stankiewicz, P. (2015a). Addressing social representations in socio-technical transitions with the case of shale gas. *Environ. Innov. Soc. Trans.* 16, 120–141. doi: 10.1016/j.eist.2015.01.004
- Upham, P., Oltra, C., and Boso, A. (2015b). Towards a cross-paradigmatic framework of the social acceptance of energy systems. *Energy Res. Soc. Sci.* 8, 100–112. doi: 10.1016/j.erss.2015.05.003
- Urry, J. (2004). The "system" of automobility. *Theory Cult. Soc.* 21, 25–39. doi: 10.1177/0263276404046059
- van Zomeren, M., Postmes, T., and Spears, R. (2008). Toward an integrative social identity model of collective action: a quantitative research synthesis of three socio-psychological perspectives. *Psychol. Bull.* 134, 504–535. doi: 10.1037/0033-2909.134.4.504
- Verkehrswende, A. (2018). Klimaschutz im Verkehr: Maßnahmen zur Erreichung des Sektorziels 2030. Available at: https://www.agora-verkehrswende.de/fileadmin/Projekte/2017/Klimaschutzszenarien/Agora_Verkehrswende_Klimaschutz_im_Verkehr_Massnahmen_zur_Erreichung_des_Sektorziels_2030.pdf (Accessed February 09, 2021).
- Verkehrswende, A. (2019). Neue Wege in die Verkehrswende: Impulse für Kommunikationskampagnen zum Behaviour Change. Available at: https://www.agora-verkehrswende.de/fileadmin/Projekte/2018/Kommunikation_Behavior_Change/21_Neue-Wege-in-der-Verkehrswende_Agora_Verkehrswende_WEB.pdf (Accessed February 09, 2021).
- Von Schneidmesser, D. (2021). "Öffentliche Mobilität und neue Formen der Governance: das Beispiel Volksentscheid Fahrrad" in *Öffentliche Mobilität. Voraussetzungen für eine menschengerechte Verkehrsplanung*. ed. O. Schwedes (Wiesbaden: VS Verlag für Sozialwissenschaften and Springer Fachmedien Wiesbaden GmbH Wiesbaden), 139–163.
- Watson, M. (2012). How theories of practice can inform transition to a decarbonised transport system. *J. Transp. Geogr.* 24, 488–496. doi: 10.1016/j.jtrangeo.2012.04.002
- Whitmarsh, L. (2012). How useful is the multi-level perspective for transport and sustainability research? *J. Transp. Geogr.* 24, 483–487. doi: 10.1016/j.jtrangeo.2012.01.022
- Whittle, C., Whitmarsh, L., Haggard, P., Morgan, P., and Parkhurst, G. (2019). User decision-making in transitions to electrified, autonomous, shared or reduced mobility. *Transp. Res. Part D Transp. Environ.* 71, 302–319. doi: 10.1016/j.trd.2018.12.014
- Zimmer, W., Blanck, R., Bergmann, T., Mottschall, M., von Waldenfels, R., Cyganski, R., et al. (2016). "Endbericht Renewability III: Optionen einer Dekarbonisierung des Verkehrssektors. Available at: http://www.renewability.de/wp-content/uploads/Renewability_III_Endbericht.pdf (Accessed February 01, 2021).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Ruhrort and Allert. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



We Need to Change: Integrating Psychological Perspectives Into the Multilevel Perspective on Socio-Ecological Transformations

Marlis C. Wullenkord^{**} and Karen R. S. Hamann[†]

Social, Environmental, and Economic Psychology, Department of Psychology, University of Koblenz-Landau, Landau, Germany

Keywords: socio-ecological transformation, multilevel perspective, self-determination theory, self-efficacy theory, agency, socio-technical transitions, opinion, environmental psychology

PSYCHOLOGY'S PLACE IN SOCIO-TECHNICAL TRANSITION RESEARCH

OPEN ACCESS

Edited by:

Sonja Maria Geiger,
Justus Liebig University, Germany

Reviewed by:

Sebastian Bamberg,
Bielefeld University of Applied
Sciences, Germany
Daniel Hanss,
Darmstadt University of Applied
Sciences, Germany

*Correspondence:

Marlis C. Wullenkord
wullenkord@uni-landau.de

[†]These authors have contributed
equally to this work and share first
authorship

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 18 January 2021

Accepted: 22 March 2021

Published: 26 April 2021

Citation:

Wullenkord MC and Hamann KRS
(2021) We Need to Change:
Integrating Psychological Perspectives
Into the Multilevel Perspective on
Socio-Ecological Transformations.
Front. Psychol. 12:655352.
doi: 10.3389/fpsyg.2021.655352

"By embedding humans into systemic models [...] we can see that even when we are talking about global transformations, the source of intentional change is human thinking, feeling, and acting. Socio-ecological-technological systems are created, ordered, and stabilized through human decision-making and (often) conscious creation of regime structures."—Göpel (2016, p. 50/51)

It sounds self-evident when Göpel explains how deeply ingrained humans are in transition processes. However, when working on a virtual lecture series called *Psychologie des sozial-ökologischen Wandels* (*The Psychology of Socio-Ecological Change*)¹ we felt challenged when attempting to connect all parts into a consistent narrative on the connections of psychology and a socio-ecological transformation (i.e., the deep transformation of society aiming for decarbonization and socio-ecological justice, WBGU, 2011). With this challenge came ideas about transformation-oriented psychology that we feel inspired to share.

Previous research acknowledged that cultural worldviews and mindsets are essential for transformations (Meadows, 1999). The status quo and associated tangible structural outcomes are a result of human relationships and agency over time (Elias, 1982). Psychology as the study of human perception and behavior can contribute to transition research by investigating the processes underlying human agency. Nevertheless, psychological perspectives are rarely explicitly integrated into socio-technical transition research (Bögel and Upham, 2018). There have been pleas to clarify the role of individual-level processes in transitions (see Cattaneo et al., 2014; Bögel and Upham, 2018; Upham et al., 2020; Becker et al., 2021) and we personally experience a certain openness within psychology to do so. Kazdin (2009) even ascribes a crucial role to psychology in connecting different research areas. So why have those appeals only rarely been put into practice?

Environmental psychology historically focused on intra-individual factors (e.g., attitudes, control beliefs) and used them to explain pro-environmental behavior. As a result, it has been criticized for making somewhat mechanistic and reductionist assumptions, treating psychological constructs as isolated factors (see Dijk et al., 2016), and neglecting that contextual factors like larger-scale social structures and ecological processes influence behavioral outcomes (see Steg and Vlek, 2009). There are undeniable ontological and epistemological differences between psychological and transition science. Moreover, transformations are challenging to capture using psychological methods, and disciplinary research often

¹<https://ipu-ev.de/bildungsmaterialien/online-vorlesung/>

earns more (career) credits than interdisciplinary research. Nonetheless, we believe that psychological perspectives are crucial for transformations but that transition researchers will only integrate psychological perspectives if they consider processes and outcomes relevant for understanding transformations. Placing one's own research into transition-oriented approaches may be a challenging first step due to the difficulties inherent in interdisciplinary work, given the context-specificity of both the research object and transition research itself, and because it remains unclear how to do so in a meaningful way. Nevertheless, we present an attempt to make psychological perspectives more impactful through theoretical integration, using two psychological theories and an exemplifying transition-model (see current debate by Nielsen et al., 2021 and Van Valkengoed et al., 2021).

A Multilevel Approach to Transformations

There are several systemic models explaining socio-technical transitions, like the Multilevel Perspective (MLP, Geels and Schot, 2007, 2010) or the Multiphase Concept (Mersmann et al., 2014). One currently predominant model is the MLP (Geels and Schot, 2010). It looks at how socio-technical societal subsystems interact in transformation-processes across time and space: The landscape (macro-level; e.g., megatrends like climate change, the market system, hegemonic paradigms²), regimes (meso-level; e.g., policy, technology, science), and niches (micro-level). Higher levels—institutionalized, inertial, and historically rooted—are impactful but slow and difficult to change. Regimes are stabilized through path-dependencies like institutionalization or social-psychological infrastructures (e.g., norms, shared beliefs, see Welzer, 2011). They hamper individuals to imagine alternatives, lock the status quo, and prevent rapid change. Change occurs most readily in niches that provide safeguarded spaces to test radical socio-technical innovations. When regimes are destabilized, for instance because of landscape-level pressures like climate change, windows of opportunity open, and niche-innovations can establish themselves in regimes. While the MLP is useful for understanding socio-technical innovations, it is difficult to pinpoint human agency in it (see Geels, 2011 for a discussion; see Winner, 1986 for a fundamental critique of a technology-focus as lever of change).

Göpel (2016) explicitly acknowledges individuals and hegemonic paradigms in transformations by adding two layers: The mini-level contains individuals making up institutions. The meta-level represents the “hegemonic paradigm and common sense framework that serves as a reference for individual strategies and narratives” of change (p. 47). Both levels interact: The mini-level influences the meta-level because every individual contributes to changing and shaping the future paradigm and thereby reality. The meta-level is deeply embedded in the meso-, micro-, and mini-levels and mediates between them. For instance, it affects how individuals in specific regimes think (cognitive lock-ins, see Welzer, 2011).

²i.e., predominant ways of thinking.

THEORETICAL INTEGRATION OF PSYCHOLOGICAL CONSTRUCTS INTO GÖPEL'S MLP

Interactions between the mini- and meta-levels are “the glue that holds societies together” (Göpel, 2016, p. 47) and can be promising research topics of a transformation-oriented psychology. Here, we exemplify with two psychological theories, namely Self-Determination Theory and Self-Efficacy Theory, how psychological perspectives could be embedded in Göpel's MLP (Göpel, 2016). **Figure 1** depicts these thoughts.

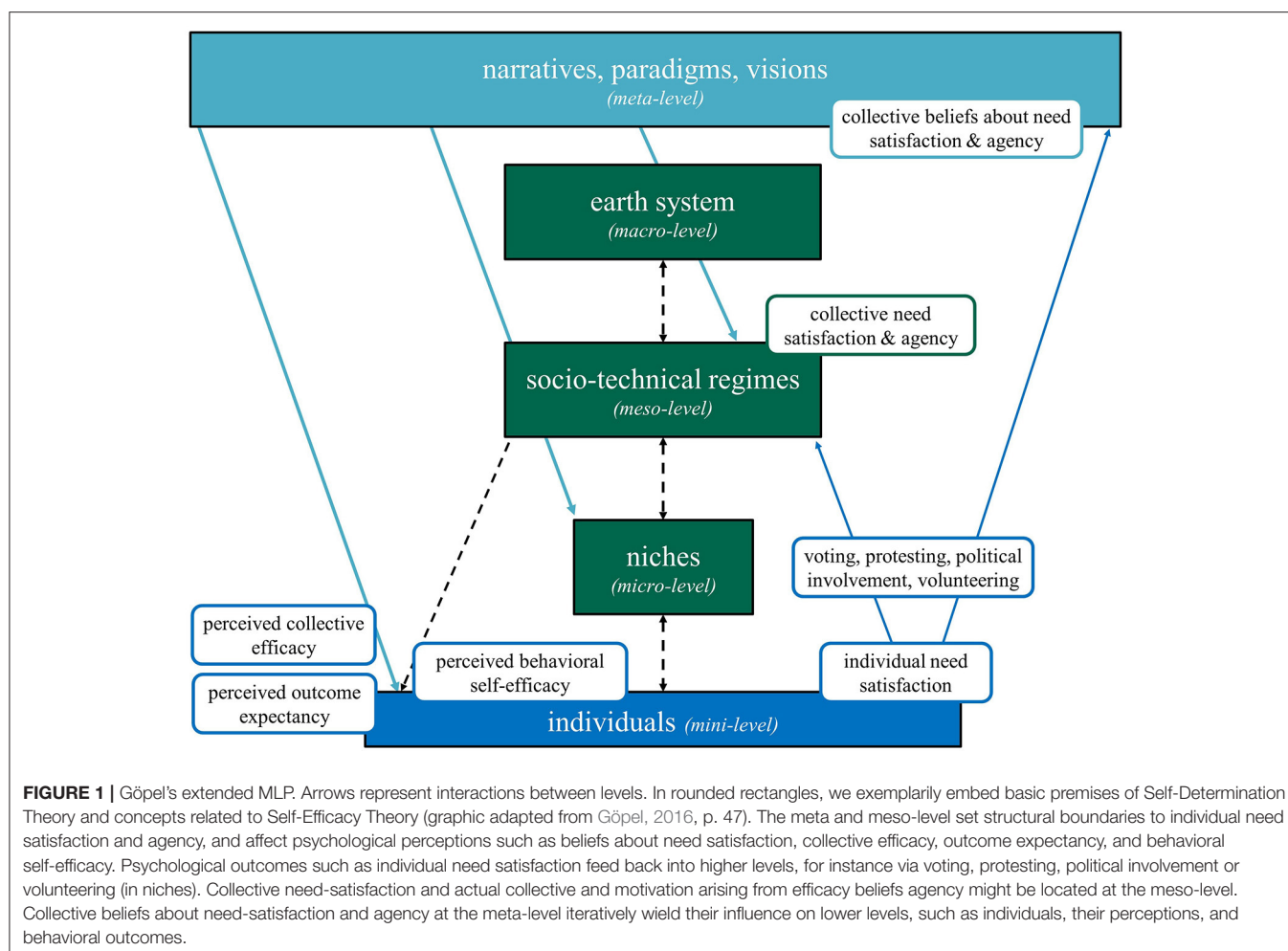
Self-Determination Theory

Self-Determination Theory (Deci and Ryan, 2000; Ryan and Deci, 2017) is a humanistic, organismic-dialectical theory of human motivation. It proposes the universal, innate, basic psychological needs for autonomy (agency), competence (efficacy), and relatedness (belonging) as pre-requisites for healthy human functioning and self-sustaining, autonomous motivation. If these needs are frustrated rather than satisfied, humans become defensive, have difficulty integrating threatening information, and struggle to cope with challenges in proactive, healthy ways. Given that actors at all societal levels perceive the climate crisis and its subsequent implications for societal transformation as threatening and challenging, understanding basic psychological need satisfaction is critical (see Wullenkord, 2020).

Being a dialectical theory, Self-Determination Theory goes beyond the traditional individualistic approach of cognitive psychology and thereby fits well into transition-oriented ways of thinking. It proposes that need satisfaction is a function of the social context: Social contexts mediate in how far individuals or groups (e.g., activists in grassroots movements) can satisfy their needs. This, in turn, affects how individuals shape those contexts to be need-satisfying. For instance, the meso-level may set actual constraints in how far people *can* meet their needs (e.g., laws promoting social inequality may thwart need satisfaction), while the meta-level may influence how people *perceive* their needs to be met (e.g., narratives around growth-orientation represent need-frustrating, extrinsic values). Individual need satisfaction influences how individuals shape their proximate contexts, indirectly shaping niches and regimes, and contributing to the predominant way of understanding the world (meta-level).

Self-Efficacy Theory

Bandura's Self-Efficacy Theory (1997) arose as a critique of Skinner's (1971) behaviorism, assuming that humans are agentic beings that have the power to shape their surroundings (see Bandura, 2019 for a summary). Thus, Self-Efficacy Theory might be a suitable framework to investigate transformations in which individuals are not only the outcome of higher-level influences but actively create those settings as political agents. Self-efficacy is the belief that one is able to perform a specific behavior to produce certain outcomes (Bandura, 1997). Previous research has mainly considered behavioral self-efficacy (i.e., the belief that one can perform certain *behaviors*, Bandura, 2006a), in contrast to outcome expectancy (i.e., the belief that an action produces certain *outcomes*, Bandura, 1997). Perceived collective



efficacy (i.e., the belief that a group agent can produce certain outcomes, Bandura, 1997) seems particularly important for collective change.

Self-efficacy affects people's aspirations, accomplishments, well-being, and perseverance in goal-pursuit in the face of difficulties (Bandura, 2006b, 2019). We hypothesize that behavioral self-efficacy evolves mostly from direct feedback and experiences made on the meso- and micro-level (e.g., regime lock-ins), while outcome expectancies and collective efficacy regarding societal transformations might be more strongly mediated by meta-level influences like success stories and visions as indirect social feedback (e.g., cognitive lock-ins). Even though Self-Efficacy Theory is primarily an individual-focused social cognitive theory, it may provide a basis for investigating actual (not only perceived) collective agency (see Empowerment Theory, Cattaneo and Chapman, 2010).

DISCUSSION

Based on the above considerations, we suggest how environmental psychology research could become more transition-oriented and exemplify how we may change our own

research practices to contribute to socio-technical transition research. When we provide examples, we mainly focus on the university regime, even though a vast array of research topics is possible.

We need to develop and consider transformation-oriented concepts and connect them with psychological constructs and processes. To this end, we need to engage in the discourse on transition studies, set transformation-oriented research agendas that bridge systemic and individual perspectives, and phrase research questions accordingly. In the context of needs, one may ask "How do student initiatives as exemplary niches satisfy needs and thus foster autonomous motivation for long-term engagement, constantly recreating themselves to meet the needs of their members?" Further, "What influence does students' collective efficacy have on environmental intentions?" (Hamann and Reese, 2020, study 1) could become "What influence does students' collective efficacy have on a transformation of the university regime and how does the university regime in turn influence students' collective efficacy?"

We need to acknowledge real-life contexts as cause and consequence of individual behavior. To do so, we need to fit our theories to the contexts in which we use them. Even

though criticized as reductionist and mechanistic (see Bögel and Upham, 2018), the Theory of Planned Behavior (Ajzen, 1991) is useful in contexts in which mindful decisions are possible. Yet in most contexts, theories bridging different levels might be more appropriate (e.g., value- and identity-oriented, dialectical theories, see Bamberg, 2018, Schulte et al., 2020). To acknowledge real-life contexts, we could focus on regime- or niche-specific research questions, include more long-term perspectives, and draw on data sets that are representative for specific contexts (see Brick, 2021 for a collection of openly available, large-scale datasets). Moreover, we might apply methods from other disciplines to get a better picture of contexts. For example, to investigate students' collective efficacy in the university regime, we could examine university polls and university visions (meta-level) and collect data on university size and infrastructure (meso-level, e.g., complementing quantitative data collection with interviews). We would then not only examine individual behavioral outcomes but actual political change, changes in university narratives, participation processes, and the effectiveness of student actions.

We need to focus more on niches. Even though pioneer activity plays a crucial role in many transition models (e.g., Geels, 2011), it is largely underemphasized in environmental psychology. We need a discussion about niche groups, niche practices, and their respective influence (see Becker et al., 2021). For example, one may consider students' need satisfaction when participating in niches that aim to transform the university regime (e.g., install a green-office) and investigate psychological processes underlying long-term engagement.

We need to view individuals as political agents. Transition research has thus far mostly focused on technology acceptance and individuals as users or consumers (see Bögel and Upham, 2018; Köhler et al., 2019). By investigating individuals and groups as political agents, psychology could offer new perspectives to transition research with individual and collective levers of change. For example, studies could focus on university students as voters of a student parliament and active contributors to decisions relevant to what the cafeteria offers, instead of as mere consumers of (non)sustainable cafeteria products.

We need to have a disciplinary discourse about the interdisciplinary position of environmental psychology. The increasing amount of collaborative research teams (Kazdin, 2009) is a promising development and needs to be expanded (see

Gifford, 2014). This development makes it even more important to discuss environmental psychology's place in research on socio-ecological transformation and necessary skills and resources connected to it at conferences, within research teams, or in theoretical articles (see Clayton et al., 2016).

We need to set a transformation-oriented research agenda. Large socio-ecological transformations could incorporate many new social practices (e.g., citizen participation, work time reduction, unconditional basic income). We might contribute to co-creating such protected spaces for niche practices in order to investigate them. For instance, we could set up living labs to explore how to deal with conflicting sustainability goals of various stakeholders (see Köhler et al., 2019).

We need to constantly rediscover our own curiosity about real-world processes. Finally, we propose to regularly question our own research in light of multidisciplinary theoretical and practical relevance, for instance by employing different, perhaps self-reflective methodological approaches.

Conclusion

In this opinion piece, we exemplified why and how to integrate our disciplinary perspective into the broader discourse on transitions, and discussed implications for environmental psychology research. Of course, our own view is limited and subject to discussion. We hope to stimulate such discussion and encourage readers to reflect on their own research practices—with the overarching goal of understanding and promoting a socio-ecological transformation.

AUTHOR CONTRIBUTIONS

MW contributed the part on Self-Determination Theory. KH contributed the part on Self-Efficacy Theory. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

We would like to thank Parissa Chokrai, Benedikt Seger, Gerhard Reese (environmental psychology), Andreas Roos (human ecology), and two reviewers for their helpful comments on an earlier draft of this manuscript. We appreciate how their comments revealed a multitude of different opinions and enjoyed the thought-provoking but also challenging interdisciplinary discussion it sparked.

REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* 50, 179–211. doi: 10.1016/0749-5978(91)90020-T
- Bamberg, S. (2018). Vom inaktiven Sympathisanten zum Aktivisten—Gruppen- und Identitätsbildungsprozesse als Fokus umweltpsychologischer Forschung [From inactive sympathizer to activist: Group and identity formation processes as focus of environmental psychological research]. *Umweltpsychologie* (Zeitschrift Umweltpsychologie) 22, 150–159.
- Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York, NY: Freeman and Company.
- Bandura, A. (2006a). "Guide to construction of self-efficacy scales," in *Self-Efficacy Beliefs of Adolescents*, Vol. 5, eds F. Pajares and T. Urdan (Charlotte, NC: Information Age), 307–337.
- Bandura, A. (2006b). Toward a psychology of human agency. *Perspect. Psychol. Sci.* 1, 164–180. doi: 10.1111/j.1745-6916.2006.00011.x
- Bandura, A. (2019). Applying theory for human betterment. *Perspect. Psychol. Sci.* 14, 12–15. doi: 10.1177/1745691618815165
- Becker, S., Bögel, P. M., and Upham, P. (2021). The role of social identity in institutional work for sociotechnical transitions: the case of

- transport infrastructure in Berlin. *Technol. Forecast. Soc. Change* 162:120385. doi: 10.1016/j.techfore.2020.120385
- Bögel, P. M., and Upham, P. (2018). Role of psychology in sociotechnical transitions studies: review in relation to consumption and technology acceptance. *Environ. Innov. Soc. Trans.* 28, 122–136. doi: 10.1016/j.eist.2018.01.002
- Brick, C. (2021). *Open Psychological Datasets*. Available online at: <https://docs.google.com/spreadsheets/d/1ejOJTNTL5ApCuGTUciV0REEEAqvhI2Rd2FCoj7afops/edit> (accessed on January 14, 2021).
- Cattaneo, L. B., Calton, J. M., and Brodsky, A. E. (2014). Status quo versus status quake: putting the power back in empowerment. *J. Community Psychol.* 42, 433–446. doi: 10.1002/jcop.21619
- Cattaneo, L. B., and Chapman, A. R. (2010). The process of empowerment: a model for use in research and practice. *Am. Psychol.* 65, 646–659. doi: 10.1037/a0018854
- Clayton, S., Devine-Wright, P., Swim, J., Bonnes, M., Steg, L., Whitmarsh, L., et al. (2016). Expanding the role for psychology in addressing environmental challenges. *Am. Psychol.* 71, 199–215. doi: 10.1037/a0039482
- Deci, E. L., and Ryan, R. M. (2000). The “what” and “why” of goal pursuits: human needs and the self-determination of behavior. *Psychol. Inq.* 11, 227–268. doi: 10.1207/S15327965PLI1104_01
- Dijk, M., Wells, P., and Kemp, R. (2016). Will the momentum of the electric car last? testing a hypothesis on disruptive innovation. *Technol. Forecast. Soc. Change* 105, 77–88. doi: 10.1016/j.techfore.2016.01.013
- Elias, N. (1982). *The Civilizing Process*. New York, NY: Pantheon Books.
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: responses to seven criticisms. *Environ. Innov. Soc. Trans.* 1, 24–40. doi: 10.1016/j.eist.2011.02.002
- Geels, F. W., and Schot, J. (2007). Typology of sociotechnical transition pathways. *Res. Policy* 36, 399–417. doi: 10.1016/j.respol.2007.01.003
- Geels, F. W., and Schot, J. (2010). “The dynamics of transitions: a socio-technical perspective,” in *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*, eds Schot, J., Grin, J., and Rotmans, J. (New York, NY: Routledge), 9–102.
- Gifford, R. (2014). Environmental psychology matters. *Annu. Rev. Psychol.* 65, 541–579. doi: 10.1146/annurev-psych-010213-115048
- Göpel, M. (2016). *The Great Mindshift. How a New Economic Paradigm and Sustainability Transformations go Hand in Hand*. Berlin: Springer.
- Hamann, K. R. S., and Reese, G. (2020). My influence on the world (of others): goal efficacy beliefs and efficacy affect predict private, public, and activist pro-environmental behavior. *J. Soc. Issues* 76, 35–53. doi: 10.1111/josi.12369
- Kazdin, A. E. (2009). Psychological science’s contributions to a sustainable environment: Extending our reach to a grand challenge of society. *Am. Psychol.* 64, 339–356. doi: 10.1037/a0015685
- Köhler, J., Geels, F. W., Kern, F., Markard, J., Onsong, E., Wiecek, A., et al. (2019). An agenda for sustainability transitions research: state of the art and future directions. *Environ. Innov. Soc. Trans.* 31, 1–32. doi: 10.1016/j.eist.2019.01.004
- Meadows, D. (1999). *Leverage Points: Places to Intervene in a System*. Lynedoch: The Sustainability Institute.
- Mersmann, F., Wehnert, T., Göpel, M., Arens, S., and Ujj, O. (2014). *Shifting Paradigms: Unpacking Transformation for Climate Action*. Wuppertal: Wuppertal Institute for Climate, Environment and Energy.
- Nielsen, K. S., Cologna, V., Lange, F., Brick, C., and Stern, P. C. (2021). The case for impact-focused environmental psychology. *J. Environ. Psychol.* 101559. doi: 10.1016/j.jenvp.2021.101559
- Ryan, R. M., and Deci, E. L. (eds.). (2017). *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*. New York, NY: Guilford Press. doi: 10.1521/978.14625/28806
- Schulte, M., Bamberg, S., Rees, J., and Rollin, P. (2020). Social identity as a key concept for connecting transformative societal change with individual environmental activism. *J. Environ. Psychol.* 72:101525. doi: 10.1016/j.jenvp.2020.101525
- Skinner, B. F. (1971). *Beyond Freedom and Dignity*. New York, NY: Bantam Vintage.
- Steg, L., and Vlek, C. (2009). Encouraging pro-environmental behaviour: an integrative review and research agenda. *J. Environ. Psychol.* 29, 309–317. doi: 10.1016/j.jenvp.2008.10.004
- Upham, P., Bögel, P., and Dütschke, E. (2020). Thinking about individual actor-level perspectives in sociotechnical transitions: a comment on the transitions research agenda. *Environ. Innov. Soc. Trans.* 34, 341–343. doi: 10.1016/j.eist.2019.10.005
- Van Valkengoed, A. M., Steg, L., Perlaviciute, G., Schultz, P. W., Brosch, T., Gatersleben, B., et al. (2021). Theory enhances impact. Reply to: “The case for impact-focused environmental psychology”. *J. Environ. Psychol.* 101597. doi: 10.1016/j.jenvp.2021.101597
- WBGU (2011). *World in Transition. A Social Contract for Sustainability. Flagship Report*. WBGU–German Advisory Council on Global Change, Bowling Green, OH, United States. Available online at: https://www.wbgu.de/fileadmin/user_upload/wbgu/publikationen/hauptgutachten/hg2011/pdf/wbgu_jg2011_en.pdf (accessed January 05, 2021).
- Welzer, H. (2011). *Mental Infrastructures: How Growth Entered the World and Our Souls*. Berlin: Heinrich Böll Foundation.
- Winner, L. (1986). *The Whale and the Reactor: A Search for Limits in an Age of High Technology*. Chicago, IL: The University of Chicago Press.
- Wullenkord, M. C. (2020). Climate change through the lens of self-determination theory: how considering basic psychological needs may bring environmental psychology forward. *Umweltpsychologie*, (Zeitschrift Umweltpsychologie) 24, 110–129.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Wullenkord and Hamann. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Commentary: We Need to Change: Integrating Psychological Perspectives Into the Multilevel Perspective on Socio-Ecological Transformations

Daniel Hanss*

Department of Social Sciences, Darmstadt University of Applied Sciences, Darmstadt, Germany

Keywords: transformation research, socio-technical transition, multilevel perspective, agency, environmental psychology

A Commentary on

We Need to Change: Integrating Psychological Perspectives Into the Multilevel Perspective on Socio-Ecological Transformations

by Wullenkord, M. C., and Hamann, K. R. S. (2021). *We need to change: Integrating psychological perspectives into the multilevel perspective on socio-ecological transformations*. *Front. Psychol.* 12:655352. doi: 10.3389/fpsyg.2021.655352

OPEN ACCESS

Edited by:

Sonja Maria Geiger,
Justus Liebig University, Germany

Reviewed by:

Torsten Masson,
Leipzig University, Germany
Maxie Schulte,
Bielefeld University of Applied
Sciences, Germany

*Correspondence:

Daniel Hanss
daniel.hanss@h-da.de

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 14 June 2021

Accepted: 23 July 2021

Published: 18 August 2021

Citation:

Hanss D (2021) Commentary: We
Need to Change: Integrating
Psychological Perspectives Into the
Multilevel Perspective on
Socio-Ecological Transformations.
Front. Psychol. 12:724768.
doi: 10.3389/fpsyg.2021.724768

INTRODUCTION

In their opinion article, Wullenkord and Hamann (2021) propose research avenues for increasing psychology's relevance for and impact in transformation research. One of their suggestions is to integrate constructs of psychological agency theories into an extended version (Göpel, 2016) of the multi-level perspective (MLP; Geels and Schot, 2007). My opinion is that this approach can give psychology some general guidance, for example, as to whether existing agency research sufficiently considers different structural levels that characterize socio-technical transitions. One likely insight will be that psychology needs to pay more attention to group-level constructs and concepts at the intersection of psychology and sociology [as suggested by Upham et al. (2020), Ruhrort and Allert (2021), albeit unrelated to MLP]. Efforts to explore the role of social (Schulte et al., 2020) or global identity (Loy et al., 2021) for individual and collective pro-environmental behaviors are examples of steps toward closing this research gap. However, I also think that the proposed theory integration has limitations that deserve mentioning:

- One limitation concerns the advancement of MLP through auxiliary theories. While Geels (2011) points out the potential value of including insights on agency into MLP, he also stresses that open, heuristic frameworks are better suited for studying multi-dimensional topics—like socio-technical transitions—than rigorous, mathematical explanatory models. Psychological agency theories that link behavior causally to specific underlying factors may, thus, be incompatible with MLP.
- Another limitation concerns the scope of agency perspectives for application in transformation research. Wullenkord and Hamann (2021) emphasize that psychology needs to pay more attention to processes and events in system transformations to increase its practical value for

transformation research. I agree but think that their approach to contemplate psychological agency perspectives within a general explanatory framework like MLP risks ignoring system characteristics essential to understanding agency in transformations, many of which likely depend on the domain and context in which a transformation takes place. Ignoring these characteristics may lead to premature conclusions about the relevance of psychological constructs.

More comprehensive insights for psychological contributions can evolve from analyses of specific systems and transformations that consider the contextual embeddedness of actors and behaviors. These analyses are essential elements of inter- and transdisciplinary transformation research initiatives and may be guided by MLP. For psychology to become more transformation-oriented, psychologists need to actively engage in these initiatives and help advance solutions toward their common practices and challenges.

Below, I will give a brief overview of different strands of transformation research. I will then provide examples of how psychology can support these research strands through agency-related concepts and research. I, thereby, hope to complement Wullenkord and Hamann's 2021 and other (e.g., Upham et al., 2020; Bruhn, 2021) recent contributions on the relevance of psychology for transformation research.

STRANDS OF TRANSFORMATION RESEARCH

Transformation research can be broadly distinguished by the *mode* in which research is conducted: *problem-oriented*, *descriptive-analytical* vs. *solution-oriented*, *transformative* (Wittmayer and Hölscher, 2017). The former mode investigates the complexity and dynamics of systems (e.g., socio-ecological or socio-technical) underlying sustainability-related challenges, by integrating perspectives of different scientific disciplines. The latter mode builds upon and goes beyond problem description and analysis. It strives to develop, test, and implement practical solutions to sustainability-related challenges in collaborative fashion by integrating insights from different scientific disciplines and expertise of societal actors (Wiek et al., 2012). During this process, solution options are evaluated on impact indicators, like carbon emission estimates from life cycle analyses, and only pursued, if they promise significant improvements in the targeted system. Another way to distinguish transformation research is with regard to the *system under investigation*. For example, sustainability science focusses on *socio-ecological* and transition research on *socio-technical* or *socio-economic* systems (Wittmayer and Hölscher, 2017), with each line of research using different analytic frameworks.

One such framework, rooted in transition research, is MLP. Geels (2011) refers to MLP as a “heuristic device” to help analysts derive conclusions about events and dynamic patterns in transitions by pointing them to relevant questions and problems about the system under investigation. Among

these questions and problems are such relating to the identification of transition-relevant actors, behaviors, and their influencing factors.

HOW TRANSFORMATION RESEARCH INITIATIVES CAN BENEFIT FROM PSYCHOLOGICAL AGENCY CONCEPTS

Problem-oriented, descriptive analytical initiatives may ask what contextual and psychological factors underlie agency in an “unsustainable” socio-technological system, such as electricity or transport in a confined geographical region. These systems and their transitions are influenced by multiple individual and group actors (e.g., consumers, policymakers, companies), with potentially distinct constellations of interests, beliefs, or strategies, and involve various types of agency (Köhler et al., 2019), likely unique to specific systems. Furthermore, transformation-relevant behaviors are embedded in institutions (i.e., formal and informal rules), spatial arrangements (e.g., infrastructure, urban design characteristics), and cultural contexts (Di Giulio et al., 2014). For example, people's choice of transportation may be affected by formal parking space regulations in their neighborhoods or at their workplaces, while informal rules could, e.g., develop from conversations about mobility and livable urban spaces taking place in local citizen networks. Transport decisions may also depend on how much public space is attributed to different transport modes or how residential, commercial, and recreational areas are spatially organized in communities and the resulting distances that people need to travel in everyday life. While spatial organization of public spaces may be culture specific, cultural influences could, e.g., also stem from status connotations of different transport modes. To shed light on these various aspects, analyses of the system at hand are warranted before psychological constructs can be meaningfully selected for the study of agency. System analyses can be guided by MLP (see, e.g., Nykvist and Whitmarsh, 2008) and should provide sufficient detail on the contextual embeddedness of the relevant actors and behaviors, to inform assumptions about which psychological constructs need be considered. If contextual and psychological factors are integrated into explanatory behavior models and put to empirical test, insights from these studies can inform more comprehensive descriptions of the respective system and prospects of how it may be transformed.

Solution-oriented, transformative initiatives may strive to facilitate niche innovations in a concrete socio-technical system and involve analyses (e.g., guided by MLP) of the context and actors relevant to collaborative development and implementation of the innovations. Collaboration can be conducted at varying degrees of distance, with more proximate approaches building upon bidirectional consulting and learning between researchers and societal actors (Lang and Wiek, 2021). Researchers in such transdisciplinary initiatives will face challenges like actively engaging societal actors with relevant expertise and influence—but different roles (e.g., representatives

of companies, municipal administration, citizens' initiatives), professional backgrounds, and motivations—for collaboration in niches. In later transition stages, researchers may need to build ownership and intent among implementers and potential adopters of the niche innovations. Psychological agency concepts and research can inform these efforts, for example, with insights on how to strengthen individual and group-level determinants of niche-actor engagement (Hamann et al., 2021) or adoption of niche-innovation among users in the regime (Keller et al., 2021). Such psychological contributions can draw from and feed back into descriptive-analytical transformation research.

DISCUSSION

To increase its relevance for and impact in transformation research, psychology needs to embrace the complexity and context embeddedness of agency in system transitions. Another recent initiative concerned with impact orientation in environmental psychology has stressed that contextual factors are particularly important for explaining high-impact behaviors, probably more so than the attitude(like) constructs covered by prevailing psychological agency theories (Lange et al., 2021; Nielsen et al., 2021). The authors, consequently, argue for explanatory approaches to studying high impact behaviors and inductive development of agency theories.

REFERENCES

- Bruhn, T. (2021). How can transformative sustainability research benefit from integrating insights from psychology? *Front. Psychol.* 12:676989. doi: 10.3389/fpsyg.2021.676989
- Di Giulio, A., Fischer, D., Schäfer, M., and Blättel-Mink, B. (2014). Conceptualizing sustainable consumption: toward an integrative framework. *Sustainabil. Sci. Pract. Policy* 10, 45–61. doi: 10.1080/15487733.2014.11908124
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environ. Innovat. Soc. Transit.* 1, 24–40. doi: 10.1016/j.eist.2011.02.002
- Geels, F. W., and Schot, J. (2007). Typology of sociotechnical transition pathways. *Res. Policy* 36, 399–417. doi: 10.1016/j.respol.2007.01.003
- Göpel, M. (2016). *The Great Mindshift: How a New Economic Paradigm and Sustainability Transformations Go Hand in Hand*. Cham: Springer e-book version. doi: 10.1007/978-3-319-43766-8
- Hamann, K. R. S., Holz, J. R., and Reese, G. (2021). Coaching for a sustainability transition: Empowering student-led sustainability initiatives by developing skills, group identification, and efficacy beliefs. *Front. Psychol.* 12:623972. doi: 10.3389/fpsyg.2021.623972
- Keller, A., Köhler, J. K., Kleihauer, S., and Hanss, D. (2021). Why consumers shift from single-use to reusable drink cups: An empirical application of the stage model of self-regulated behavioural change. *Sustain. Product. Consumpt.* 27, 1672–1687. doi: 10.1016/j.spc.2021.04.001
- Köhler, J., Geels, F. W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., et al. (2019). An agenda for sustainability transitions research: State of the art and future directions. *Environ. Innovat. Soc. Transit.* 31, 1–32. doi: 10.1016/j.eist.2019.01.004
- Lang, D. J., and Wiek, A. (2021). Structuring and advancing solution-oriented research for sustainability. *Ambio*. doi: 10.1007/s13280-021-01537-7. [Epub ahead of print].
- Lange, F., Nielsen, K. S., Cologna, V., Brick, C., and Stern, P. C. (2021). Making theory useful for understanding high-impact behavior. A response to van Valkengoed et al. (2021). *J. Environ. Psychol.* 75. doi: 10.1016/j.jenvp.2021.101611
- Loy, L. S., Tröger, J., Prior, P., and Reese, G. (2021). Global citizens - global jet setters? The relation between global identity, sufficiency orientation, travelling, and a socio-ecological transformation of the mobility system. *Front. Psychol.* 12:622842. doi: 10.3389/fpsyg.2021.622842
- Nielsen, K. S., Cologna, V., Lange, F., Brick, C., and Stern, P. C. (2021). The case for impact-focused environmental psychology. *J. Environ. Psychol.* 74. doi: 10.1016/j.jenvp.2021.101559
- Nykqvist, B., and Whitmarsh, L. (2008). A multi-level analysis of sustainable mobility transitions: Niche development in the UK and Sweden. *Technol. Forecast. Soci. Change* 75, 1373–1387. doi: 10.1016/j.techfore.2008.05.006
- Ruhrort, L., and Allert, V. (2021). Conceptualizing the role of individual agency in mobility transitions: Avenues for the integration of sociological and psychological perspectives. *Front. Psychol.* 12:623652. doi: 10.3389/fpsyg.2021.623652
- Schulte, M., Bamberg, S., Rees, J., and Rollin, P. (2020). Social identity as a key concept for connecting transformative societal change with individual environmental activism. *J. Environ. Psychol.* 72:101525. doi: 10.1016/j.jenvp.2020.101525
- Upham, P., Bögel, P. M., and Dütschke, E. (2020). Thinking about individual actor-level perspectives in sociotechnical transitions: A comment on the transitions research agenda. *Environ. Innovat. Soc. Transit.* 34, 341–343. doi: 10.1016/j.eist.2019.10.005
- Wiek, A., Ness, B., Schweizer-Ries, P., Brand, F. S., and Farioli, F. (2012). From complex systems analysis to transformational change: A comparative

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

FUNDING

Publication of this commentary was funded by the Open Access Publishing Fund of Darmstadt University of Applied Sciences.

- appraisal of sustainability science projects. *Sustainabil. Sci.* 7, 5–24. doi: 10.1007/s11625-011-0148-y
- Wittmayer, J., and Hölscher, K. (2017). *Transformationsforschung: Definitionen, Ansätze, Methoden*. Available online at: <https://www.umweltbundesamt.de/publikationen/transformationsforschung> (accessed August 2, 2021).
- Wullenkord, M. C., and Hamann, K. R. S. (2021). We need to change: Integrating psychological perspectives into the multilevel perspective on socio-ecological transformations. *Front. Psychol.* 12:655352. doi: 10.3389/fpsyg.2021.655352

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Copyright © 2021 Hanss. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Coaching for a Sustainability Transition: Empowering Student-Led Sustainability Initiatives by Developing Skills, Group Identification, and Efficacy Beliefs

Karen R. S. Hamann^{1*}, Jana R. Holz² and Gerhard Reese¹

¹ Environmental Psychology Unit, Department of Social, Environmental, and Economic Psychology, Faculty of Psychology, University of Koblenz-Landau, Landau, Germany, ² Junior Research Group "Mentalities in Flux", Institute of Sociology, Friedrich-Schiller-University Jena, Jena, Germany

OPEN ACCESS

Edited by:

Daniel Fischer,
Wageningen University and
Research, Netherlands

Reviewed by:

Torsten Masson,
Leipzig University, Germany
José Gutiérrez-Pérez,
University of Granada, Spain
Marco Rieckmann,
University of Vechta, Germany

*Correspondence:

Karen R. S. Hamann
hamann@uni-landau.de

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 30 October 2020

Accepted: 29 March 2021

Published: 05 May 2021

Citation:

Hamann KRS, Holz JR and Reese G
(2021) Coaching for a Sustainability
Transition: Empowering Student-Led
Sustainability Initiatives by Developing
Skills, Group Identification, and
Efficacy Beliefs.
Front. Psychol. 12:623972.
doi: 10.3389/fpsyg.2021.623972

Self-, collective, and participative efficacy are strong predictors of sustainability action. Yet, few studies have investigated the dynamics and variability of efficacy beliefs. In this transdisciplinary study, we tested such factors in the context of a peer-to-peer coaching program for sustainability volunteers, embedded in a structured-educational context. Over weekends, 2 qualified coaches trained 36 German bottom-up, student-led sustainability initiatives. These coaches instructed students in team building, envisioning, project planning, and on-campus sustainability practice. While 317 participants completed our pre-questionnaire, $N = 165$ completed both the pre- and post-questionnaire. As hypothesized, after having participated in the coaching weekend, action skills, collaboration skills, group identification, and self-, collective, and participative efficacy all increased. The latter of these increased, to our knowledge, for the first time in environmental psychology research. Group identification and having a vision emerged as important efficacy predictors, and participative efficacy beliefs in turn predicted volunteering. Moreover, we took initial steps in investigating the interaction of psychological and structural factors from a multilevel perspective. Our analyses revealed that efficacy beliefs on the individual level were higher when the university had a green office and when the student initiative was at a small university. We conclude by proposing an empowerment model for sustainability volunteers and by discussing the practical implications of our findings.

Keywords: efficacy beliefs, sustainability volunteering, sustainability behavior, group identification, coaching program, university, student initiatives, multilevel perspective

INTRODUCTION

"We already have all the facts and solutions. All we have to do is to wake up and change." (Greta Thunberg, TED, 2018) (Thunberg, 2018).

Sustainability movements, such as Fridays for Future, are on the rise, with continuous protests in more than 100 countries (BBC, 2019, 2020). The spotlights of such bottom-up initiatives tend

to be focused on those select individuals who initiate and inspire others to join movements, while overlooking underlying structures and supporting people (e.g., the Fridays for Future organizers, or groups already pioneering sustainable forms of living). Yet, they too form an integral part of sustainability transitions.

According to Geels and Schot (2007), such sustainability transitions require change on multiple levels: socio-technical landscapes (e.g., long-term value patterns or demographic trends), socio-technical regimes (e.g., infrastructures or lifestyles), and niches (e.g., small networks producing radical innovations). From this multilevel perspective, socio-ecological transitions take place if niche alternatives are tested by pioneers and prepared to be embedded in, or even replace, socio-technical regimes. As such, we set out to examine the case of German bottom-up, student-led sustainability initiatives (niches) that were coached by *netzwerk n*, a non-profit organization that promotes sustainability throughout the education practices, operations, research, and governance of higher education institutions (university regime) (*netzwerk n e.V.*, n.d.). In this transdisciplinary research project, we developed research questions and design conjointly with *netzwerk n* (see Lang et al., 2012). Results were later discussed at application-oriented conferences, and with members of *netzwerk n*, thus contributing to advancing the coaching program and transforming practices in sustainability initiatives in the future. From a scientific point of view, we were especially interested in explaining sustainability behavior at the individual and group level from a psychological perspective.

Specifically, we draw on recent models of collective action to examine the roles of self-, collective, and participative efficacy beliefs in the process of psychological and actual empowerment. To this end, we raise three main questions: Does a coaching program have the potential to empower its participants? Do group identification, collaboration skills, action skills, and envisioning a sustainable future enhance perceived efficacy? Do efficacy beliefs play a relevant part in activist motivation and activity? Throughout our study, we use Geels and Schot's (2007) multilevel perspective as a base for embedding our psychological perspective into the broader context of the socio-technical regimes and landscapes of universities. As most sustainability initiatives in our sample focus on the environmental dimension of sustainability, our literature review summarizes research on environmental activist, and pro-environmental behaviors.

The Case of Environmental Activists

Representative studies suggest that the proportion of the German population volunteering for environmental and nature protection increased from 4 to 6% between 2006 and 2008 to 8–9% between 2010 and 2016 [Bundesministerium für Umwelt, Naturschutz, und nukleare Sicherheit [BMU] and Umweltbundesamt [UBA], 2015, 2017]. In 2014, 48% of all non-activists reported they could imagine actively engaging in environmental protection in the future. This potential for sustainability activism requires an understanding of the conditions for effective, satisfactory, and long-lasting active engagement in niches—a behavior rarely studied in psychological

research (see Curtin and McGarty, 2016). In line with Curtin and McGarty (2016), we define activists as “people who actively work for social or political causes and especially those who work to encourage other people to support those causes” (p. 228). Intentionally, this definition includes both protesters who might put pressure on the socio-technical landscape, but also volunteers who sustain the organizational structures of social and ecological niches. As reflected in our study, university students are often presented as and targeted to be pioneers in socio-ecological transitions (UNESCO Global Action Programme ESD, n.d.). A major theme and driving force in an environmental activist's life is the feeling of efficacy (Martinez and McMullin, 2004; Almers, 2013). By focusing on psychological efficacy beliefs in a broader context of agency and empowerment in regimes and landscapes, our study sheds light on why sustainability volunteers become active, how their active engagement might be boosted, and how they influence sustainability transitions.

Efficacy Beliefs at the Individual and Group Levels and Somewhere in Between

According to Bandura's self-efficacy theory (1997), self-efficacy refers to the belief that one can successfully execute the behaviors required to produce certain desired outcomes. In this respect, self-efficacy beliefs comprise some amalgam of agent-action-aim relationships. While Bandura (1997) focuses on agent-action self-efficacy (one's perceived ability to perform a behavior), other environmental psychology studies focus on agent-aim self-efficacy (see Hamann and Reese, 2020). In psychology literature, agent-aim efficacy is often termed self-efficacy (Hanss and Böhm, 2010), perceived (consumer) effectiveness (Lee et al., 2014), and response efficacy (Doherty and Webler, 2016). In the context of this paper, agent-aim self-efficacy may be an initiative member's perceived ability to change sustainability policies at their university. However, some authors argue that sustainability challenges require collective solutions and, as such, social identity factors should be taken into account (see Fritzsche et al., 2018).

Tajfel (1978, p. 63) defines social identity as a combination of a person's perceived group membership and the emotional significance of that membership. In other words, it is the capacity to define oneself in terms of “we” instead of “I” (Fritzsche et al., 2018). Building on this understanding, collective efficacy refers to a social group, i.e., a group member's belief in the group's ability to produce desired outcomes (Bandura, 1997). In the context of this study, this could be an initiative member's belief that their group has the ability to persuade their university to offer more sustainability-related courses. Then again, as suggested by Olson's paradox (1968), too much collective efficacy could eventually lead to inaction as a single member's behavior might seem unnecessary for goal achievement (Olson, 1968). Accounting for this, Van Zomeren et al. (2013) introduced participative efficacy, which is the belief that a person can make a significant contribution to the achievement of a group goal¹.

Finally, several qualitative and quantitative studies suggest that efficacy-related affective states such as feeling

¹ Within this study, self-, collective, and participative efficacy all pertain to agent-aim efficacy beliefs.

hopeful, euphoric, moved, or enthusiastic, are associated with sustainability actions (Drury and Reicher, 2005; Drury et al., 2005; Ojala, 2015; Feldman and Hart, 2016; Coelho et al., 2017; Hamann and Reese, 2020; Landmann and Rohmann, 2020; but see van Zomeren et al., 2019). While Bandura (1997) and Coelho et al. (2017) view affective states as antecedents of efficacy beliefs, Landmann and Rohmann (2020) conceptualize them as mediators between collective efficacy and collective action. We follow Drury and Reicher's (2005) notion that cognitive efficacy beliefs and efficacy affect (e.g., feeling hopeful, enthusiastic) jointly constitute empowerment, and explore the role of efficacy affect in the interplay of efficacy beliefs and sustainability behavior.

How the Agent-Aim Aspect of Efficacy Beliefs Relate to Sustainability Behaviors

Perceived efficacy is needed to increase climate mitigation behaviors (e.g., Intergovernmental Panel on Climate Change [IPCC], 2019, p. 364) as well as other sustainability behaviors. Whereas agent-action efficacy beliefs were investigated in a meta-analysis that provided support for its importance in environmental actions (see Bamberg and Möser, 2007), agent-aim efficacy beliefs have not received as much attention in the research community. As such, we present a brief overview of correlational and intervention studies. Based on a categorization by Stern (2000) and Homburg and Stolberg (2006), we contrast previous findings with four subtypes of pro-environmental behavior that we think are also suitable for the broader sustainability domain: private behavior (e.g., recycling), indirect behavior (e.g., encouraging others), and activism that is further divided into protesting (e.g., joining protests) and volunteering (e.g., organizing sustainability events). The division within the activism subtype aligns with former studies that distinguished between organizing and participative action (Alisat and Riemer, 2015), campaign and protest action (Amna, 2012), and institutionalized and non-institutionalized action (Van Stekelenburg et al., 2016). Yet, some authors doubt if such a differentiation is sensible as both protesting and volunteering can be viewed as collective action (see Kende, 2016; Van Zomeren, 2016; Thomas et al., 2017; Sabherwal et al., 2021). In this study, we have the opportunity to test if such a distinction has incremental value.

Private Behavior

While many studies find agent-aim self-efficacy to be an important predictor of private behavior such as energy saving behavior or sustainable consumption (Roberts, 1996; Straughan and Roberts, 1999; Kim and Choi, 2005; Hanss and Böhm, 2010; Lee et al., 2014; Hunter and Rööös, 2016; Loy et al., 2020), others do not (Homburg and Stolberg, 2006; Kim, 2011; Chen, 2015; Wang and Lin, 2017). Regarding efficacy aims, Hanss and Böhm (2010) found that an indirect self-efficacy aimed at encouraging others to promote sustainable development was a better predictor of private behavior than self-efficacy aimed generally at promoting sustainable development (see also Hanss et al., 2016). However, another study produced the opposite result (Hamann and Reese, 2020). Collective efficacy seems to be

a relevant predictor for private behavior such as the intention to use an electric vehicle (Homburg and Stolberg, 2006; Rees and Bamberg, 2014; Chen, 2015; Barth et al., 2016; Carmi and Mostovoy, 2017). Therefore, Jugert et al. (2016) propose the existence of a mediation path between collective efficacy and private behavior via self-efficacy. This was supported in their own and others' correlational research (e.g., Reese and Junge, 2017).

Indirect Behavior

While, in one study, self-efficacy generally aimed at protecting the environment did not seem to predict indirect behavior (Geiger et al., 2017), in another study, indirect self-efficacy aimed at encouraging others was its most important predictor (Hamann and Reese, 2020). An earlier study by Homburg and Stolberg (2006) revealed that collective efficacy also relates to indirect behavior.

Protesting and Volunteering

Though environmental protesting and volunteering seem to be best predicted by collective efficacy (Rees and Bamberg, 2014; Thomas and Louis, 2014; Besta et al., 2017; Sabherwal et al., 2021; for a meta-analysis beyond the environmental context, see Van Zomeren et al., 2008), self-efficacy is also a fairly good predictor (Brunsting and Postmes, 2002; Lee et al., 2014; Doherty and Webler, 2016). Recent studies found results favoring participative efficacy over collective efficacy as a predictor of protesting and volunteering (e.g., participation in transition town meetings), especially for participants who identified strongly with the cause (Bamberg et al., 2015; van Zomeren et al., 2019; Hamann and Reese, 2020).

To summarize this correlational research, there are mixed results for all behavior subtypes with a tendency for self-efficacy predicting private behavior, collective efficacy predicting protesting, and participative efficacy predicting volunteering. It also appears that outcomes are usually psychological and self-reported rather than structural and observable. Empowerment theory (Zimmerman, 1990) complements self-efficacy theory (Bandura, 1997) as empowerment is defined as a participative process through which people achieve greater control, efficacy, and social justice (Rappaport, 1987). It therefore explicitly includes structural aspects (such as influences from regimes and landscapes) alongside psychological aspects. Based on Cattaneo et al. (2014), we aimed to enrich the psychological field by assessing observable and structural changes. We looked at social media events and posts as well as an institution's establishing of a green office (a sustainability office funded and approved by a university; Rootability, n.d.) as observable outcomes of perceived efficacy.

Efficacy Predictors—Many Suggestions, Few Empirical Studies

Bandura (1997) proposed four main predictors of efficacy beliefs: mastery experiences, social modeling, verbal persuasion, and physiological/affective states. Although useful, there is no evidence that this list is conclusive, and we are unaware of any empirical tests within environmental studies (but for political activism, see Evripidou and Drury, 2013). Except for the

single substantial meta-analysis that demonstrated an association between efficacy beliefs and group identification (Van Zomeren et al., 2008), what we are now summarizing are largely untested psychological determinants of efficacy beliefs that are relevant to the coaching program and university context.

Action Skills and Envisioning

Many researchers have pointed out the importance of perceived knowledge and action skills. Almers (2013) describes action competence as a composition of several types of knowledge: knowledge of (1) problem causes and consequences (2), envisioning solutions (3), how conditions can change, and (4) implementation (see also Geller, 1995; Cattaneo and Chapman, 2010; Riemer et al., 2016; Vestergren et al., 2016). In the same vein, the interactional components of psychological empowerment in empowerment theory (skill development, critical awareness, and understanding of causal mechanisms) might serve as efficacy predictors (see also Zimmerman, 1990, 1995). Almers (2013) found that perceived knowledge relates to skills and confidence amongst sustainability volunteers. However, in their interviews, Drury et al. (2005) found that protesters cited knowledge only once as an empowering factor. Like Almers (2013), Drury and Reicher (2009) consider creating a vision of a better world a crucial efficacy predictor. Envisioning might be particularly facilitated if confronted with inspiring personalities like Greta Thunberg (Sabherwal et al., 2021). Developing a vision of sustainability solutions is also a critical function of niches in the multilevel perspective (Geels, 2011).

Group Identification

In literature on collective action, efficacy is oftentimes associated with and predicted by group identification (Drury and Reicher, 2005, 2009; Van Zomeren et al., 2008; Blackwood and Louis, 2012; Greenaway et al., 2015; Vestergren et al., 2016). Likewise, social support was frequently mentioned in qualitative interviews as a prerequisite for collective efficacy (Drury and Reicher, 1999; see also Babicky and Seebauer, 2020). Other authors have underlined the following group cohesion characteristics as possible efficacy predictors: appreciation and encouragement from others (Drury and Reicher, 1999; Almers, 2013), reciprocity (Lubell et al., 2007; Collins et al., 2014), trust (Collins et al., 2014), and social norms (Van Zomeren et al., 2004; Doherty and Webler, 2016; Wang and Lin, 2017).

Collaboration Skills

Finally, some researchers discussed and examined various signs of collaboration skills as efficacy predictors. These include resource mobilization (Zimmerman, 1995), goal setting (Cattaneo and Chapman, 2010), other members' perceived expertise (Marks et al., 2001), group consensus (Bongiorno et al., 2016), conflict management (Riger, 1984; Peterson and Zimmerman, 2004), role clarity (Chen and Bliese, 2002; Harp et al., 2017), and opportunity role structure (i.e., accessibility of positions) (Peterson and Zimmerman, 2004). From a procedural perspective, collective action itself can serve as efficacy predictors (Swim et al., 2019).

In summary, among the manifold psychological efficacy predictors, mostly group identification and norms are quantitatively tested in the field of environmental studies. Thus, our study pioneers the testing of several psychological and structural efficacy predictors that might be particularly relevant for sustainability volunteers.

Interventions: Efficacy Beliefs Crushed and Uplifted

In laboratory studies, agent-aim efficacy beliefs were successfully manipulated by highlighting behaviors and their impacts (Van Zomeren et al., 2010; Feldman and Hart, 2016; Jugert et al., 2016), using an environmental (loss) story frame (Morton et al., 2011; Steinhorst et al., 2015), with a behavior task of medium (vs. low or high) difficulty (Reese and Junge, 2017), with messages about non-violent protests (Thomas and Louis, 2014), and with discussions (Thomas et al., 2015). Other manipulations, such as providing favorable feedback (Doran et al., 2017), showing an activist video (regarding general efficacy measures, Landmann and Rohmann, 2020), and presenting hopeful messages (van Zomeren et al., 2019), were unsuccessful in promoting efficacy beliefs. A large-scale, knowledge-based, 8-week field intervention by Hanss and Böhm (2013) also failed to raise efficacy beliefs. Other research was hindered by baseline differences or lacked a pre- and post-test control group design (Bongiorno et al., 2016; Riemer et al., 2016). Taken together, efficacy manipulations produced mixed results, and there is a clear lack of field studies.

RESEARCH DESIGN

In cooperating with the NGO, *netzwerk n*, we had the unique chance of investigating a peer-to-peer coaching program for student-led sustainability initiatives, using pre- and post-questionnaire. During the coaching weekend, *netzwerk n* coaches (typically previously-trained students from other universities) visited 36 bottom-up student initiatives and instructed students in team building, envisioning, project managing, and on-campus sustainability. We decided to implement a voluntary pre- and post-questionnaire with a 6-month follow-up for all participants. This allowed for a strong empirical test of efficacy beliefs, group identification, and sustainability behaviors in the field, while at the same time providing a practically relevant evaluation.

Hypotheses

The coaching program included elements of previously successful interventions and proposed efficacy predictors (e.g., conveying sustainability knowledge, modeling best practices from other universities, and acquiring new project management skills). For an overview of coaching methods, see **Supplementary Table A1**. Our empirical field study tests several hypotheses derived from theory:

- **Pre-post comparison.** The following factors are stronger after the coaching weekend than before it: psychological factors such as action skills, having a vision, group identification, collaboration skills, efficacy affect, efficacy

beliefs, sustainability behavior, and volunteer time (1a), and observable factors such as social media events and posts (1b).

- **Efficacy beliefs as outcomes.** Efficacy beliefs are positively predicted by action skills, having a vision, group identification, and collaboration skills as psychological factors (2a), the existence of a green office as a regime factor (2b), and a smaller university (fewer students) and smaller town as landscape factors (2c). We expected volunteers in a small environment (e.g., small university) would be more likely to feel that their environment could be easily changed.
- **Efficacy beliefs as predictors.** Over and above other relevant covariates, efficacy beliefs positively predict sustainability behavior and volunteer time (3a), number of social media events and posts, and (3b) establishing of a green office (as indicator of a regime change) (3c). Compared to collective efficacy, self-efficacy is a stronger positive predictor of private behavior, and participative efficacy is a stronger positive predictor of volunteering (3d).

Participants and Design

Throughout 2017 and 2018, student-led sustainability initiatives applied to participate in *netzwerk n* coaching programs. After admittance, *netzwerk n* would initiate a 2–4-day meeting between initiative members and two peer-to-peer coaches (students of another university). Four weeks before their coaching weekend, groups typically had a Skype meeting with their coaches and received an e-mail from the project coordinator with warm-up questions and an invitation to our pre-questionnaire (see **Supplementary Material A2** for a description of the coaching weekend). Approximately one week after their coaching weekend, participants received an e-mail with information on next steps and our post-questionnaire.

Our final sample consisted of $N = 341$ members participating in $N = 39$ coaching weekends. Three groups took part in two coaching weekends. Of all participants, $N = 317$ completed our pre-questionnaire (196 females, 99 males; age $M = 23.43$ years, $SD = 3.25$), $N = 193$ finished our post-questionnaire (111 females, 52 males; age $M = 23.28$ years, $SD = 3.03$) on average 2 weeks after the coaching weekend, and $N = 34$ participated in the 6-month follow-up (22 females, 10 males; age $M = 23.82$ years, $SD = 3.14$). The large dropout rates are probably due to the voluntary nature of participation. On average, participants volunteered 5 h per week for their initiative during the pre-questionnaire, and 10% were paid to do so as part of a student job. The English version of the questionnaire was completed by 18 participants, and 19 initiative members had taken part in this particular coaching program before. After their coaching weekend, $N = 30$ coaching teams completed questionnaires regarding the coaching methods they employed.

Measures

Given the transdisciplinary nature of this process, both our own scientific demands and the practical demands of *netzwerk n* were taken into account. All items were measured on 7-point Likert scales from 1 (*totally disagree/incorrect*) to 7 (*totally agree/correct*). Both pre- and post-questionnaires contained the following scales in the displayed sequence. Scale reliability was

based on pre-questionnaire data. All item-scale correlations were larger than 30. As APA guidelines were followed for the ethical conduct of research, the questionnaires included an informed consent form. See **Supplementary Materials A25** and **A26** for the full questionnaire.

Action Skills

We constructed six items for action skills with reference to proposed efficacy predictors ($\alpha = 0.78$, see e.g., Geller, 1995; Almers, 2013). These items reflect the knowledge and skills typically addressed in the coaching weekend (e.g., familiarity with sustainability concepts, and project management). Sample item: “I am familiar with sustainability at my university (e.g., organizational structures, environmental management systems, etc.).” We decided to use the term action skills instead of action competence as our measure captures precise knowledge and skills rather than an educational ideal (see Mogensen and Schnack, 2010).

Group Identification, Collaboration Skills, and Having a Vision

Four items measured identification with one’s own sustainability initiative ($\alpha = 0.78$) based on Cameron (2004, e.g., “I feel like I belong to the initiative”). Together with *netzwerk n*, we generated a scale for perceived collaboration skills, which incorporated theoretical propositions but had a low Cronbach’s Alpha value due to its large spectrum of contents ($\alpha = 0.56$, see e.g., Marks et al., 2001; Collins et al., 2014). Sample item: “I am satisfied with the communication structures of our initiative.” We included having a vision as a one-item efficacy predictor (“I have a vision of how a sustainable university could look”).

Efficacy Affect

Efficacy affect was measured by the following three items adapted from Hamann and Reese (2020, $\alpha = 0.84$): “In my work for the initiative, I feel... motivated/hopeful/enthusiastic” (see also Feldman and Hart, 2016). Note that these items were only included for 32 coaching sessions.

Efficacy Beliefs

We adapted 13 items on sustainable development efficacy beliefs to our context ($\alpha = 0.87$), which were derived from Hanss and Böhm (2010) and Van Zomeren et al. (2013). Agent-aim self-efficacy was captured in five items ($\alpha = 0.79$), of which, two measured general sustainable development self-efficacy (e.g., “I, through individual actions, can promote sustainable development”), two measured an indirect self-efficacy to encourage others (e.g., “My sustainable action will encourage others to do the same”), and one measured university-specific self-efficacy (“I, through individual actions, can promote sustainable university development”). We operationalized agent-aim collective efficacy with five items that exactly mirrored the self-efficacy items ($\alpha = 0.87$, e.g., “Through joint actions, we as an initiative can promote sustainable development”). Three items measured agent-aim participative efficacy ($\alpha = 0.88$), of which, two addressed general participative efficacy (e.g., “I, as an individual, can make a significant difference, so that we,

as an initiative, can promote sustainable development”) and one addressed university-specific participative efficacy (“I, as an individual, can make a significant difference, so that we, as an initiative, can promote sustainable university development”).

Sustainability Behavior and Volunteer Time

Sustainability behavior was measured with nine items ($\alpha = 0.72$). We captured private behavior in three consumption-related items that reflected the ecological dimension of sustainability and were adapted from Kaiser et al. (2010, e.g., “I mainly buy seasonal food,” $\alpha = 0.73$). We operationalized indirect behavior according to Homburg and Stolberg (2006) with two items (e.g., “I try to convince my friends and family members of the importance of sustainable development,” $r = 0.44$). Protesting [e.g., “I participate in protests (demonstrations, rallies, occupations, etc.) that promote sustainable development,” $r = 0.42$] and volunteering (e.g., “I organize educational events about sustainability topics,” $r = 0.38$) were measured with two items each, taken from Alisat and Riemer (2015). Based on Mazzoni et al. (2015), we asked participants how many hours per week they were working or volunteering for their initiative.

Single Measures and Demographics

For exploratory purposes, we inquired about participants’ environmental identity (“I think of myself as an environmentally-friendly person,” see Lauren et al., 2016), stakeholder efficacy (“I feel able to contact stakeholders of my university”), volunteer burnout (“I feel burned out because of my commitment,” see Skaalvik and Skaalvik, 2007), volunteer payment, and demographics (age, gender, semester). For our collaboration partner, *netzwerk n*, questionnaires also contained evaluation items, e.g., “Coaches met our group needs.”

Coach Questionnaire

Coaches received questionnaires asking them to indicate which of the listed standard *netzwerk n* coaching methods they employed (yes/no) (see **Supplementary Table A1**). In addition, coaches were asked if they themselves were satisfied with their coaching weekend.

Social Media and Structural Variables

In order to assess changes in student initiative niches, we collected data on how many Facebook events (excluding internal group meetings) and posts (excluding re-posts) the student initiatives generated in the 1.5 years following ($N = 35$) and preceding the coaching ($N = 30$, initiatives were excluded if they had not owned an account for the 1.5 years preceding the coaching). For exploratory purposes, we further divided events into educational events (e.g., climate lectures), action events (e.g., upcycling workshops), university discussion events (e.g., discussions with other status groups), and protest events (e.g., preparing for Fridays for Future).

In order to capture landscape and regime influences, we gathered information on each university’s student population, city population, number of staff members, student-staff ratio, number of professors, student-professor ratio, budget, budget-student ratio, the year in which the university was founded, and the gender of the university’s president (based on most recent

information). Moreover, we included whether the institution was a university or university of applied sciences, state or privately funded, located in former Western or Eastern Germany, and focused more on humanities or natural sciences. For depicting structural changes, we further coded if there had been a green office before and/or after the coaching, which was part of the institution (e.g., with permanent employees). Data was collected in 2020, dependent on online availability, and was supplied by three coders. Each data point was coded by at least two coders and inconsistencies were resolved by personal exchange.

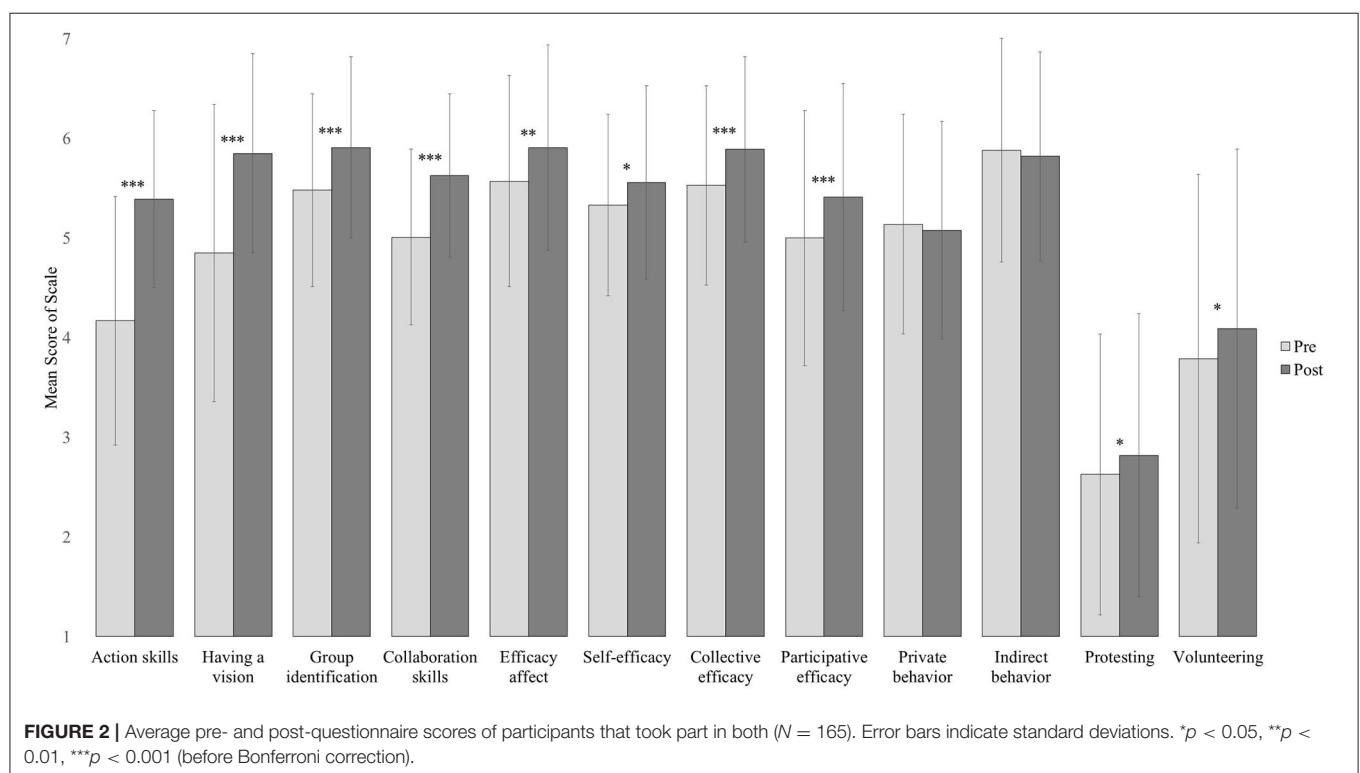
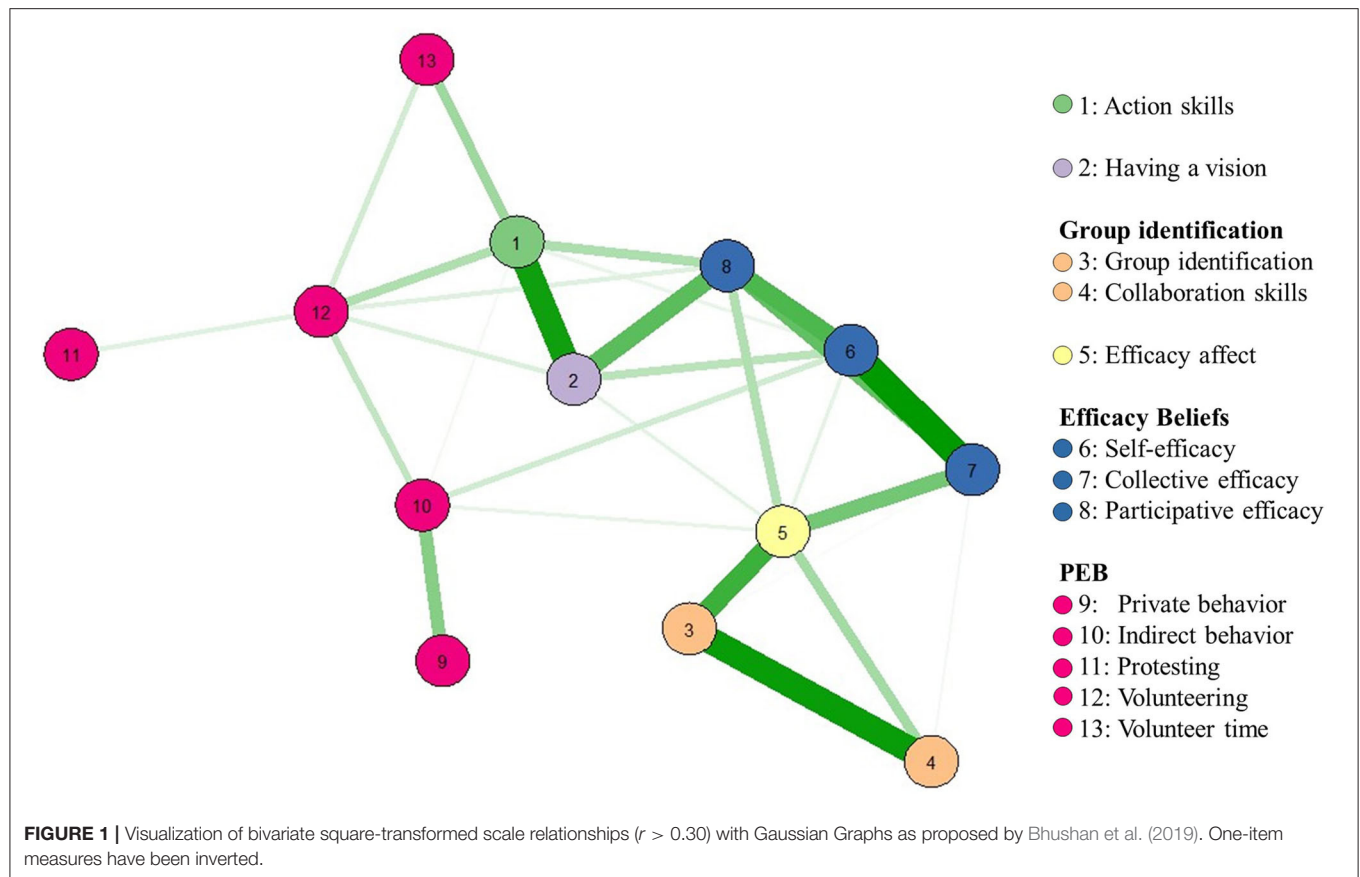
Data Analysis

We performed data analysis with R Statistics version 3.6.0, and we performed data management with SPSS 25. We provide a trimmed dataset, script, and further analyses on OSF (see reference section, Hamann et al., 2019). For psychological hypotheses, we used multilevel modeling and report pseudo R^2 according to Raudenbush and Bryk (2002), which is a measure indicating the proportion of the variance that predictor variables explain in the outcome variable. Furthermore, we examined H1 with t -tests and H2/3 with latent change models. For multilevel models of H1, and latent change models, we used our pre-post sample with $N = 165$, in which 12 participants were excluded beforehand because the time lag exceeded 4 months. H2/3 were tested with $N = 310$ pre-questionnaire participants (7 were excluded because they did not report their university). We detected no multivariate outliers using Mahalanobis distance when overall scales were included. When subscales were used for Mahalanobis distance, it was suggested that five participants be excluded. We checked main analyses without these outliers, but no differences occurred. Because of skewed distributions, we repeated every analysis with square-transformed scales. Unless otherwise noted, square-transformed scales produced similar results. To control for error accumulation in our hypotheses, we suggest a Bonferroni correction that divides p by the number of hypotheses. Therefore, a significant relation is signaled by $p < 0.025$ for 2 hypotheses in H1b, H2c, H3a/b/d, by $p < 0.0125$ for 4 hypotheses in H2a, and by $p < 0.006$ for 8 hypotheses in H1a. **Figure 1** shows correlations of our main constructs. Means, standard deviations, and correlations of scales can be found in **Supplementary Tables A3, A4 and Supplementary Figure A5**.

RESULTS

Confirmatory Factor Analysis

We first confirmed the proposed factor structure of efficacy beliefs and sustainability behavior. Regarding efficacy beliefs, a 5-factor model with self-, collective, and participative efficacy as latent factors and 2 nested factors (1 for 3 university-specific items and 1 for 4 efficacy items with the goal to encourage others; CFI = 0.983, RMSEA = 0.048, AIC = 11,517) fit the data better than a 3-factor model with only self-, collective, and participative efficacy (CFI = 0.913, RMSEA = 0.099, AIC = 11,666) and a 1-factor solution (CFI = 0.706, RMSEA = 0.178, AIC = 12,126). For sustainability behavior, the best fitting model was a 4-factor solution with a private, indirect, protesting, and volunteering factor (CFI = 0.912, RMSEA = 0.088, AIC



= 9,874). This model fit the data better than both a 3-factor solution with a private, indirect, and protesting/volunteering factor (CFI = 0.857, RMSEA = 0.105, AIC = 9,903) and a 1-factor solution (CFI = 0.620, RMSEA = 0.162, AIC = 10,034). CFAs are portrayed in **Supplementary Figures A6 and A7**.

Multilevel Analyses

Including a subject level and a sustainability coaching (group) level, we first calculated intraclass correlation coefficients (ICCs) for our main constructs, efficacy and sustainability behavior. Concerning pre-post comparisons, the subject level explained 32% of the variance in efficacy beliefs and 53% in sustainability behavior, while the group level explained 14% of variance in efficacy beliefs and 16% in sustainability behavior. Looking at all pre-participants, the group level explained 3% of the variance in efficacy beliefs and 12% in sustainability behavior. We included both levels in our analyses. For H2 and H3, we created predictors centered at the group-mean (see Tabachnick and Fidell, 2013). For H1, and partially H2b with dichotomous predictors, level 1 residuals were set to 0, and pseudo R^2 could not be calculated.

Hypothesis 1: Pre-post Comparison

Multilevel models revealed that the following psychological constructs of H1a were significantly higher after the coaching weekend than before it (see also **Figure 2**): action skills ($b = 1.14$ [0.95, 1.34], $t(162) = 11.62$, $p < 0.001$), having a vision ($b = 0.96$ [0.71, 1.21], $t(162) = 7.48$, $p < 0.001$), group identification ($b = 0.38$ [0.19, 0.58], $t(163) = 3.91$, $p < 0.001$), collaboration skills ($b = 0.63$ [0.46, 0.80], $t(162) = 7.38$, $p < 0.001$), efficacy affect ($b = 0.30$ [0.10, 0.51], $t(133) = 2.93$, $p = 0.004$), and efficacy beliefs ($b = 0.28$ [0.14, 0.42], $t(162) = 3.95$, $p < 0.001$). Yet, the change in volunteer time did not pass Bonferroni correction ($M(SD)_{pre} = 4.88$ (3.36), $M(SD)_{post} = 5.34$ (3.69), $b = 0.50$ [0.08, 0.92], $t(161) = 2.35$, $p = 0.020$), and sustainability behavior did not change significantly ($b = 0.06$ [-0.06, 0.18], $t(150) = 1.05$, $p = 0.298$). *Post-hoc* analyses demonstrated that self-efficacy ($b = 0.18$ [0.03, 0.18], $t(162) = 2.34$, $p = 0.020$), collective efficacy ($b = 0.33$ [0.16, 0.49], $t(162) = 3.88$, $p < 0.001$), participative efficacy ($b = 0.38$ [0.20, 0.57], $t(162) = 4.06$, $p < 0.001$), protesting ($b = 0.21$ [0.03, 0.38], $t(161) = 2.31$, $p = 0.022$), and volunteering ($b = 0.30$ [0.07, 0.53], $t(161) = 2.55$, $p = 0.012$) all increased. No changes emerged for private ($b = -0.10$ [-0.25, 0.05], $t(150) = -1.29$, $p = 0.198$) or indirect behavior ($b = -0.10$ [-0.26, 0.06], $t(161) = -1.22$, $p = 0.224$). We repeated and confirmed analyses with square-transformed scales and paired t -tests (see **Supplementary Tables A8 and A9**). Due to a low sample size in our follow-up questionnaire, we report long-term data for exploratory purposes only. Significant pre- vs. follow-up differences emerged for participatory efficacy and volunteering ($p < 0.05$) but appeared only descriptively in other constructs (see **Supplementary Table A10** for more detailed descriptive analyses).

We tested H1b with dependent t -tests in a sample that consisted of $N = 28$ universities as subjects. Supporting our hypothesis, student initiatives hosted more Facebook events in the 1.5 years following coaching ($M_{post} = 17.43$, $SD_{post} = 13.11$) than in the 1.5 years preceding coaching ($M_{pre} = 12.04$, $SD_{pre} = 8.07$, $t(27) = 2.31$, $r = 0.406$, $p = 0.029$), yet this change did

not pass Bonferroni correction. In *post-hoc* analyses, we found that, while there was an increase in the number of all event types, only the number of educational events increased significantly: educational events ($M_{pre} = 6.64$, $M_{post} = 10.29$, $r = 0.399$, $p = 0.032$), action events ($M_{pre} = 4.68$, $M_{post} = 6.36$), university discussion events ($M_{pre} = 0.18$, $M_{post} = 0.36$), and protest events ($M_{pre} = 0.61$, $M_{post} = 0.79$). For Facebook posts, there was no significant increase in the number of posts after coaching ($M_{post} = 115.11$, $SD_{post} = 67.38$) compared to before coaching ($M_{pre} = 105.37$, $SD_{pre} = 85.95$, $t(26) = 0.63$, $r = 0.123$, $p = 0.534$).

Hypothesis 2: Efficacy Beliefs as Outcomes

Partially supporting H2a, having a vision and group identification significantly predicted efficacy, whereas collaboration skills did not, and action skills did not pass Bonferroni correction (overall pseudo $R^2 = 0.218$, see **Table 1**). *Post-hoc* analyses revealed that this result was valid for both self- and participative efficacy ($p < 0.05$, see **Supplementary Tables A11–13**). For collective efficacy, group identification ($b = 0.18$ [0.05, 0.32], $t(259) = 1.51$, pseudo $R^2 = 0.023$, $p = 0.009$) and collaboration skills ($b = 0.19$ [0.05, 0.33], $t(258) = 2.58$, pseudo $R^2 = 0.021$, $p = 0.001$) were significant predictors, while action skills and having a vision were not ($p < 0.05$) (overall pseudo $R^2 = 0.139$).

Confirming H2b, the existence of a green office prior to the coaching weekend positively predicted pre-questionnaire overall efficacy beliefs ($b = 0.37$ [0.07, 0.68], $t(33) = 2.51$, $p = 0.017$). Interestingly, the existence of a green office also predicted collective efficacy, participative efficacy, action skills, collaboration skills, and volunteer time ($p < 0.05$ for all). In line with H2c, a smaller student population at the university positively predicted higher pre-questionnaire efficacy beliefs ($b = -0.01$ [-0.02, -0.005], $t(282) = -3.20$, pseudo $R^2 = 0.012$, $p = 0.002$). However, this was not the case for a smaller city population ($b = -0.04$ [-0.15, 0.07], $t(33) = -0.78$, pseudo $R^2 < 0.001$, $p = 0.439$). Exploratory analyses showed that the effect of university size on efficacy beliefs was also reflected in associations of efficacy beliefs with the number of staff members, number of professors, and the budget ($p < 0.05$ for all), while other structural variables (e.g., year in which the university was founded) did not predict efficacy beliefs ($p > 0.05$ for all).

Hypothesis 3: Efficacy Beliefs as Predictors

In accordance with H3a, efficacy beliefs significantly predicted overall sustainability behavior over and above other covariates ($b = 0.17$ [0.03, 0.32], $t(233) = 2.30$, pseudo $R^2 = 0.019$, $p = 0.022$). Efficacy affect ($b = 0.18$ [0.06, 0.30], $t(231) = 2.97$, pseudo $R^2 = 0.033$, $p = 0.003$) and action skills ($b = 0.24$ [0.14, 0.34], $t(231) = 4.58$, pseudo $R^2 = 0.080$, $p < 0.001$) emerged as additional significant predictors of sustainability behavior, whereas having a vision ($b = 0.08$ [-0.001, 0.16], $t(231) = 1.91$, pseudo $R^2 = 0.011$, $p = 0.057$), group identification ($b = 0.01$ [-0.13, 0.15], $t(231) = 0.11$, pseudo $R^2 = 0.004$, $p = 0.910$), and collaboration skills ($b = -0.12$ [-0.26, 0.02], $t(231) = -1.72$, pseudo $R^2 = 0.009$, $p = 0.086$) did not (overall pseudo $R^2 = 0.288$). For volunteer time, efficacy beliefs did not turn out to be a significant predictor ($b = -0.25$ [-0.84, 0.33], $t(227) = -0.84$, pseudo $R^2 = < 0.001$, $p = 0.403$, see **Supplementary Tables A14 and A15**).

TABLE 1 | Fixed effect predictors of efficacy beliefs for pre-questionnaire participants.

	<i>b</i>	95% <i>CI</i>	<i>SE b</i>	<i>df</i>	<i>t</i>	Pseudo <i>R</i> ²	<i>p</i>
(Intercept)	5.32	5.21, 5.42	0.05	31	103.48		<0.001
Action skills	0.10	0.01, 0.19	0.05	270	2.20	0.014	0.029
Having a vision	0.12	0.05, 0.19	0.04	270	3.33	0.036	0.001
Group identification	0.22	0.10, 0.34	0.06	270	3.67	0.044	<0.001
Collaboration skills	0.07	−0.05, 0.19	0.06	270	1.08	<0.001	0.282
Overall pseudo <i>R</i> ² = 0.218							

Since, for both H3b and H3c, our dependent variable was group-based, we aggregated our pre-questionnaire independent variables at the group level (as more initiative members participated in them), ran regression analyses with White's adjustment for heteroscedasticity, and report HC3 as recommended by Foster-Johnson and Kromrey (2018). Efficacy beliefs did not predict post coaching Facebook posts ($b = 48.78 [-4.55, 102.11]$, $t(31) = 1.87$, $R^2 = 0.076$, $p = 0.072$), Facebook events ($b = 6.58 [-8.25, 21.41]$, $t(32) = 0.90$, $R^2 = 0.037$, $p = 0.373$), or establishing of a green office ($b = -0.45 [-2.53, 1.64]$, $z(27) = -0.42$, $p = 0.676$). Exploratory *post-hoc* analyses revealed that efficacy beliefs predicted post coaching action events, and that this effect was driven by self-efficacy and collective efficacy ($p < 0.05$ for all). Moreover, volunteer behavior predicted discussion events ($p < 0.01$), and volunteer time predicted Facebook posts ($p < 0.05$). Looking at descriptive results, establishing a green office was associated with lower pre-questionnaire self-efficacy ($M_{\text{established}} = 5.07$, $M_{\text{not_established}} = 5.24$), higher collective efficacy ($M_{\text{established}} = 5.47$, $M_{\text{not_established}} = 5.31$), lower participatory efficacy ($M_{\text{established}} = 4.54$, $M_{\text{not_established}} = 4.88$), and more volunteer time ($M_{\text{established}} = 5.85$, $M_{\text{not_established}} = 4.13$) that also emerged as marginally significant predictor ($p = 0.063$). Due to low and unbalanced group sample sizes, results should be interpreted with caution.

H3d tested if, compared to collective efficacy, self-efficacy was a better predictor of private behavior and participative efficacy was a better predictor of volunteering and volunteer time. As can be seen in **Table 2**, only efficacy affect but no subtype of efficacy beliefs predicted private behavior. In congruence with H3d, **Tables 3, 4** show that participative efficacy turned out to be a main positive predictor of volunteering and volunteer time, together with action skills and group identification. Collective efficacy, self-efficacy, and collaboration skills partially emerged as negative predictors. *Post-hoc* analyses showed that self-efficacy, efficacy affect, and action skills predict indirect behavior (overall $R^2 = 0.18$) and that participative efficacy and action skills predict protesting (overall $R^2 = 0.12$, $p < 0.008$ for all predictors), see **Supplementary Tables A16 and A17**.

Latent Change Analyses of Hypotheses 2a and 3a

We used latent change modeling to examine relationships of changes in constructs and therefore divided action skills into sustainability knowledge and university-related skills. We

used a random parceling approach and did not analyze university-related skills and volunteering as the assumption of a strong measurement variance was violated. In agreement with H2a, changes in efficacy beliefs were associated with changes in sustainability knowledge (self-efficacy: $r = 0.75$, $p = 0.017$; collective efficacy: $r = 0.61$, $p = 0.020$; participative efficacy: $r = 0.75$, $p = 0.003$) and group identification (self-efficacy: $r = 0.69$, $p = 0.011$; collective efficacy: $r = 0.58$, $p = 0.016$; participative efficacy: $r = 0.70$, $p = 0.003$). However, only a change in participative efficacy significantly correlated with a change in collaboration skills ($r = 0.57$, $p = 0.017$). Regarding H3a, a change in all efficacy beliefs and affect accompanied a change in private behavior (self-efficacy: $r = 0.87$, $p = 0.027$; collective efficacy: $r = 0.706$, $p = 0.018$; participative efficacy: $r = 0.71$, $p = 0.019$; efficacy affect: $r = 0.67$, $p = 0.026$) and indirect behavior (self-efficacy: $r = 0.77$, $p = 0.024$; collective efficacy: $r = 0.59$, $p = 0.041$; participative efficacy: $r = 0.57$, $p = 0.039$; efficacy affect: $r = 0.69$, $p = 0.032$).

Further Exploratory Analyses

First, we checked if participants who filled out pre- and post-questionnaires differed from participants who only filled out pre-questionnaires. Indeed, the latter showed significantly lower sustainability behavior ($F_{(1,303)} = 10.87$, $p = 0.001$). This held true for all subscales ($p > 0.05$ for all). Then, we tested whether specific methods (e.g., envisioning, project management, and learning about university structures) had effects on respective psychological items (e.g., having a vision and perceived collaboration skills) and found that learning about best practices ($b = 1.19 [0.53, 1.86]$, $t(117) = 3.57$, $p < 0.001$) and learning about university structures ($b = 0.89 [0.24, 1.53]$, $t(118) = 2.73$, $p = 0.007$) showed the proposed method \times pre-post interactions, as apparent in **Supplementary Figures A18 and A19**. Finally, we explored activist burnout and found that it was positively predicted by action skills and participative efficacy ($p < 0.001$ for both), whereas self-efficacy, collective efficacy, and collaboration skills seemed to buffer activist burnout as negative predictors ($p < 0.05$ for all, overall pseudo $R^2 = 0.191$, see **Supplementary Table A20** for effect sizes and **Supplement A21** for further exploratory analyses).

DISCUSSION

Our field study tested whether it is possible to enhance sustainable development efficacy beliefs and sustainability behavior by means of a coaching program. We further examined

TABLE 2 | Fixed effect predictors of private sustainability behavior (pre-questionnaire).

	<i>b</i>	95% <i>CI</i>	<i>SE b</i>	<i>df</i>	<i>t</i>	Pseudo <i>R</i> ²	<i>p</i>
(Intercept)	5.04	4.87, 5.21	0.09	30	58.96		<0.001
Self-efficacy	0.10	−0.10, 0.30	0.10	236	0.10	<0.001	0.320
Collective efficacy	0.14	−0.07, 0.36	0.11	237	1.27	0.003	0.204
Participative efficacy	−0.08	−0.23, 0.07	0.08	236	−1.00	<0.001	0.320
Efficacy affect	0.32	0.14, 0.50	0.09	236	3.46	0.045	<0.001
Action skills	0.09	−0.06, 0.24	0.08	236	1.14	0.001	0.256
Having a vision	0.05	−0.07, 0.17	0.06	236	0.78	<0.001	0.439
Group identification	−0.18	−0.39, 0.03	0.11	236	−1.65	0.007	0.100
Collaboration skills	0.01	−0.19, 0.22	0.11	237	0.14	<0.001	0.892
Overall pseudo <i>R</i> ² = 0.080							

TABLE 3 | Fixed effect predictors of volunteering (pre-questionnaire).

	<i>b</i>	95% <i>CI</i>	<i>SE b</i>	<i>df</i>	<i>t</i>	Pseudo <i>R</i> ²	<i>p</i>
(Intercept)	3.66	3.32, 4.01	0.17	27	21.38		<0.001
Self-efficacy	0.11	−0.15, 0.38	0.14	228	0.84	<0.001	0.404
Collective efficacy	−0.38	−0.67, −0.09	0.15	228	−2.53	0.023	0.012
Participative efficacy	0.31	0.11, 0.51	0.10	227	2.96	0.033	0.003
Efficacy affect	0.18	−0.06, 0.42	0.12	228	1.44	0.005	0.150
Action skills	0.41	0.21, 0.61	0.10	227	3.92	0.059	<0.001
Having a vision	0.14	−0.02, 0.30	0.08	227	1.68	0.008	0.094
Group identification	0.37	0.09, 0.66	0.15	227	2.55	0.023	0.012
Collaboration skills	−0.42	−0.70, −0.14	0.15	228	−2.91	0.032	0.004
Overall pseudo <i>R</i> ² = 0.293							

TABLE 4 | Fixed effect predictors of volunteer time (pre-questionnaire).

	<i>b</i>	95% <i>CI</i>	<i>SE b</i>	<i>df</i>	<i>t</i>	Pseudo <i>R</i> ²	<i>p</i>
(Intercept)	4.77	4.12, 5.47	0.34	24	14.17		<0.001
Self-efficacy	−0.53	−1.04, −0.03	0.26	223	−2.03	0.015	0.043
Collective efficacy	−0.35	−0.90, 0.20	0.29	224	−1.22	0.003	0.225
Participative efficacy	0.64	0.26, 1.02	0.20	223	3.23	0.041	0.001
Efficacy affect	0.37	−0.08, 0.83	0.24	224	1.58	0.006	0.116
Action skills	0.78	0.39, 1.16	0.20	223	3.87	0.058	<0.001
Having a vision	−0.01	−0.32, 0.30	0.16	223	−0.06	<0.001	0.956
Group identification	0.59	0.05, 1.14	0.28	223	2.12	0.015	0.036
Collaboration skills	−0.83	−1.36, −0.30	0.28	224	−2.99	0.032	0.003
Overall pseudo <i>R</i> ² = 0.202							

how action skills, having a vision, group identification, and collaboration skills influence efficacy beliefs, and whether efficacy beliefs can explain sustainability behavior, social media activity, and structural changes.

Summary of Main Results

In accordance with H1, action skills, having a vision, group identification, collaboration skills, efficacy affect, and efficacy beliefs (especially collective and participative efficacy) were significantly stronger after the coaching weekend than before it. Protesting, volunteering, and volunteer time descriptively increased, while no changes emerged for private or indirect

behavior. Initiatives also generated more Facebook events and posts after coaching than before coaching. However, the effect remained insignificant, presumably due to low sample size. Consistent with H2, having a vision, group identification, the existence of a green office, and small university size positively predicted overall efficacy beliefs (and varied regarding efficacy subtypes). While city size did not relate to efficacy beliefs, the predictive value of action skills and collaboration skills differed in regression and latent change analyses. Regarding H3, efficacy beliefs predicted sustainability behavior, but not volunteer time, number of Facebook posts and events, or establishing a green office after coaching. Looking at specific efficacy types,

self-efficacy only predicted private behavior in latent change, but not regression, models. For private and indirect behavior, efficacy affect seems to be more relevant. As expected, participative efficacy predicted volunteering and volunteer time. Intriguingly, collaboration skills, self-efficacy, and collective efficacy appeared to be negative predictors of volunteering and volunteer time. In the following discussion, we first focus on psychological processes and then integrate regime and landscape factors in our reasoning.

A Coaching Program as a Means for Change

Extending findings from previous field studies (see Hanss and Böhm, 2013), the coaching program managed to increase efficacy beliefs and volunteering. To our knowledge, this is the first study to reveal increases of participative efficacy beliefs in the field of environmental studies. Private and indirect behavior were not affected. This might be due to the coaching program's primary focus being group processes and not individual and collective impacts, as was the case with successful laboratory studies (see Jugert et al., 2016). A group process focus might also explain why, compared to self-efficacy, collective and participative efficacy were more affected by the coaching program. Additionally, long-term analyses suggest that the time-span of 1–2 weeks between the coaching weekend and invitation to the post-questionnaire might have been too short to display changes in actual behaviors. Yet, there is evidence for long-term effects of participative efficacy and volunteering in our follow-up questionnaire (see **Supplementary Table A10**). We assume that, through the coaching program, groups gained skills to organize themselves in a sustainable, supportive, and productive way, which further promotes participative efficacy and volunteer commitment.

Typical for field studies, we cannot point directly to what caused these effects. However, as mentioned earlier, the coaching program had many characteristics of successful interventions and proposed efficacy predictors, such as group discussions (Thomas et al., 2015) or finding a common vision and goal (Drury and Reicher, 2009; Cattaneo and Chapman, 2010). Also, the peer-to-peer approach might have played a role. Fortunately, we were able to test the effects of the specific methods used in the coaching program. While learning about best practices and university structures led to perceived knowledge of them, all other methods revealed no significant interactions, and analyses hint at the possibility that coaches employed methods tailored to participants' pre-knowledge. It is the nature of this field setting that methods were not varied systematically and that they possibly interacted with one another as well as with the activities, setting, and coaches' personalities.

Fostering Efficacy Beliefs, Sustainability Behavior, and Structural Changes

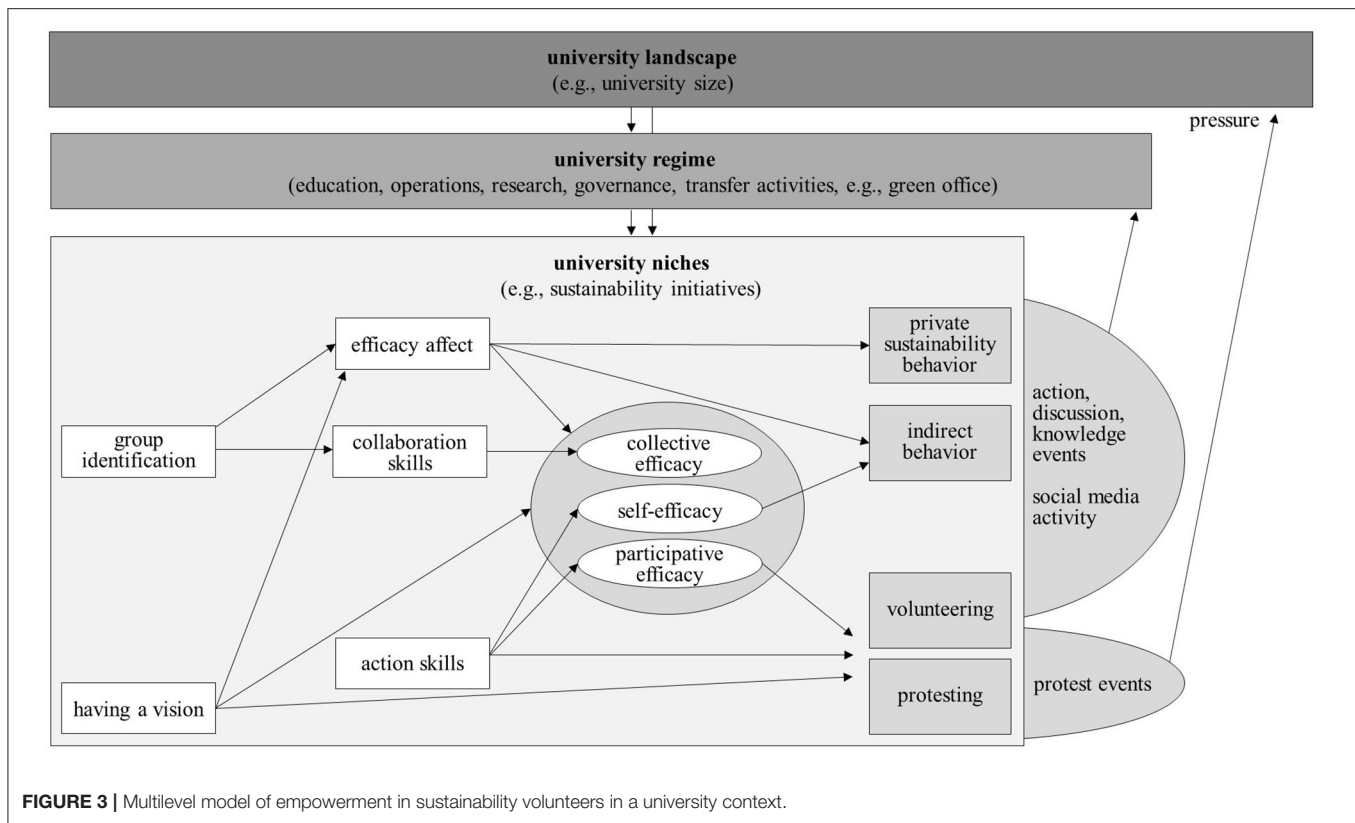
This field investigation contributes strongly to the study of efficacy predictors, thus expanding self-efficacy theory (Bandura, 1997) and empowerment theory (Zimmerman, 1990) in the field of environmental psychology. As proposed by various authors (Blackwood and Louis, 2012; Vestergren et al., 2016), our

empirical analyses show that group identification relates to all types of efficacy. Individual action skills (especially sustainability knowledge) are important for self- and participative efficacy, while group-related collaboration skills are more relevant for collective efficacy. Latent change analyses support these findings and indicate that collaboration skills are also associated with participative efficacy. Moreover, having a vision appears to be an innovative and strong positive predictor of self- and participative efficacy, as is shown in recent work by Fernando et al. (2020). While action skills and collaboration skills are present in self-efficacy theory as mastery experience and verbal persuasion (Bandura, 1997) and in empowerment theory as perceived competence and skill development (Zimmerman, 1995), neither group identification nor having a vision plays a major role in either theory. These should receive more attention in future research practice.

In our study, efficacy beliefs show latent change but not multilevel-regression associations with private behavior. Then again, though volunteering was strongly predicted by participative efficacy in regression analyses, it was not testable in latent change analyses. These findings make it difficult to draw final conclusions. Efficacy affect strongly influences private and indirect behavior in both latent change and regression analyses, but any effect on volunteering or volunteer time, as proposed by Ojala (2015) and Drury et al. (2005), is canceled out by other variables, like participative efficacy (see van Zomeren et al., 2019). This is especially surprising given that efficacy affect was operationalized as feeling hopeful, motivated, and enthusiastic in connection to participants' volunteering. Exploratory analyses in **Supplementary Table A22** suggest efficacy affect to be a strong possible predictor of all efficacy types (see also Bandura, 1997; Coelho et al., 2017), yet our study does not allow causal conclusions.

In line with former studies (Thomas and Louis, 2014; Besta et al., 2017), group identification relates positively to volunteering, volunteer time, and protesting, and yet, participative efficacy shows stronger relations, which suggests participative efficacy beliefs are directly related to collective action (see Van Zomeren et al., 2008). Likewise, action skills stand out as an important predictor of volunteering and protesting. We propose though that its strong predictive power is attributable to the opposite causal direction, "if I volunteer, I gain action skills." This might, of course, also be true for efficacy beliefs (see Sitzmann and Yeo, 2013). Further, protesting and volunteering display the same predictor structure but yield separate factors. Thus, the question remains whether distinguishing between those two types of activism is useful in psychological research (see Thomas et al., 2017). Surprisingly, collective efficacy and collaboration skills turn into negative predictors of volunteering when tested simultaneously with participative efficacy and group identification, which lends support to Olson's paradox (Olson, 1968). If an initiative member perceives the group as very competent and effective, they may not feel the urge to act themselves.

From a multilevel perspective, an institution's green office functions as a structural catalyst. Besides predicting collective and participative efficacy beliefs, it is also associated with action skills,



collaboration skills, and volunteer time. Looking at other regime and landscape variables, we are astonished that only university size and none of our other structural variables seem to play a crucial role in developing efficacy beliefs and other psychological motivators (e.g., year in which the university was founded, gender of the university's president, and university type). Regarding initiatives' media output, initiatives generated more Facebook posts and events (educational, actionable, discussion-based, and protesting) after coaching compared to before coaching, but efficacy beliefs only predict action events in *post-hoc* analyses. Explorative analyses reveal that more volunteering is associated with more discussion events, and that volunteer time relates to Facebook posts. The three types of efficacy beliefs show somewhat diverging relations to the establishment of a green office, yet volunteering time emerges as marginally significant predictor. Those findings suggest that more effort that is put into a sustainability initiative indeed has the potential to lead to media visibility and university regime changes. However, results should be interpreted with caution due to their exploratory nature and their low sample size in group-level analyses.

A Multilevel Model of Empowerment in Sustainability Volunteers

Our results emphasize that a distinction must be made between efficacy belief and sustainability behavior subtypes in order to determine the motivation of volunteers, and that structural regime and landscape factors are worth taking into account. Thus, we developed a theoretical and empirical model based

on the social identity model of collective action [SIMCA] by Van Zomeren et al. (2008), the social identity model of pro-environmental action [SIMPEA] (Fritzsche et al., 2018), and Geels' (2011) multilevel perspective (see **Figure 3**).

For sustainability volunteers as a niche group, efficacy beliefs (here, participative efficacy) predict collective action similar to SIMCA and SIMPEA. Group identification influences volunteering and protesting via efficacy affect and efficacy beliefs, suggesting that mediation paths for volunteers differ amongst newly founded groups, protesters, and laypeople [see EMSICA model by Thomas et al. (2012), Bongiorno et al. (2016), Landmann and Rohmann (2020), and Sabherwal et al. (2021)]. Action skills and having a vision emerge as predictors, both of which might be connected to appraisals and moralization (see Fritzsche et al., 2018). Niche groups are influenced by university landscape and regime factors. They in turn influence regimes via events and social media activity and put pressure on the landscape by raising protest. As this model acknowledges intraindividual, interactional, behavioral, and structural correlates of efficacy beliefs, it is adaptable to empowerment theory (Zimmerman, 1990; Cattaneo and Chapman, 2010). Theoretical considerations and exploratory analyses leading to the psychological part of this model can be viewed in **Supplementary Material A21.4**.

Finally, as proposed by some authors, we explored efficacy beliefs as a buffer for activist burnout (Vestergren et al., 2016). Previous studies show a strong belief in one's own efficacy might serve as a buffer for burnout in teachers (Skaalvik and

Skaalvik, 2007) and in older adults (Govindan, 1999). Our analyses show that action skills and participative efficacy are positively related to activist burnout. Probably, both lead to more volunteering behavior, which in turn prompts a physical and mental overload in the volunteers. However, both self- and collective efficacy, as well as perceived collaboration skills, were negatively associated with, and thus seem to buffer, activist burnout. This preliminary finding calls for extensive future research on the buffering function of specific efficacy types for activist burnout.

Limitations and Future Directions

It is the nature of a field study that we cannot rule out alternative explanations. We would have liked to have included a (waiting list) control group in this study, but our specific sample of sustainability volunteers at universities prevented us from finding matching participants without having incentives to offer. Therefore, results must be interpreted with caution as we cannot draw causal conclusions or rule out that pre-post comparisons may be driven by exogenous variables (e.g., initiatives simply choosing to meet more frequently). Nevertheless, by analyzing coaching methods, using latent change analyses, and including structural variables, we gained knowledge of processes at work. Future research should examine coaching effects compared to a control group. A larger time-span between coaching weekends and post-questionnaires could uncover further changes in sustainability behavior. However, our follow-up dropout rate prevents a meaningful analysis in our case. A surprisingly large dropout occurred from pre- to post-questionnaire, and participants who dropped out before the post-test had significantly lower baseline rates regarding sustainability behavior. This might have influenced our results as it was probably the more engaged initiative members who participated in both questionnaires. We suggest that prospective studies provide an individual or group incentive for participation. Moreover, this study makes a first attempt to observe actual power regimes and shifts as a consequence of psychologically empowered people (see Cattaneo et al., 2014), however, the necessity of group-level analyses posed a threat to our results (see Foster-Johnson and Kromrey, 2018). Future studies should investigate larger group samples in order to understand the practical value of efficacy beliefs. In our study, a clear limitation is that some student initiatives only created one Facebook event for a “sustainability week” while others created events for each workshop within such a week. However, we think that this bias was mainly canceled out by the great number of events. Moreover, we only collected information on the quantity of posts, leaving out post quality. For future research, we think it would be promising to focus on efficacy affect as an efficacy belief predictor and mediator of efficacy-behavior relations, social norms (Doherty and Webler, 2016), and other group variables, like entitativity, permeability, and size (Lickel et al., 2000), and to explore more diverse efficacy goals since their predictive power seems to depend on the stage of commitment (Hornsey et al., 2006). Intrinsic motivation and need satisfaction could also be a worthwhile focus of future studies (Deci and Ryan, 2000; Boezeman and Ellemers, 2009), especially because our

constructs already mirror elements of self-determination theory like the needs for competence (action skills, collaboration skills, efficacy beliefs), relatedness (group identification), and autonomy (efficacy beliefs).

CONCLUSION AND PRACTICAL IMPLICATIONS

This study tested the effects of a peer-to-peer coaching program on student-led sustainability initiatives. Contributing to self-efficacy theory in the field of environmental studies, it is the first field study to show changes in participative efficacy beliefs. Even if sample acquisition might be difficult, we encourage other researchers to investigate volunteers with practically important questions, like “How can people be motivated to volunteer in socio-ecological niches and keep up their (group) motivation?” Methods of the *netzwerk n* coaching program are available online, in German (*netzwerk n e.V.*, 2018), and can be used for laboratory intervention testing as well as sustainability practice. Our results indicate that, in order to foster activism for sustainability, activists need to be psychologically and structurally empowered through a strong bond with their activist group, (learning) essential action skills, supportive institutions, like green offices, and circumstances that make them feel they can actually make a difference. With the below final quote, we would like to invite sustainability practitioners to pay special attention to group processes and embrace coaching opportunities.

To realize in the here and now aspects of a world that does not yet exist (e.g., freedom, authenticity, equality) is to bring that world closer—through empowering its agents with the belief that they can create it. In a very concrete sense, then, social movement activists need to be architects of the imagination (Drury and Reicher, 2009).

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in an online repository at: <https://osf.io/7k2zq/>.

ETHICS STATEMENT

Ethical review and approval was not required for the study setting in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

KH: study development, data collection, data analysis, and writing of manuscript. JH: study development, coordination of coaching program, data collection, and editing. GR: study development, editing, and supervision.

FUNDING

This research did not receive any special funding and is part of the Ph.D. of KH, who was granted a scholarship from the German Federal Environmental Foundation and the University of Koblenz-Landau.

ACKNOWLEDGMENTS

The authors would like to thank Marlis Wullenkord for her excellent constructive feedback on a previous version of this manuscript, and the reviewers for their thorough comments. Moreover, we thank Julian Meuren and Alisa Scheuermann for their assistance in the process of data collection, and

Rebekah Olson for critically editing the English language of the manuscript. We also thank the Federal Ministry for Education and Research for funding the implementation of the project “Sustainable and future-oriented higher education institutions”. Finally, we would like to thank all the student initiative volunteers who, without any particular incentives, took the time to take part in our study.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.623972/full#supplementary-material>

REFERENCES

- Alisat, S., and Riemer, M. (2015). The environmental action scale: Development and psychometric evaluation. *J. Environ. Psychol.* 43, 13–23. doi: 10.1016/j.jenvp.2015.05.006
- Almers, E. (2013). Pathways to action competence for sustainability - six themes. *J. Environ. Educ.* 44, 116–127. doi: 10.1080/00958964.2012.719939
- Amna, E. (2012). How is civic engagement developed over time. Emerging answers from a multidisciplinary field. *J. Adoles.* 35, 611–627. doi: 10.1016/j.adolescence.2012.04.011
- Babcicky, P., and Seebauer, S. (2020). Collective efficacy and natural hazards: differing roles of social cohesion and task-specific efficacy in shaping risk and coping beliefs. *J. Risk Res.* 23, 695–712. doi: 10.1080/13669877.2019.1628096
- Bamberg, S., and Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: a new meta-analysis of determinants of pro-environmental behaviour. *J. Environ. Psychol.* 27, 14–25. doi: 10.1016/j.jenvp.2006.12.002
- Bamberg, S., Rees, J., and Seebauer, S. (2015). Collective climate action: determinants of participation intention in community-based pro-environmental initiatives. *J. Environ. Psychol.* 43, 155–165. doi: 10.1016/j.jenvp.2015.06.006
- Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York, NY: Freeman & Company.
- Barth, M., Jugert, P., and Fritzsche, I. (2016). Still underdetected - Social norms and collective efficacy predict the acceptance of electric vehicles in Germany. *Transport. Res. F Traff. Psychol. Behav.* 37, 64–77. doi: 10.1016/j.trf.2015.11.011
- BBC (2019). *School Strike for Climate: Protests Staged Around the World*. Retrieved from: <https://www.bbc.com/news/world-48392551> (accessed April 13, 2021).
- BBC (2020). *Climate Change: Fridays for Future School Strikes Are Back*. Retrieved from: <https://www.bbc.co.uk/newsround/54278690> (accessed April 13, 2021).
- Besta, T., Jaśkiewicz, M., Kosakowska-Berezecka, N., Lawendowski, R., and Zawadzka, A. M. (2017). What do I gain from joining crowds? Does self-expansion help to explain the relationship between identity fusion, group efficacy and collective action? *Eur. J. Soc. Psychol.* 48, 152–167. doi: 10.1002/ejsp.2332
- Bhushan, N., Mohnert, F., Sloot, D., Jans, L., Casper, A., and Steg, L. (2019). Using a gaussian graphical model to explore relationships between items and variables in environmental psychology research. *Front. Psychol.* 10:1050. doi: 10.3389/fpsyg.2019.01050
- Blackwood, L. M., and Louis, W. R. (2012). If it matters for the group then it matters to me: collective action outcomes for seasoned activists. *Br. J. Soc. Psychol.* 51, 72–92. doi: 10.1111/j.2044-8309.2010.02001.x
- Boezeman, E. J., and Ellemers, N. (2009). Intrinsic need satisfaction and the job attitudes of volunteers versus employees working in a charitable volunteer organization. *J. Occup. Organ. Psychol.* 82, 897–914. doi: 10.1348/096317908X383742
- Bongiorno, R., McGarty, C., Kurz, T., Haslam, S. A., and Sibley, C. G. (2016). Mobilizing cause supporters through group-based interaction. *J. Appl. Soc. Psychol.* 46, 203–215. doi: 10.1111/jasp.12337
- Brunsting, S., and Postmes, T. (2002). Social movement participation in the digital age: predicting offline and online collective action. *Small Group Res.* 33, 525–554. doi: 10.1177/104649602237169
- Bundesministerium für Umwelt, Naturschutz, und nukleare Sicherheit [BMU] and Umweltbundesamt [UBA] (2015). *Umweltbewusstsein in Deutschland 2014. Ergebnisse Einer Repräsentativen Bevölkerungsumfrage*. Berlin, Dessau-Roßlau. Retrieved from: <https://www.umweltbundesamt.de/publikationen/umweltbewusstsein-in-deutschland-2014> (accessed April 13, 2021).
- Bundesministerium für Umwelt, Naturschutz, und nukleare Sicherheit [BMU] and Umweltbundesamt [UBA] (2017). *Umweltbewusstsein in Deutschland 2016. Ergebnisse Einer Repräsentativen Bevölkerungsumfrage*. Berlin, Dessau-Roßlau. Retrieved from: <https://www.umweltbundesamt.de/publikationen/umweltbewusstsein-in-deutschland-2016> (accessed April 13, 2021).
- Cameron, J. E. (2004). A three-factor model of social identity. *Self Ident.* 3, 239–262. doi: 10.1080/13576500444000047
- Carmi, N., and Mostovoy, N. (2017). The effect of group size on energy consumption by communal electricity users. *J. Environ. Psychol.* 54, 50–56. doi: 10.1016/j.jenvp.2017.10.001
- Cattaneo, L. B., Calton, J. M., and Brodsky, A. E. (2014). Status quo versus status quake: putting the power back in empowerment. *J. Community Psychol.* 42, 433–446. doi: 10.1002/jcop.21619
- Cattaneo, L. B., and Chapman, A. R. (2010). The process of empowerment: a model for use in research and practice. *Am. Psychol.* 65, 646–659. doi: 10.1037/a0018854
- Chen, G., and Bliese, P. D. (2002). The role of different levels of leadership in predicting self- and collective efficacy: evidence for discontinuity. *J. Appl. Psychol.* 87, 549–556. doi: 10.1037/0021-9010.87.3.549
- Chen, M. F. (2015). Self-efficacy or collective efficacy within the cognitive theory of stress model: which more effectively explains people's self-reported pro-environmental behaviour. *J. Environ. Psychol.* 42, 66–75. doi: 10.1016/j.jenvp.2015.02.002
- Coelho, F., Pereira, M. C., Cruz, L., Simões, P., and Barata, E. (2017). Affect and the adoption of pro-environmental behaviour: a structural model. *J. Environ. Psychol.* 54, 127–138. doi: 10.1016/j.jenvp.2017.10.008
- Collins, C. R., Neal, J. W., and Neal, Z. P. (2014). Transforming individual civic engagement into community collective efficacy: the role of bonding social capital. *Am. J. Community Psychol.* 54, 328–336. doi: 10.1007/s10464-014-9675-x
- Curtin, N., and McGarty, C. (2016). Expanding on psychological theories of engagement to understand activism in context(s). *J. Soc. Issues* 72, 227–241. doi: 10.1111/josi.12164
- Deci, E. L., and Ryan, R. M. (2000). The “What” and “Why” of goal pursuits: human needs and the self-determination of behavior. *Psychol. In.* 4, 227–268. doi: 10.1207/S15327965PLI1104_01
- Doherty, K., and Webler, T. (2016). Social norms and efficacy beliefs drive the Alarmed segment's public-sphere climate actions. *Nat. Clim. Change* 6, 1–8. doi: 10.1038/nclimate3025

- Doran, R., Hanss, D., and Øgaard, T. (2017). Can social comparison feedback affect indicators of eco-friendly travel choices? Insights from two online experiments. *Sustainability* 9, 1–15. doi: 10.3390/su9020196
- Drury, J., Cocking, C., Beale, J., Hanson, C., and Rapley, F. (2005). The phenomenology of empowerment in collective action. *Br. J. Soc. Psychol.* 44, 309–328. doi: 10.1348/014466604X18523
- Drury, J., and Reicher, S. (1999). The intergroup dynamics of collective empowerment: substantiating the social identity model of crowd behavior. *Group Process. Intergr. Relat.* 2, 381–402. doi: 10.1177/1368430299024005
- Drury, J., and Reicher, S. (2005). Explaining enduring empowerment: a comparative study of collective action and psychological outcomes. *Eur. J. Soc. Psychol.* 35, 35–58. doi: 10.1002/ejsp.231
- Drury, J., and Reicher, S. (2009). Collective psychological empowerment as a model of social change: researching crowds and power. *J. Soc. Issues* 65, 707–725. doi: 10.1111/j.1540-4560.2009.01622.x
- Evrpidou, A., and Drury, J. (2013). This is the time of tension: collective action and subjective power in the greek anti-austerity movement. *Contention* 1, 31–51. doi: 10.3167/cont.2013.010103
- Feldman, L., and Hart, P. S. (2016). Using political efficacy messages to increase climate activism: the mediating role of emotions. *Sci. Commun.* 38, 99–127. doi: 10.1177/1075547015617941
- Fernando, J. W., O'Brien, L. V., Burden, N. J., Judge, M., and Kashima, Y. (2020). Greens or space invaders: Prominent utopian themes and effects on social change motivation. *Eur. J. Soc. Psychol.* 50, 278–291. doi: 10.1002/ejsp.2607
- Foster-Johnson, L., and Kromrey, J. D. (2018). Predicting group-level outcome variables: an empirical comparison of analysis strategies. *Behav. Res. Methods* 50, 2461–2479. doi: 10.3758/s13428-018-1025-8
- Fritzsche, I., Barth, M., Jugert, P., Masson, T., and Reese, G. (2018). A social identity model of pro-environmental action (SIMPEA). *Psychol. Rev.* 125, 245–269. doi: 10.1037/rev0000090
- Geels (2011). The multi-level perspective on sustainability transitions: responses to seven criticisms. *Environ. Innov. Soc. Transit.* 1, 24–40. doi: 10.1016/j.eist.2011.02.002
- Geels, F. W., and Schot, J. (2007). Typology of sociotechnical transition pathways. *Res. Policy* 36, 399–417. doi: 10.1016/j.respol.2007.01.003
- Geiger, N., Swim, J. K., and Frazer, J. (2017). Creating a climate for change: Interventions, efficacy and public discussion about climate change. *J. Environ. Psychol.* 51, 104–116. doi: 10.1016/j.jenvp.2017.03.010
- Geller, E. S. (1995). Actively caring for the environment: an integration of behaviorism and humanism. *Environ. Behav.* 27, 184–195. doi: 10.1177/0013916595272004
- Govindan, A. (1999). *Self-Efficacy and Depression in Older Adults: Differences Between Volunteers and Non-volunteers* (Master's thesis). Retrieved from: <https://ro.ecu.edu.au/theses/1241>
- Greenaway, K. H., Haslam, S. A., Cruwys, T., Branscombe, N. R., Ysseldyk, R., and Heldreth, C. (2015). From “we” to “me”: group identification enhances perceived personal control with consequences for health and well-being. *J. Pers. Soc. Psychol.* 109, 53–74. doi: 10.1037/pspi0000019
- Hamann, K. R. S., Holz, J., and Reese, G. (2019). *Coaching for a Sustainability Transition: Data and Script*. Open Science Framework. Retrieved from: <https://osf.io/7k2zq/>
- Hamann, K. R. S., and Reese, G. (2020). My influence on the world (of Others): goal efficacy beliefs and efficacy affect predict private, public, and activist pro-environmental behavior. *J. Soc. Issues* 76, 35–53. doi: 10.1111/josi.12369
- Hanss, D., and Böhm, G. (2010). Can I make a difference? The role of general and domain-specific self-efficacy in sustainable consumption decisions. *Umweltpsychologie* 14, 46–74.
- Hanss, D., and Böhm, G. (2013). Promoting purchases of sustainable groceries: an intervention study. *J. Environ. Psychol.* 33, 53–67. doi: 10.1016/j.jenvp.2012.10.002
- Hanss, D., Böhm, G., Doran, R., and Homburg, A. (2016). Sustainable consumption of groceries: the importance of believing that one can contribute to sustainable development. *Sustain. Dev.* 24, 357–370. doi: 10.1002/sd.1615
- Harp, E. R., Scherer, L. L., and Allen, J. A. (2017). Volunteer engagement and retention: their relationship to community service self-efficacy. *Nonprofit Volunt. Sect. Q.* 46, 442–458. doi: 10.1177/0899764016651335
- Homburg, A., and Stolberg, A. (2006). Explaining pro-environmental behavior with a cognitive theory of stress. *J. Environ. Psychol.* 26, 1–14. doi: 10.1016/j.jenvp.2006.03.003
- Hornsey, M. J., Blackwood, L., Louis, W., Fielding, K., Mavor, K., Morton, T., et al. (2006). Why do people engage in collective action? Revisiting the role of perceived effectiveness. *J. Appl. Soc. Psychol.* 36, 1701–1722. doi: 10.1111/j.0021-9029.2006.00077.x
- Hunter, E., and Röss, E. (2016). Fear of climate change consequences and predictors of intentions to alter meat consumption. *Food Policy* 62, 151–160. doi: 10.1016/j.foodpol.2016.06.004
- Intergovernmental Panel on Climate Change [IPCC] (2019). *Special Report: Global Warming of 1.5°C*. Retrieved from: <https://www.ipcc.ch/sr15/> (accessed April 13, 2021).
- Jugert, P., Greenaway, K. H., Barth, M., Büchner, R., Eisentraut, S., and Fritzsche, I. (2016). Collective efficacy increases pro-environmental intentions through increasing self-efficacy. *J. Environ. Psychol.* 48, 12–23. doi: 10.1016/j.jenvp.2016.08.003
- Kaiser, F. G., Byrka, K., and Hartig, T. (2010). Reviving campbell's paradigm for attitude research. *Pers. Soc. Psychol. Rev.* 14, 351–367. doi: 10.1177/1088868310366452
- Kende, A. (2016). Separating social science research on activism from social science as activism. *J. Soc. Issues* 72, 399–412. doi: 10.1111/josi.12172
- Kim, Y. (2011). Understanding green purchase: the influence of collectivism, personal values and environmental attitudes, and the moderating effect of perceived consumer effectiveness. *Seoul J. Bus.* 17, 65–92. doi: 10.35152/snsjb.2011.17.1.003
- Kim, Y., and Choi, S. M. (2005). Antecedents of green purchase behavior: an examination of collectivism, environmental concern, and PCE. *Adv. Cons. Res.* 32, 592–599. Available online at: <https://www.acrwebsite.org/volumes/9156/volumes/v32/NA-32>
- Landmann, H., and Rohmann, A. (2020). Being moved by protest: Collective efficacy beliefs and injustice appraisals enhance collective action intentions for forest protection via positive and negative emotions. *J. Environ. Psychol.* 71:101491. doi: 10.1016/j.jenvp.2020.101491
- Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., et al. (2012). Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustain. Sci.* 7, 25–43. doi: 10.1007/s11625-011-0149-x
- Lauren, N., Fielding, K. S., Smith, L., and Louis, W. (2016). You did, so you can and you will: Self-efficacy as a mediator of spillover from easy to more difficult pro-environmental behaviour. *J. Environ. Psychol.* 48, 191–199. doi: 10.1016/j.jenvp.2016.10.004
- Lee, Y. K., Kim, S., Kim, M. S., and Choi, J. G. (2014). Antecedents and interrelationships of three types of pro-environmental behavior. *J. Bus. Res.* 67, 2097–2105. doi: 10.1016/j.jbusres.2014.04.018
- Lickel, B., Hamilton, D. L., Wierzchowska, G., Lewis, A., Sherman, S. J., and Uhles, A. N. (2000). Varieties of groups and the perception of group entitativity. *J. Pers. Soc. Psychol.* 78, 223–246. doi: 10.1037/0022-3514.78.2.223
- Loy, L. S., Hamann, K. R. S., and Reese, G. (2020). Navigating through the jungle of information. Informational self-efficacy predicts climate change-related media exposure, knowledge, and behaviour. *Clim. Change* 163, 2097–2116. doi: 10.1007/s10584-020-02918-9
- Lubell, M., Zahran, S., and Vedlitz, A. (2007). Collective action and citizen responses to global warming. *Polit. Behav.* 29, 391–414. doi: 10.1007/s11109-006-9025-2
- Marks, M. A., Mathieu, J. E., and Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Acad. Manag. Rev.* 26, 356–376. doi: 10.5465/amr.2001.4845785
- Martinez, T. A., and McMullin, S. L. (2004). Factors affecting decisions to volunteer in nongovernmental organizations. *Environ. Behav.* 36, 112–126. doi: 10.1177/0013916503256642
- Mazzoni, D., Van Zomeren, M., and Cicognani, E. (2015). The motivating role of perceived right violation and efficacy beliefs in identification with the Italian water movement. *Polit. Psychol.* 26, 315–330. doi: 10.1111/pops.12101
- Mogensen, F., and Schnack, K. (2010). The action competence approach and the 'new' discourses of education for sustainable development, competence and quality criteria. *Environ. Educ. Res.* 16, 59–74. doi: 10.1080/13504620903504032
- Morton, T. A., Rabinovich, A., Marshall, D., and Bretschneider, P. (2011). The future that may (or may not) come: how framing changes responses to

- uncertainty in climate change communications. *Glob. Environ. Change* 21, 103–109. doi: 10.1016/j.gloenvcha.2010.09.013
- netzwerk n e.V. (2018). *Methode n. Werkzeuge für Eure Nachhaltige Hochschule*. Retrieved from: <https://netzwerk-n.org/mediathek/bildungsmaterialien/#methoden> (accessed April 13, 2021).
- netzwerk n e.V. (n.d.). *Wer wir Sind*. Retrieved from: <https://www.netzwerk-n.org/info/macherinnen/> (accessed April 13, 2021).
- Ojala, M. (2015). Hope in the face of climate change: associations with environmental engagement and student perceptions of teachers' emotion communication style and future orientation. *J. Environ. Educ.* 46, 133–148. doi: 10.1080/00958964.2015.1021662
- Olson, M. (1968). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.
- Peterson, N. A., and Zimmerman, M. A. (2004). Beyond the individual - toward a nomological network of organizational empowerment. *Am. J. Community Psychol.* 34, 129–145. doi: 10.1023/B:AJCP.0000040151.77047.58
- Rappaport, J. (1987). Terms of empowerment/exemplars of prevention: toward a theory for community psychology. *Am. J. Community Psychol.* 15, 121–148. doi: 10.1007/BF00919275
- Raudenbush, S. W., and Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods, 2nd Edn*. Thousand Oaks, CA: Sage.
- Rees, J. H., and Bamberg, S. (2014). Climate protection needs societal change: determinants of intention to participate in collective climate action. *Eur. J. Soc. Psychol.* 44, 466–473. doi: 10.1002/ejsp.2032
- Reese, G., and Junge, E. A. (2017). Keep on Rockin' in a (Plastic-)Free World: collective efficacy and pro-environmental intentions as a function of task difficulty. *Sustainability* 9, 1–13. doi: 10.3390/su9020200
- Riemer, M., Voorhees, C., Dittmer, L., Alisat, S., Alam, N., Sayal, R., et al. (2016). The youth leading environmental change project: a mixed-method longitudinal study across six countries. *Ecopsychology* 8, 174–187. doi: 10.1089/eco.2016.0025
- Riger, S. (1984). Vehicles for empowerment: the case of feminist movement organizations. *Stud. Empowerm.* 3, 99–117. doi: 10.1300/J293v03n02_06
- Roberts, J. A. (1996). Green consumers in the 1990s: profile and implications for advertising. *J. Bus. Res.* 36, 217–325. doi: 10.1016/0148-2963(95)00150-6
- Rootability (n.d.). *The Green Office Model*. Retrieved from: <https://www.greenofficemovement.org/> (accessed April 13, 2021).
- Sabherwal, A., Ballew, M. T., van der Linden, S., Gustafson, A., Goldberg, M. H., Maibach, E. W., et al. (2021). The greta thunberg effect: familiarity with greta thunberg predicts intentions to engage in climate activism in the United States. *J. Appl. Soc. Psychol.* 1–13. doi: 10.1111/jasp.12737
- Sitzmann, T., and Yeo, G. (2013). A meta-analytic investigation of the within-person self-efficacy domain: is self-efficacy a product of past performance or a driver of future performance? *Pers. Psychol.* 66, 531–568. doi: 10.1111/peps.12035
- Skaalvik, E. M., and Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *J. Educ. Psychol.* 99, 611–625. doi: 10.1037/0022-0663.99.3.611
- Steinhorst, J., Klöckner, C. A., and Matthies, E. (2015). Saving electricity – For the money or the environment? Risks of limiting pro-environmental spillover when using monetary framing. *J. Environ. Psychol.* 43, 125–135. doi: 10.1016/j.jenvp.2015.05.012
- Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues* 56, 407–424. doi: 10.1111/0022-4537.00175
- Straughan, R. D., and Roberts, J. A. (1999). Environmental segmentation alternatives: a look at green consumer behavior in the new millennium. *J. Consum. Market.* 16, 558–575. doi: 10.1108/07363769910297506
- Swim, J. K., Geiger, N., and Lengieza, M. L. (2019). Climate change marches as motivators for bystander collective action. *Front. Commun.* 4:4. doi: 10.3389/fcomm.2019.00004
- Tabachnick, B. G., and Fidell, L. S. (2013). *Using Multivariate Statistics*. Boston, MA: Pearson.
- Tajfel, H. (1978). *Differentiation Between Social Groups*. London: Academic Press.
- Thomas, E. F., and Louis, W. R. (2014). When will collective action be effective? Violent and non-violent protests differentially influence perceptions of legitimacy and efficacy among sympathizers. *Pers. Soc. Psychol. Bull.* 40, 263–276. doi: 10.1177/0146167213510525
- Thomas, E. F., Mavor, K. I., and McGarty, C. (2012). Social identities facilitate and encapsulate action-relevant constructs: a test of the social identity model of collective action. *Group Process. Intergr. Relat.* 15, 75–89. doi: 10.1177/1368430211413619
- Thomas, E. F., McGarty, C., and Mavor, K. (2015). Group interaction as the crucible of social identity formation: a glimpse at the foundations of social identities for collective action. *Group Process. Intergr. Relat.* 19, 137–151. doi: 10.1177/1368430215612217
- Thomas, E. F., Rathmann, L., and McGarty, C. (2017). From “I” to “We”: Different forms of identity, emotion, and belief predict victim support volunteerism among nominal and active supporters. *J. Appl. Soc. Psychol.* 47, 1–11. doi: 10.1111/jasp.12428
- Thunberg, G. (2018). *The Disarming Case to Act Right Now Against Climate Change*. TED. Retrieved from: https://www.ted.com/talks/greta_thunberg_the_disarming_case_to_act_right_now_on_climate (accessed April 13, 2021).
- UNESCO Global Action Programme ESD (n.d.). *Die Bildungsbereiche des Nationalen Aktionsplans: Hochschule*. Retrieved from: <https://www.bne-portal.de/de/hochschule-1764.html> (accessed April 13, 2021).
- Van Stekelenburg, J., Klandermans, B., and Akkerman, A. (2016). Does civic participation stimulate political activity? *J. Soc. Issues* 72, 286–314. doi: 10.1111/josi.12167
- Van Zomeren, M. (2016). Building a tower of babel? Integrating core motivations and features of social structure into the political psychology of political action. *Polit. Psychol.* 37, 87–114. doi: 10.1111/pops.12322
- van Zomeren, M., Pauls, I. L., and Cohen-Chen, S. (2019). Is hope good for motivating collective action in the context of climate change? Differentiating hope's emotion- and problem-focused coping functions. *Glob. Environ. Change* 58:101915. doi: 10.1016/j.gloenvcha.2019.04.003
- Van Zomeren, M., Postmes, T., and Spears, R. (2008). Toward an integrative social identity model of collective action: a quantitative research synthesis of three socio-psychological perspectives. *Psychol. Bull.* 34, 504–535. doi: 10.1037/0033-2909.134.4.504
- Van Zomeren, M., Saguy, T., and Schellhaas, F. M. H. (2013). Believing in “making a difference” to collective efforts: participative efficacy beliefs as a unique predictor of collective action. *Group Process. Intergr. Relat.* 16, 618–634. doi: 10.1177/1368430212467476
- Van Zomeren, M., Spears, R., Fischer, A. H., and Leach, C. W. (2004). Put your money where your mouth is! Explaining collective action tendencies through group-based anger and group efficacy. *J. Pers. Soc. Psychol.* 87, 649–664. doi: 10.1037/0022-3514.87.5.649
- Van Zomeren, M., Spears, R., and Leach, C. W. (2010). Experimental evidence for a dual pathway model analysis of coping with climate crisis. *J. Environ. Psychol.* 30, 339–349. doi: 10.1016/j.jenvp.2010.02.006
- Vestergren, S., Drury, J., and Hammar Chiriac, E. (2016). The biographical consequences of protest and activism: a systematic review and a new typology. *Soc. Mov. Stud.* 16, 203–221. doi: 10.1080/14742837.2016.1252665
- Wang, E. S. T., and Lin, H. C. (2017). Sustainable development: the effects of social normative beliefs on environmental behavior. *Sustain. Dev.* 25, 595–609. doi: 10.1002/sd.1680
- Zimmerman, M. A. (1990). Toward a theory of learned hopefulness: a structural model analysis of participation and empowerment. *J. Res. Pers.* 24, 71–86. doi: 10.1016/0092-6566(90)90007-S
- Zimmerman, M. A. (1995). Psychological empowerment: issues and illustrations. *Am. J. Community Psychol.* 23, 581–599. doi: 10.1007/BF02506983

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Hamann, Holz and Reese. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



Fostering Cultures of Sustainability in a Multi-Unit Office Building: A Theory of Change

Bianca Christel Dreyer^{1,2†}, Manuel Riemer^{1,2*†}, Brittany Spadafore^{1,2}, Joel Marcus³, Devon Fernandes⁴, Allan Taylor⁵, Stephanie Whitney⁶, Sean Geobey⁷ and Aisling Dennett⁵

¹Viessmann Centre for Engagement and Research in Sustainability, Waterloo, ON, Canada, ²Department of Psychology, Wilfrid Laurier University, Waterloo, ON, Canada, ³School of Administrative Studies, York University, Toronto, ON, Canada, ⁴Humber College, Toronto, ON, Canada, ⁵Sustainable Waterloo Region, Waterloo, ON, Canada, ⁶Office of Research Services, Wilfrid Laurier University, Waterloo, ON, Canada, ⁷Waterloo Institute for Social Innovation and Resilience, University of Waterloo, Waterloo, ON, Canada

OPEN ACCESS

Edited by:

Sebastian Bamberg,
Bielefeld University of Applied
Sciences, Germany

Reviewed by:

Henrike Rau,
Ludwig Maximilian University of
Munich, Germany
Niko Schäpke,
University of Freiburg, Germany

*Correspondence:

Manuel Riemer
mriemer@wlu.ca

[†]These authors share first authorship

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 31 October 2020

Accepted: 12 April 2021

Published: 10 May 2021

Citation:

Dreyer BC, Riemer M, Spadafore B,
Marcus J, Fernandes D, Taylor A,
Whitney S, Geobey S and
Dennett A (2021) Fostering Cultures
of Sustainability in a Multi-Unit Office
Building: A Theory of Change.
Front. Psychol. 12:624311.
doi: 10.3389/fpsyg.2021.624311

Psychological approaches to fostering sustainability are heavily focused on individual behaviors and often insufficiently address the physical and social contexts individuals are embedded in. This limits the ability to create meaningful, long-lasting change, as many of day-to-day behaviors are social practices embedded in broader cultural norms and systems. This is particularly true in the work context, where organizational cultures heavily condition both the actions of individual employees and the collective actions of organizations. Thus, we argue cultures, not behaviors, must become the focus of sustainability change efforts. In this paper, we present a theory of change aimed at fostering strong organizational cultures of sustainability (COS) within a high-performance multi-tenant office building. Our theory takes a systems perspective that incorporates the social and physical aspects of the work environment, and views culture change as a co-creative exercise involving engagement of multiple stakeholders. The paper concludes with implications for practice and research.

Keywords: culture of sustainability, theory of change, behavior change, sustainability, systems thinking, culture, engagement, participation

INTRODUCTION

“It is not only in the external physical environment, but just as much in our cultures [...] that change has to take place, if we are to have a world that is sustainable for the human race in the future” (Packalén, 2010, p. 121).

There is growing recognition that significant cultural transformations are needed to successfully respond to ongoing global crises, such as the climate change crisis (Packalén, 2010). However, solutions have been primarily focused on technical innovations rather than culture shifts (Agyeman, 2005a). We were faced with this discrepancy when our team was approached in 2016 by a local environmental Non-Governmental Organization (NGO) with an opportunity to contribute to the ideation of a multi-tenant high-performance office building. Together with several partners (the leadership team), this NGO wanted to create a building that is not only carbon-neutral and regenerative, a building “that gives back” (See Riemer et al., 2021, for the story of this building), but is also commercially viable so it could be easily replicated.

High-performance buildings (HPBs), also referred to as “green” or “sustainable” buildings, can be defined as structures created with the intention of reducing resource use, emissions, and waste, while increasing occupant well-being and health (Brown et al., 2010). Yet, based on experiences of the Centre for Interactive Research in Sustainability (Fedoruk et al., 2015) and other buildings like it, there are multiple gaps between design and performance, despite the use of cutting-edge technologies and sustainable design. While there are many reasons for these performance gaps, one reason is believed to be the (in-)actions of building citizens, and more specifically building managers and organizational employees (Fedoruk et al., 2015; Coleman and Robinson, 2018). Our addition to the leadership team offered expertise related to fostering human actions that could support the performance goals of the building and realize its promise as an adaptation to the global climate crisis. We knew this required an approach that went beyond a one-off behavior change program, and instead focused on the development of building wide self-sustaining cultures¹ of sustainability.

A scan of the literature for systemic approaches to creating and maintaining organizational- and building-level cultures of sustainability (COS) in a multi-tenant HPB, provided insufficient resources for the development of practical guidelines. This led to our decision to create a theory of change of how to co-create such cultures, building on existing work of HPBs and (organizational) change toward sustainability (e.g., Pelletier and Aitken, 2014). A theory of change “is essentially a comprehensive description and illustration of how and why a desired change is expected to happen in a particular context” (Center for Theory of Change, n.d.). A theory of change is not meant to be the same as a scientific theory with testable hypotheses as is common in psychology, but rather a theory-informed framework providing guidance to a practical approach of creating meaningful change for a specific issue. For this purpose, we engaged in “theory-knitting” (Kalmar and Sternberg, 1988) by integrating a variety of existing theories into one comprehensive applied theory of change (Riemer and Bickman, 2011). In this approach, “one integrates the best aspects of a set of given theories with one’s own ideas regarding the domain under investigation” (Kalmar and Sternberg, 1988, p.153), in our case fostering COS. While this is a useful approach for dealing with complex applied phenomena and to overcoming the limiting reductionism inherent in many psychological theories, it is not without its challenges. For example, it is crucial to ensure that the integrated theories do not rest upon incompatible basic assumptions and paradigms. It is important to note that the presented theory of change framework was primarily developed based on theoretical applications and existing literature at the time we created it, and therefore represents our expectation of what would happen once implemented.² With agreement from the building citizens

and leadership team, a living lab concept was incorporated into the building design and operation and served as a mechanism for both the implementation and evaluation of our approach. Thus establishing an onsite laboratory for experimentation in sustainable transformations and practical solutions for real-world problems (Heiskanen et al., 2018; Laakso, 2019). In a forthcoming paper, we will be sharing our experience and the challenges of operationalizing and implementing this theory of change. In this paper, we will first discuss the relevance of cultures of sustainability for achieving the goals of high-performance office buildings (and sustainability more broadly). This will provide the context that informed our approach. We will then offer our theory of change as a system-oriented framework informed by bottom-up engagement processes and discuss its potential challenges and their potential solutions, followed by a general conclusion.

CULTURES AND SUSTAINABILITY IN THE BUILT ENVIRONMENT

Conceptualizing our theory of change required understanding how sustainability and change has been considered and integrated in both the built environment and organizations themselves. In the last 2 decades, sustainability has become synonymous with the necessity of integrating the imperatives of environmental protection, economic development, and social justice – the so-called tri-factor of sustainability (Marcus et al., 2010). At the same time, there are growing concerns about how sustainability change efforts can facilitate integrated thinking, while they continue to apply this typology. Gibson et al. (2005, p. 94) argue that decision-makers are “struggling to understand the overall implications of separate ecological, social, and economic assessment reports that are integrated only by the staples holding the documents together.” Social justice and equity (including economic equity) are integrally part of achieving just and sustainable futures; they cannot be considered separately, and we cannot have one without the other (Rauschmayer et al., 2015; see also discussions of “just sustainabilities” literature that argues for a strong connection of social justice and environmental sustainability, e.g., Agyeman, 2005a,b, 2008). Thus, we echo others in asserting the need to ensure justice is “an essential and integral part of systemic change” (van Steenbergen and Schipper, 2017, p.8). In order to assess and “achieve” sustainability, its core elements need to be integrated. This requires changes both in the conceptualization and implementation of sustainability change efforts. Specifically, a stronger focus on social systems and the underlying cultures that shape the system structures and behavior patterns is needed. Given our context of a multi-tenant office building, we will first explore current conceptualizations of sustainability change in the built environment and among organizations. We will then discuss how the focus on cultures can address current tensions in the sustainability and (organizational) change literatures, and end with a discussion of core principles of cultures of sustainability.

¹Cultures of sustainability are referred to in the plural to recognize that there are many different cultures of sustainability, and not one distinct “culture” that can be defined as such (see also Kagan, 2010 for a more thorough discussion).

²We would like to acknowledge the excellent suggestions by the two reviewers that led to further integration of more recent literatures.

Sustainability in the Built Environment

The concept of “sustainable” buildings has further complicated an already complex concept. While some argue that buildings are inherently unsustainable, others argue what is needed is a focus on making them sustainable (Robinson and Cole, 2015). This call for action has resulted in significant innovations in technology and governance models for individual building systems; mostly focused on transitions to a low-carbon economy (Foxon, 2011). Third party certification bodies, for example, focus heavily on technology and design, such as the Leadership in Energy and Environmental Design (LEED) rating system (Azhar et al., 2011), with the intention of reducing the environmental impact of buildings through carbon reductions. Unfortunately, HPBs frequently fail to meet their expected reduction targets, a phenomenon coined the “performance gap” (Fedoruk et al., 2015; Coleman et al., 2018). Coleman et al. (2018), however, point out that limiting the performance gap to energy and other carbon reduction targets misses others related to the impact of buildings on its citizens, through indoor environmental quality and social factors, or on society at large.

A more nuanced notion of performance gaps could consider gaps between predicted vs. actual resource use (such as energy, water, and waste), measured vs. perceived indoor environmental conditions (such as temperature, air, and lighting; Fabbri and Tronchin, 2015; Phillips and Levin, 2015; Tuohy and Murphy, 2015) and expected vs. actual lived experiences (such as equity, well-being, comfort, and productivity; De Wilde, 2014; Fedoruk et al., 2015; Coleman and Robinson, 2018). These gaps can also have synergistic impacts with one another. The current trend of designing for carbon reductions, such as energy performance improvements, can contradict measures for optimal indoor environmental quality or equity and well-being for building citizens (Wargocki and Wyon, 2013; Arif et al., 2016; Baloch et al., 2020).³ For example, a HPB may not provide any ability to control the indoor environment (e.g., adjust temperatures), creating occupant discomfort and a narrow focus on carbon reductions of the built environment has wider implications on social and economic sustainabilities through housing affordability, fuel poverty, and health inequities (Shrubsole et al., 2019a). It is partly due to the failure to consider buildings as dynamic systems within wider contexts that make these low-carbon transitions prone to negative and unintentional consequences (Janda, 2011). Building performance and sustainability goals thus need to be expanded, as buildings are part of wider socio-economic activities and cultural practices and they play a crucial role in many aspects of people’s lives (Shrubsole et al., 2019a).

³Most physical design features of HPBs (and other buildings) are still decided in a top-down process with little engagement. Yet, engagement should not start with the transition into the new or retrofitted building. There is growing literature that points out that many performance gaps in HPBs are related to a lack of engagement processes early in the design phase of the building. As Reed (2007) describes it, this process of integrated design shifts the role of the architect/planner/designer away from the expert holding all the knowledge to that of a facilitator of a process of revealing. Integrative design can thus create more bottom-up physical features.

As argued elsewhere (Shove, 2010; Rauschmayer et al., 2015; Fischer and Newig, 2016; Geels, 2020), understanding and addressing the causes of (un)sustainability raises the question of whether to tackle individual or structural factors, or perhaps to find adequate ways for a combination of both. Finding this dialectic is contended to be a prerequisite of sustainability. Thus, it is imperative to understand the role of building citizens and other stakeholders (individuals) and (organizational) structures in working toward the sustainability goals of HPBs; especially in office buildings where employees often spend a third of their day (Dreyer et al., 2018). Thus, a theory of change intended to foster sustainability within this context ought to consider these complexities.

Transitioning Organizations Toward Sustainability

In conceptualizing fostering changes, or “transitions” of (building and organizational) systems toward sustainability it is useful to consider the contributions that transition management literature has made toward understanding these processes. Transitions are understood as changes in the regime, “conglomerates of structure (physical setting), culture (prevailing perspective), and practices (rules, routines, and habits)” (Rotmans and Loorbach, 2009, p. 185). A regime change can be influenced by three interlocking dynamics: top-down (pressures of context, i.e., landscape), bottom-up (niche changes gain influence), or processes at the regime level, which lead to an integration of innovations from the niche level into the regime (Loorbach and Rotmans, 2010; Hargreaves et al., 2013; Fischer and Newig, 2016). The former change mechanism implies the importance of contextual forces in upholding dominant systems. The latter two change mechanisms imply the importance of bottom-up niche innovations, which diverge from and challenge existing regime systems. The transition management literature acknowledges the dynamic interplay between top-down forces of contextual factors and bottom-up influences of actors (Fischer and Newig, 2016; Geels, 2020), brought about by the repeated performance of normative or divergent practices (Hargreaves et al., 2013). Yet these conceptualizations do not adequately capture how everyday actions of individuals contribute to and are influenced by sociocultural forces and vice versa. This is reflected in the critical analysis of the transition management literature by Loorbach et al. (2008, p.310), who concluded that “although experiments also involve societal and institutional aspects, they are still insufficient to amount to a fundamental debate, let alone change, at the level of societal culture and structures.”

Literature on organizational change processes echoes that both organizational factors (e.g., size and structure) and individual factors (e.g., attitudes, beliefs, and sociodemographics) influence the actions of individuals and the group (Williams et al., 1989; Mullins, 1999; King and Lenox, 2000). Tudor et al. (2008), for example, suggest that the best framework for understanding change in an organizational setting incorporates individual and organizational factors as interrelated, integrated, and dynamic processes. However, for decades, organizational “change”

was dominated by a discourse of “stability” (Orlikowski, 1996). In fact, most organizing discourses continue to be premised on the primacy of organizational stability (e.g., planned change models, technological imperative and punctuated equilibrium; Tsoukas and Chia, 2002). These narrow considerations of organizational change, which see it as abrupt, radical, planned and/or top-down are limiting, as change is seen as something “unusual.” Instead, scholars point to the importance of considering change as normative in processes of “organizational becoming” rather than “organizational being” (Tsoukas and Chia, 2002). Every action by an organizational member either reproduces existing organizational properties or alters them (articulated by Giddens, 1984 as social practice theory). Organizational change in this sense is inherent in everyday human actions, not inherently based on stability (Orlikowski, 1996).

Applying these notions to sustainability-related change efforts in HPBs demands an integrated perspective that equally considers individual agency and structures, and the inherent power of human actions as a driver of change. Researchers are increasingly pointing to the importance of an organization’s culture as integral in shaping the actions of organizational members (Linnenluecke et al., 2009; Salvioni et al., 2017; Adams et al., 2018; Bauer et al., 2020; Niedlich et al., 2020). Change initiatives are most likely to succeed when they are compatible with the existing (organizational) cultures; or when they are not, significant cultural transformation occurs to improve this alignment (Schein, 1985). While the “cultural” dimension appears to be a fundamental dimension of the transformation toward sustainability, it has been largely neglected. In the following, we will explore how centering cultures as a key leverage point for change can help (re-)integrate dimensions of sustainability, and the roles of individual agency and structure in change (Packalén, 2010; Dessein et al., 2015; Kagan et al., 2018).

Cultures as the Leverage Point for Sustainability

Foremost, “culture is the living, changing dynamic of how we live our lives, individually and collectively, locally and globally, consciously and unconsciously” (Worts, 2011, p. 118). It refers to all that we mean when we talk about values and norms, rituals and traditions, symbols and language (both textual and visual), and practices. Values form the underlying base and practices, rituals and language are the experiential manifestation of those values (Hofstede et al., 1990; Dreyer et al., 2018). Fundamentally, cultures are a dynamic of human relationships (Worts, 2011). We can say that collectively, we are shaped by our cultures, even if our “cultures” never reveal themselves on a conscious level. Finding out what these concealed mechanisms are is part of intercultural communication, which arguably is extremely important for social sustainabilities (Packalén, 2010). Cultures can thus be understood as dynamic change processes; and just like change, can be considered inherent in everyday human actions (Schwartz and Davis, 1981).

There is increasing recognition of the role of cultures as a prerequisite for social change, given that they represent a central value system, guarantee social cohesion and are a mode of

place and identity-making (Lehmann, 2010; Barthel-Bouchier, 2012; UNESCO, 2013). Culture is also discussed as a motor for transformation, producing “creativity,” “engagement,” and “projection” (Florida, 2005; Habitat, 2013; UNESCO, 2013; Vojnovic, 2014; James, 2015). Packalén (2010, p. 119) describes that culture, through “reflection, development, and changes in our values, forms the basis for [sustainability], but also produces new culture itself.” In this sense, culture is intertwined with other important aspects like a “sustainable way of life,” providing an alternative to a neoliberal consumer culture (UNESCO, 2013; Davies, 2015). We agree with Packalén (2010, p. 118) that the change required for ensuring truly sustainable futures “can only succeed if we consider it a necessary undertaking for the whole of society, as a great, culturally transforming, creative task, as a kind of ‘concrete utopia.’” Thus, sustainability “should be more thoroughly thought through and extended so that the cultural dimension is on par with, or rather permeates, the ecological, economic, and social dimensions like a red thread running through a thick rope, clearly visible for all to see” (Packalén, 2010, p. 119). In this vein, one could conceive of three roles for culture: culture *in*, culture *for*, and culture *as* sustainability (Dessein et al., 2015).

First, culture can have a supportive and self-promoting role (characterized as “culture *in*”). This expands conventional sustainability discourse by adding culture as a self-standing fourth pillar alongside separate ecological, social, and economic considerations and imperatives (Thiele, 2013). Second, a role (“culture *for*”), which offers culture as a more influential force that can operate beyond itself. This role moves culture into a framing, contextualizing, and mediating mode that can balance all three of the existing pillars and guide sustainable transformation between economic, social, and ecological pressures and needs (Worts, 2011). Third, a more fundamental role (“culture *as*”) sees culture as the necessary overall foundation and structure for achieving the aims of sustainability transformations. In all three roles, culture is recognized as the root of all human actions and an overarching concern (even a new paradigm) in sustainability. One can therefore see the debate about what sustainability really is as a discourse of cultures (Packalén, 2010), and cultures as a foundation of social justice, economic equity, and environmental protection. In the following, we discuss how cultures can serve as a means for working toward just and sustainable change.

Cultures of Sustainability

A serious limitation in working toward sustainability goals is that they can be interpreted from different (potentially contradictory) ideological perspectives (Ben-Eli, 2018) and that understandings of sustainability are rarely explicitly articulated in change efforts (Agyeman, 2005b; Davidson and Venning, 2011). We recognize that sustainability’s diverse interpretations have emerged from social processes. Further, because sustainability (and even more so sustainable development) is a normative concept, defined in a Western cultural context, it may conflict with non-Western cultures (Meuleman, 2013). Thus, to operationalize the concept and allow for informed

change efforts, especially among stakeholders with differing perspectives (Pope et al., 2017) its principles and criteria must be clearly articulated.

We perceive sustainability as a concept whose meaning emerges organically from conversations about desired futures that are informed by some understanding of the ecological, social, and economic impacts of different courses of action (see Robinson, 2004; Riemer and Schweizer-Ries, 2012). Harré (2011) has argued that if we keep looking at sustainability as a kind of problem to be solved, we will be vulnerable to arguments that suggest that any of the solutions, we propose are not good enough. Thus, it is useful to think of sustainability not as goal to work toward that is fully achievable, but rather as a compass, which will help us to keep in the right direction of a continually ongoing process of change (Harré, 2011; Thiele, 2013). Any criteria for what cultures of sustainability may be, must be developed through a collaborative process. The views of Morrison-Saunders and Therivel (2006) on public participation and the delivery of sustainable outcomes are thus instructive. The authors note that inclusion through consultation alone may not lead to socially optimal solutions. The most vocal and persuasive members of the public – often those most likely to be on committees and steering groups – may not represent the views of the wider public. Therefore, ongoing participation is integral to the process and ensures that outcomes are shaped by all stakeholders rather than *ad hoc* consultation that incorporates only a limited temporal and spatial sample of community views (Clark, 2018; Hügel and Davies, 2020). Currently, those involved in debates about sustainability are mainly politicians, activists, transition management, or other experts, but rarely ordinary citizens. Yet if the general public is to understand what sustainabilities are and if their voices are to be heard, criteria for sustainability “should be drawn from broad representation of key grass-roots, professional, technical, and social groups, including youth, women, and indigenous people – to ensure recognition of diverse and changing values” (Hardi and Zdan, 1997, p. 3).

We define COS, as characterized by *shared values, symbols, rituals, and practices grounded in sustainability principles* leading to individual and societal choices that promote environmental protection, social justice, and well-being, and a supportive economy (Marcus et al., 2010; Riemer et al., 2014). We find it useful to echo Worts (2011), who describes various continuously evolving capacities, at individual and collective levels, that cultures of sustainability could include, for example, capacities for participation/engagement in what is relevant, for relatedness, compassionate connection to others and to the environment, for conscious systems of knowledge, including values, for responsible action, (and) for ability to embrace change. These capacities highlight the importance of fluidity, process, and human action; fundamentally it focuses on capacities, which recognize the importance of a simultaneous focus on structure and agency (Dittmer, 2019).

To summarize, when considering sustainability in the built environment it is important to consider the complex interactions of the physical structure of HPBs with building citizens as individual agents and organizational social structures. The review

of the organizational change literature further identified individual and organizational factors as interrelated, integrated, and dynamic processes. Cultures – that is, the interaction of values, practices, rituals, and symbols – are a central interlay connecting individual, organizational, and physical factors in working toward sustainability related outcomes. This highlights the need for a systems approach for fostering sustainability in this context. Likewise, cultures serve as a foundation of social justice, economic equity, and environmental protection. As such, a focus on cultures offers a much-needed alternative application of this tri-factor of sustainability, especially with respect to social justice. Human actions as a driver of needed structural changes, which in turn impact individuals’ actions, create a continuous reinforcing feedback loop. Thus, transitions to cultures of sustainability in this context need to be fostered through a bottom-up approach of engaged building citizens. This bottom-up engagement process is the second key aspect of our theory of change.

A THEORY OF CHANGE: FROM DESIGN TO CULTURES

As can be seen in **Figure 1**, the system is conceptualized as a complex interaction among structural elements and individual agents with COS at the intersection of those two layers. Engaged building citizens are the key agents and drivers of that COS by shaping and enacting values, symbols, rituals, and practices. COS, in turn, influences and engages building citizens, and as such constitute the key reinforcing feedback loop. It is within this feedback loop that we locate the opportunity for intervening in the system through bottom-up engagement and building a strong COS. The more building citizens are engaged in a COS (the in-flow), the stronger, more influential, and durable is the COS. On the other side, if engaged citizens become disengaged or leave for another office building, then the stock of engaged citizens declines (the out-flow) and the COS may weaken. The HPB and the tenant organizations in the building both serve as an impetus for citizen engagement and influence the COS (e.g., by communicating sustainability values). In the following, we will first elaborate the systems thinking that informed this model before turning to the engagement process as the key approach to intervening in this system.

Thinking in (Building) Systems

Building design and organizational change may not seem related, but the two elements have a symbiotic relationship. Certain building features influence an individual’s actions and experience in complex ways (Coleman, 2016; Dreyer et al., 2018; Spadafore et al., 2021; Zitars et al., 2021). For example, a centrally located, open, and inviting staircase can increase the use of stairs over the elevator, while also communicating sustainability as a value to both citizens and organizations. Similarly, a café in the building that contains inviting spaces to interact with each other and features local, healthy, organic, and fair-trade items promotes community-building and again, communicates

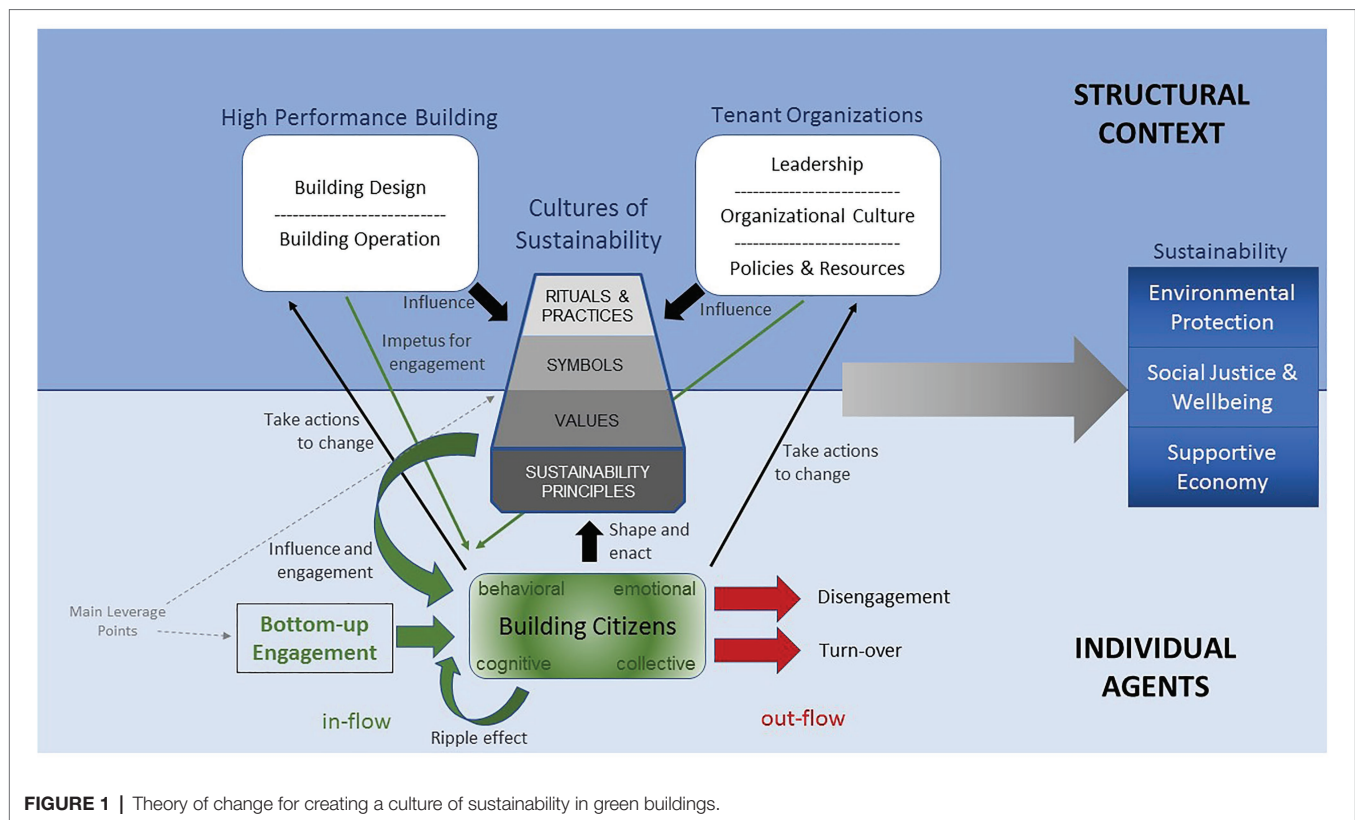


FIGURE 1 | Theory of change for creating a culture of sustainability in green buildings.

sustainable values and facilitates sustainable practices. These are just two examples of how two seemingly unrelated elements, the physical space and the decision of individuals, are connected and can ultimately lead to organizational change.

Meadows (2008, p. 2) describes a system as “a set of things – people, cells, molecules, or whatever – interconnected in such a way that they produce their own pattern of behavior over time.” This includes “adaptive, dynamic, goal seeking, self-preserving, and sometimes evolutionary behavior” (p. 13), just like a forest that is composed of a complex interplay of trees, bushes, mosses, and animals. Senge (1991) has demonstrated that within a systems context, actions that appears rational from the perspective of an individual actor can unintentionally contribute to significant problems that undermine the system as a whole. Systems thinking is a set of synergistic analytic skills used to improve and understand the system as a whole, by identifying underlying systemic structures and understanding how different system parts work together to produce specific practices and devise modifications to them in order to achieve desired goals and objectives. Once the system and its dynamics are better understood, leverage points for intervening in the system and creating transformative change can be identified (Meadows, 1999, 2008).

While the social behavior within and between different organizations in a multi-tenant office building can be viewed as a complex system itself (Dooley, 1997; Holland, 2006), the physical building adds an additional dynamic, especially when the focus is on fostering sustainability in HPBs as in our case. Porter and Cordoba (2009) identified three broad categories

of systems thinking that can be applied to the sustainability debate: functionalist, interpretative, and complex adaptive. We investigate change in HPBs *via* the framework of complex adaptive systems, which are both self-organizing and learning (Dooley, 1997; Holland, 2006) and reflect a “bottom-up approach emanating from large populations of independent, interacting, and self-interested agents” (Davidson and Venning, 2011, p. 215). An essential characteristic of such systems is its emergent characteristics and nonlinearity, leading to multiple possible outcomes of dynamics. In complex adaptive systems, taking inadequate account of the inter-relationships between objectives and outcomes, can result in negative unintended consequences, such as performance gaps in HPBs (Shrubsole et al., 2014). Thus, any engagement with such a system, whether practice- or research-oriented, demands project design, measurement, and evaluation tools that are suited for such complexity (Shrubsole et al., 2019b). The systems thinking approach thereby contrasts with traditional analysis (reductionist), which studies systems by breaking them down into their separate elements. Jay Forrester of MIT and his students set the groundwork for understanding and modeling complex system dynamics within organizations (Stermann, 2000). They highlight that parts interact with each other as an interconnected set of reinforcing and balancing feedback loops. Some of the system’s impacts or outcomes develop over time and sometimes can be quite delayed and not immediately noticeable. Taking away paper towels in the public washrooms in an office building, for example, may reduce paper waste and costs in the short-term, but it can also create resentment toward sustainable initiatives when people

relied on those paper towels for a variety of purposes (e.g., cleaning up a spill in their office) or if the available air dryer is not working well. As people get increasingly annoyed with this situation and talk to each other about it, the resentment builds and may interfere with future initiatives. Systems thinking provides tools to anticipate some of the unintended consequences and figure out ways to avoid them.

The system change framework developed by Foster-Fishman et al. (2007), builds upon earlier system theories by Forrester, Meadows, and Sternman and provides a useful approach to modeling the complex, dynamic, and multi-level interactions between the two major systems within HPBs: (A) The physical side (the building design and features), which defines our system boundary, and (B) The people side including the tenant organizations and the building citizens (Coleman, 2016). Key actors on the people side in this system include the employees (as the main occupants), owner, tenant management, building management, and staff, and the surrounding community interacting with the building. Fundamental systems parts related to the tenant organizations include their leadership, organizational culture, resources, and regulations/policies (Foster-Fishman et al., 2007). In this model, specific cultures are developed among building citizens interacting with each other and building features (some of which are in return influenced by citizens such as personal plants and artwork) and influenced by other system parts (e.g., policies, leadership). Over time and through various building phases (pre-occupancy, transition, and post-occupancy) these system components interact in unique ways, shaping the creation of the COS and the actions of building citizen and their experience in the building (Coleman, 2016), in turn influencing the resource use of the building as a whole as well as other dimensions of sustainability. The success of HPBs has traditionally been gauged by the how closely they meet the (mostly emissions-based) performance goals rather than illustrating how they function as part of this integrated system (Cole, 2012). As such, understanding the building as a system is crucial in creating COS, which then supports the performance and sustainability goals of HPBs.

In this paper, we primarily discuss the cultural aspect of this system dynamics model. However, it is important to consider other systems components that may be connected through reinforcing and balancing feedback loops (Sterman, 2000; Meadows, 2008). For example, inspired by a series of informational workshops and vegetarian cooking classes, the employees of an organization may develop a collective value for reducing the environmental impact of the food they consume during meetings. After advocating for a change with the organizational leadership, this shift in values may result in a new company policy of only allowing plant-based meals for official meetings. This policy, in turn, will then communicate the value underlying the policy to new people joining the company. The key to transformative change is to find leverage points in the current system that can bring about desired changes in the system (Foster-Fishman et al., 2007; Meadows, 2008). Detecting leverage points typically requires the participation and collaboration of different system actors to understand the dynamics within and across specific parts of

the system. Meadows (1999) found that changing systems norms and mental models is one of the most effective leverage points for creating truly transformative system changes, which is why the focus on culture is so critical to our theory of change. Yet, it is not sufficient to just incorporate the key characteristics of systems thinking into cultural change strategies. If the goal (COS) and objectives (e.g., closing the performance gaps) are not underpinned by clearly articulated sustainability principles that are endorsed by building citizens (as discussed in the previous section), identification of impetus and engagement strategies will be unclear during cultural change initiatives.

Bottom-up engagement processes that clarify, reinforce, and support the creation of principles consistent with COS are critical to ensure evaluation and re-assessment are embedded into the change process. If these are absent, the validity or the capacity of cultural change processes to deliver COS outcomes is rendered doubtful. Thus, we will now turn our attention to participatory engagement processes necessary in fostering change toward COS within the system boundaries.

Bottom-Up Change Through Engagement

A truism of organizational change is that senior management must fully support any transformational program (Danter et al., 2000). Wang et al. (2020) argue that reaching sustainability goals within HPBs is not possible without the participation of key internal stakeholders, as they are responsible for projects and actions, in addition to being affected by their implementation. Yet, as argued previously, top-down processes alone are insufficient for cultural change processes, so collective bottom-up efforts are required. For this to be effective, significant engagement is needed from the building citizens.

Engagement is a conscious process that is more comprehensive than behavior manipulations (Meyer and Gagnè, 2008; Shove, 2010). Engagement occurs across cognitive, emotional, behavioral, and collective dimensions; ideally all four simultaneously (Riemer et al., 2014). Engagement strategies grounded in this understanding focus on developing ongoing community and providing different options to connect cognitively, emotionally, behaviorally, collectively to sustainability over time (Macey and Schneider, 2008; Meyer and Gagnè, 2008; Riemer et al., 2014). Thus, engagement focuses on actions (e.g., language, rituals, and practices) that contribute to cultural change. As suggested by Senge (1991), people do not necessarily resist change, they just do not like being changed without their input. In this bottom-up approach, building citizens become promoting agents and not just recipients of sustainability policies and regulations. An engagement process is not about manipulating a person to do the right thing against their will, but about activating existing energy. That is, a person needs to have at least some initial openness to sustainability or related issues (engagement potential) or an external element that opens a space for action (impetus). Then they make a conscious decision to become more engaged (through a spark). What provides an impetus for one person or the other is not equal. For some, a shared kitchen is impetus to eat lunch away from the desk and begin interacting with other building citizens, while for others it is the invitation through a colleague to join them. In our model

(see **Figure 1**), physical design features, aspects of tenant organizations (e.g., a new policy or an onboarding video), the existing COS, as well as other citizens (through a ripple effect) can serve as impetus for engagement.

Engagement processes for social change cannot be forced, they can only be fostered. They require enough individuals with an engagement potential, which in turn requires time, resources, and long-term commitment (Riemer et al., 2012). Our change framework relies on the development of supports and services needed, and a dedication of necessary resources to the bottom-up engagement program. Once citizens who have engagement potential and impetus make a conscious decision, or “spark,” we need to ensure that people can engage; that they have the time and supports required (e.g., green team, Manager of COS). Engagement is thus something that needs to be implemented actively and intentionally. An application of systems thinking further points out that certain desired actions require changes to the social-ecological system that can either enable or hinder specific further actions. For example, if sourcing local food may be challenging for employees, they could advocate for a weekly farmers’ market at their building. The search for sustainable futures “requires connecting knowledge to the capacities and capabilities to make desired changes” (May and Perry, 2006, p. 30). It is assumed that more active engagement efforts are needed initially, while over time a strong COS and a high number of engaged citizens sustain engagement through a reinforcing feedback loop. However, disengagement (e.g., because of competing demands and lack of time) and employee turn-over can negatively affect the strength of that loop, which will likely require ongoing intentional engagement efforts to counteract that decline.

Citizens also actively shape their structural environment through specific actions. In the area of environmental protection, Alisat and Riemer (2015) have defined the concept of environmental actions as ranging from low-level participatory civic action, such as informing oneself about environmental issues and participating in community events, to highly involved and political leadership actions such as organizing a protest. Engaging in these types of actions often requires specific types of competencies, which Jensen and Schnack (1997) refer to as action competencies. More recently, Dittmer et al. (2018) identified four elements of these action competencies: knowledge about the issues, reflection on knowledge and experience within the context of one’s values, visions for alternatives, and the ability to engage in collective action. Similarly, in their call for a shift in individual and collective mindsets to effectively engage in climate action, Wamsler et al. (2020) developed a competency framework of five clusters of transformative skills and qualities necessary for shifting mindsets related to climate action. These are (1) openness, self-awareness, and reflection; (2) compassion and empathy; (3) perspective-seeking and relationality; (4) agency, empowerment, and sense-making; and (5) values-based courage and engagement. Some people will have already developed these competencies, while most people have not. Creating structures and mechanisms that function as experimental safe spaces is central to supporting the development of such competencies (Wamsler et al., 2020).

Our theory of change also incorporates “Assess & Adapt” as ongoing processes that serve to learn about stakeholders needs and competencies, through an understanding of their internal landscape and current COS. This identifies crucial leverage points and prioritizes time/resources based on gaps in the process. An ongoing assessment and feedback system then allows for continual improvement through; pre-occupancy and post-occupancy focus groups, annual building surveys, and interactive research projects, such as photovoice research, among others.

Engagement is crucial not only in terms of the delivery of the change strategy but also in the very framing of the goals/objectives of the COS. Engagement processes are not about presenting goals and ready solutions to stakeholders; as discussed above, the simple inclusion of stakeholders is not sufficient in ensuring that sustainability goals are met. *Co-creation* of goals and strategies, requires design thinking and well facilitated group processes (see Geobey, 2021). The assumption is, that over time, after being reinforced by their surroundings (both physical and social), building citizens who were slightly engaged originally will be part of a ripple effect. Research shows that we are heavily influenced by our immediate social group and diffusion of innovation and social change often starts with a few individuals (the innovators and early adopters) but then ripples to others within their social group (Rogers, 2003). Over time, this can result in cultural changes within an organization or community, which then, in turn, influences further engagement. As such, culture is a powerful means to elicit engagement. Mintzberg and Westley (1992) suggests that organizational culture is equivalent to the soul that binds people and organizations together and it guides organizational members’ believing and thinking, perceiving and feeling, ultimately directing their behavior (Smircich, 1983; Schein, 1985). Engagement and cultural change are mutually reinforcing mechanisms, which are both fluid without a determined end state; culture can be arguably experienced and expressed cognitively, emotionally, behaviorally, and collectively; and engagement across these dimensions lead to actions that change cultures.

FROM THEORY TO ACTION

With the core elements of the theory of change and their relationships laid out and justified, implementation and translation into action follow. Based on the theoretical consideration above, our team developed a manual (“Momentum for Change: A Culture of Sustainability engagement manual”) that served as a general guideline for key change agents in developing an applied collaborative COS engagement strategy (Riemer et al., 2018).⁴ In this translation from theory to proposed action, it is important to consider that the specific actions cannot be pre-determined or prescribed as that would go against the co-creative bottom-up approach and would ignore the specific cultural and organizational contexts. Rather, it is important to present a set of principles that can be applied across different

⁴This unpublished manual is available from the second author upon request.

contexts and interpreted collaboratively by local actors. In our case, we derived five core principles for the development of the strategy: systems-oriented, long-term developmental, strategic, comprehensive, and participatory (see **Table 1** for an overview).

First, our theory of change foregrounds understanding HPBs as complex and dynamic systems with three interconnected components: the physical building and the social system, which includes the tenant organizations and the building citizens. A key focus is on the emerging COS as a major mechanism for transformations that will foster enduring sustainability that permeates each tenant organization. Second, this type of transformation necessitates a critical mass of engaged building citizens (the stock) who are collectively changing shared values, social practices, rituals, and symbols/language. This is an ongoing, relational, dynamic, multi-year process that we believe can only be fostered but not directed. Third, this type of approach requires a long-term strategy with interconnected strategic actions that build upon each other. For example, it may be important to first develop relationships and community among building citizens (i.e., occupants and building managers and staff) before larger collective goals can be pursued together. Engagement of building citizens is the key driver of cultural change in this approach. Fostering this level of engagement needs to be a multi-level and multi-dimensional effort across an array of interventions that target cognitive, emotional, behavioral, and collective aspects of engaging with sustainability. Finally, the focus on bottom-up approaches to fostering collective engagement and co-creative processes by the building citizens is captured in the participatory principle.

TABLE 1 | Core principles derived from the theory of change.

Element	Intention
Systems-oriented	Rather than focusing on only changing a single element of a social system the approach will identify key leverage points in the system for transformative and durable impact
Long-term developmental	The engagement processes are built on relationships between people and mobilizing them in experimentation. Through both successes and failures these experiments create opportunities to deepen bonds of trust and integrate systematic learning into the process.
Strategic	There is a long-term strategy with a clear vision and general purpose, long-term and intermediate goals, specific objectives, general strategies, and specific actions
Comprehensive	The engagement strategy is multi-dimensional, targeting cognitive (thinking), emotional (feeling), behavioral (doing), and collective (being) dimensions, and also works across multiple scales from the individual, to the organizational, to the entire site with the ultimate goal of having impact on communities beyond itself. This requires multiple interventions rather than attempting to find a single solution to rally all stakeholders to support.
Participatory	Employees, managers, and other building citizens will use their own information, experiences, and capacities to develop “local theories” about the causes of problems and how to solve them. Through a cyclical problem-solving process, the people in the building will co-design and implement a series of solutions and learn from their results.

Source: Riemer et al., 2018.

In the application of these core principles, we developed a multi-year strategic plan. This included the use of participatory design workshops to determine what sustainability means to us, forming a building COS committee, hiring a COS manager to foster bottom-up engagement, creating opportunities to develop community, and increasing the capacity for collective actions, among other specific strategies derived from the general principles. This plan also included strategies to leverage the intentional interior design elements of the building, and created opportunities for an increased awareness of the physical space through building tours. Interest and awareness of the research and building was fostered through informational material provided for new employee onboarding. We also worked with tenant management to communicate sustainability as an organizational value using the building as the impetus for that.

POTENTIAL CHALLENGES AND SOLUTIONS

Bickman (1987, p.5) defined program theory as “a plausible and sensible model of how a program is supposed to work.” Often, however, what sounds plausible and sensible in theory will be challenged once you try to implement it in practice in specific context with all of the messiness and competing demands that exist in those real-world contexts. There are a few specific challenges, we were anticipating in implementing such a comprehensive and long-term approach as is represented by our theory of change.

1. Changing cultures takes a long time. There is danger of losing momentum if there are no quick wins. Competing demands can also lead to disengagement. Another challenge can be losing key champions who have a lot of weight in carrying the change process. Turnover is a common challenge in organizational change efforts. Thus, thinking about redundancy early is important.
2. The sponsors of change initiatives at the organizational leadership level may prefer quick-fix solutions that focus on the individual over investment in a comprehensive long-term system-change strategy. While quick-fix solutions are less likely to create meaningful and long-lasting change, they may satisfy the need to include something into the corporate sustainability report or to feature on the company's website. Therefore, a good long-term strategy may include some initial actions or programs that can lead to quick wins to ensure the continuous buy-in of the organizational leadership.
3. Companies have realized that creating positive organizational cultures is key to attracting and keeping the modern workforce, especially younger mobile employees (Fernandes, 2018). Thus, creating a COS may compete with other efforts of creating organizational cultures unique to each tenant organization within the building. For that reason, it is recommended to identify such efforts and integrate and align the COS strategy with these other efforts.

4. While a lot of individual behavior change strategies have been intentionally designed to not even require the target individuals to be consciously aware of the processes, engagement on the other hand takes conscious effort and time that many may not have and will not be given by the supervisors. This may especially be an issue in team-oriented and project-based work that has replaced the more traditional 9–5 types of jobs (Matthews et al., 2018). The nature of this type of work makes it harder for individual workers to justify their engagement in things other than the project-oriented work. Asking organizations to provide regular designated “sustainability hours” that can be used to work on individual or collective sustainability actions may be a way to address this.
5. Fostering cultural changes operating at a systems-level are resource intensive. Unless sustainability is seen as a key organizational priority, this may not be an investment organizations’ feel like they can make. Thus, it is important to ensure the level of organizational commitment before engaging in the change process.
6. Finally, multi-tenant buildings pose unique challenges because one has to deal with different organizational cultures, structures, and procedures. It also requires more upfront investment in relationship-building and developing community among employees from different organizations.

CONCLUSION

Systems theory suggests that the most impactful and long-lasting changes in social systems target system elements with high reach or influence (Murphy and Jones, 2020). Applied systems thinkers often use the iceberg model to illustrate these highly influential system layers for lasting transformative change. Accordingly, the behavioral level (which is the top layer of the iceberg that can be seen above the water surface) is the least transformative leverage point, while the deepest level (under the water surface), that is values, mental models, and cultural beliefs, is the most impactful one (Senge, 1991; Meadows, 1999; Murphy and Jones, 2020). Of course, this level is also the most complex and difficult to influence, which may be the reason why there are less applied theories in psychology that are targeted at this level, while there are plenty of theories focused on individual behavior. With this paper, we hope to contribute to an exploration and discussion within psychology of how we may develop systematic approaches to intervening at these deeper levels and offer this unique project as a promising starting point for this conversation.

The original motivation for the theory of change presented in this manuscript was the request by the leadership team to create a behavior change strategy to avoid the before mentioned performance gaps often observed for HPBs. Our team determined that creating a strategy that would change multiple actions simultaneously and maintain these changes over time, as building citizens transition in and out of the building, can only be accomplished by going deeper – below the water surface of the iceberg – by creating cultures of sustainability

through building citizen engagement. Beyond just sustainable building design, construction, and operation, cultural change initiatives undertaken with meaningful engagement have the potential to result in a more robust prototype than any single case study building. Leading not only to carbon reductions within HPBs, but also movement toward economic equity, environmental protection, and social justice (including health and well-being).

In many existing psychological theories, cultural factors are recognized as crucial influencing factors, for example, values are prominent in most individual-level behavior change strategies (e.g., value-belief-norm theory; Stern et al., 1999), yet they rarely are considered *the* focal element for transformative change. Yet, transformative change toward sustainability demands that scientists, intellectuals, and other professionals recognize the limits of current theories of change. Sustainability implies a change of fundamental cultural epistemologies and hence a fundamental change in our scientific models and approaches (Reason, 2002; Sterling, 2004). Recognizing the public role of science, many scholars further problematize the linear, instrumental perspective between institutions of higher education, research and learning and the solutions of social and political problems, such as sustainability challenges (Van Poeck and Vandenabeele, 2014). Working from within the discipline of community psychology, we also embrace the centrality of issues of justice in cultural transformations. If sustainability is to become a process with the power to transform, “justice and equity issues need to be incorporated into its very core” (Agyeman, 2008, p. 752); only then can we truly realize the potentials of HPBs. Working within current neoliberal market structures, we recognize the limitations of this economic model in supporting transformational change that is not linked to increasing growth-oriented sustainable development. Engagement of employees is only possible, if organizations encourage employees to allocate their workhours toward shared building and community-level goals. Changing cultures is extremely difficult and requires long-term commitment that many organizations may not be prepared to make.

Buildings can be more than physical spaces, we occupy, they can foster a sense of shared identity, the feeling of recognition and of belonging to a specific place that improves quality of life. When they are designed as a collective construct, a feeling of co-responsibility informs our efforts. They can then provide reference points to which people can relate and connect – a culture. We hope this paper provides organizational change agents with a framework they can use in the development of their comprehensive change strategies. However, cultural change requires more than a cookie-cutter approach, or recipe that one can simply follow, but rather general principles that require an understanding of the underlying theory of change, which is why we elaborate on ours here. This 5-year study also aims to address the significant gap in the literature regarding the empirical evaluation of such comprehensive co-creative approaches. We also hope that it gives researchers a starting point if they are looking for approaches that go beyond incremental behavior change and involve co-creation toward more just and sustainable societies.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

All authors contributed to the development of the theoretical model and intellectual conceptualization of this paper. Author contribution reflects the relative contribution of each author to iterations of the manuscript. Sharing first authorship, BD and MR contributed equally to the writing and intellectual conceptualization of the current version of this paper, with significant contributions from BS, DF, AT, JM, SG, and AD all wrote sections of the original manuscript, with JM, SW, and AD providing detailed feedback throughout the iterations of the manuscript, which this final version draws from theoretically and intellectually. All authors contributed to the article and approved the submitted version.

FUNDING

BD would like to acknowledge her support through the Vanier Canada Graduate Scholarship, which supported her work that contributed to the development of theory of change and the

development of this manuscript. The development of the theory of change, the writing of this manuscript, and the open access fees were supported by funding from the Ontario Research Fund - Research Excellence (#RE-09-117; LOF-1 38489), Canadian Foundation of Innovation (#38489) and the Social Science and Humanities Council of Canada (#890-2017-0127).

ACKNOWLEDGMENTS

We would like to acknowledge that the first two authors share the first authorship as they contributed equally to this manuscript. Further, we would like to thank the editors and our two reviewers for their very helpful feedback on earlier versions of the manuscript. The care they took in reviewing the manuscript, seeing its potential, and providing detailed suggestions for how to make it stronger, were exceptional and very much appreciated. We would also like to thank all everyone from Sustainable Waterloo Region, the building development company and tenant organizations of the green building, where we set up our living lab, and the leadership and staff at Sustainable Societies Consulting Group for their input on the development of the theory of change presented in this paper. BD would like to acknowledge her support through Vanier Canada Graduate Scholarships. Finally, we would like to thank the Social Science and Humanities Research Council of Canada, the Ontario Research Fund, and the Canadian Foundation of Innovation for supporting the living lab and the research to test the theory of change.

REFERENCES

- Adams, R., Martin, S., and Boom, K. (2018). University culture and sustainability: designing and implementing an enabling framework. *J. Clean. Prod.* 171, 434–445. doi: 10.1016/j.jclepro.2017.10.032
- Agyeman, J. (2005a). *Sustainable Communities and the Challenge of Environmental Justice*. New York: NYU Press.
- Agyeman, J. (2005b). Alternatives for community and environment: where justice and sustainability meet. *Environ. Sci. Policy Sustain. Dev.* 47, 10–23. doi: 10.3200/ENV.47.6.10-23
- Agyeman, J. (2008). Toward a “just” sustainability? *J. Med. Cult. Stud.* 22, 751–756. doi: 10.1080/10304310802452487
- Alisat, S., and Riemer, M. (2015). The environmental action scale: development and psychometric evaluation. *J. Environ. Psychol.* 43, 13–23. doi: 10.1016/j.jenvp.2015.05.006
- Arif, M., Kafatygiotou, M., Mazroei, A., Kaushik, A., and Elsarrag, E. (2016). Impact of indoor environmental quality on occupant well-being and comfort: a review of the literature. *Int. J. Sustain. Built Environ.* 5, 1–11. doi: 10.1016/j.ijsbe.2016.03.006
- Azhar, S., Carlton, W. A., Olsen, D., and Ahmad, I. (2011). Building information modeling for sustainable design and LEED® rating analysis. *Autom. Constr.* 20, 217–224. doi: 10.1016/j.autcon.2010.09.019
- Baloch, R. M., Maesano, C. N., Christoffersen, J., Banerjee, S., Gabriel, M., Csobod, E., et al. (2020). Indoor air pollution, physical and comfort parameters related to schoolchildren's health: data from the European sinphonie study. *Sci. Total Environ.* 739:139870. doi: 10.1016/j.scitotenv.2020.139870
- Barthel-Bouchier, D. (2012). *Cultural Heritage and the Challenge of Sustainability*. Walnut Creek, CA: Left Coast Press.
- Bauer, M., Niedlich, S., Rieckmann, M., Bormann, I., and Jaeger, L. (2020). Interdependencies of culture and functions of sustainability governance at higher education institutions. *Sustain. For.* 12, 1–21. doi: 10.3390/su12072780
- Ben-Eli, M. U. (2018). Sustainability: definition and five core principles, a systems perspective. *Sustain. Sci.* 13, 1337–1343. doi: 10.1007/s11625-018-0564-3
- Bickman, L. (1987). The functions of program theory. *New Dir. Program Eval.* 33, 5–18. doi: 10.1002/ev.1443
- Brown, Z., Cole, R. J., Robinson, J., and Dowlatabadi, H. (2010). Evaluating user experience in green buildings in relation to workplace culture and context. *Facilities* 28, 225–238. doi: 10.1108/02632771011023168
- Center for Theory of Change (n.d.). What is theory of change? Available at: <https://www.theoryofchange.org/what-is-theory-of-change/> (Accessed October 31, 2020).
- Clark, J. K. (2018). Designing public participation: managing problem settings and social equity. *Publ. Admin. Rev.* 78, 362–374. doi: 10.1111/puar.12872
- Cole, R. J. (2012). Transitioning from green to regenerative design. *Build. Res. Inf.* 40, 39–53. doi: 10.1080/09613218.2011.610608
- Coleman, S. (2016). Normalizing Sustainability in a Regenerative Building: the Social Practice of Being at CIRS. Doctoral dissertation. University of British Columbia.
- Coleman, S., and Robinson, J. B. (2018). Introducing the qualitative performance gap: stories about a sustainable building. *Build. Res. Inf.* 46, 485–500. doi: 10.1080/09613218.2017.1366138
- Coleman, S., Touchie, M. E., Robinson, J. B., and Peters, T. (2018). Rethinking performance gaps: a regenerative sustainability approach to built environment performance assessment. *Sustain. For.* 10:4829. doi: 10.3390/su10124829
- Danter, K. J., Griest, D. L., Mullins, G. W., and Norland, E. (2000). Organizational change as a component of ecosystem management. *Soc. Nat. Resour.* 13, 537–547. doi: 10.1080/08941920050114592
- Davidson, K. M., and Venning, J. (2011). Sustainability decision-making frameworks and the application of systems thinking: an urban context. *Local Environ.* 16, 213–228. doi: 10.1080/13549839.2011.565464
- Davies, W. K. D. (2015). “Background to sustainable cities” in *Theme Cities: Solutions for Urban Problems*. ed. W. K. D. Davies (Dordrecht: Springer Netherlands), 151–205.
- Dessein, J., Soini, K., Fairclough, G., and Horlings, L. (2015). *Culture in, for and as Sustainable Development. Conclusions From the COST Action IS1007 Investigating Cultural Sustainability*. Jyväskylä: University of Jyväskylä.

- De Wilde, P. (2014). The gap between predicted and measured energy performance of buildings: a framework for investigation. *Autom. Constr.* 41, 40–49. doi: 10.1016/j.autcon.2014.02.009
- Dittmer, L. (2019). Building Young People's Capacity for Critical and Transcendent Engagement: Examining the Institution, the Community, and the Individual as Protagonists of a School Setting (2135). Doctoral Dissertation. Wilfrid Laurier University. Scholar's Commons @ Laurier. Available at: <https://scholars.wlu.ca/etd/2135> (Accessed October 31, 2020).
- Dittmer, L., Mugaga, F., Metternich, A., Schweizer-Ries, P., Asiimwe, G., and Riemer, M. (2018). "We can keep the fire burning": building action competence through environmental justice education in Uganda and Germany. *Local Environ.* 23, 144–157. doi: 10.1080/13549839.2017.1391188
- Dooley, K. J. (1997). A complex adaptive systems model of organization change. *Nonlinear Dynam. Psychol. Life Sci.* 1, 69–97. doi: 10.1023/A:1022375910940
- Dreyer, B. C., Coulombe, S., Whitney, S., Riemer, M., and Labbé, D. (2018). Beyond exposure to outdoor nature: exploration of the benefits of a green building's indoor environment on wellbeing. *Front. Psychol.* 9:1583. doi: 10.3389/fpsyg.2018.01583
- Fabbri, K., and Tronchin, L. (2015). Indoor environmental quality in low energy buildings. *Energy Procedia* 78, 2778–2783. doi: 10.1016/j.egypro.2015.11.625
- Fedoruk, L. E., Cole, R. J., Robinson, J. B., and Cayuela, A. (2015). Learning from failure: understanding the anticipated-achieved building energy performance gap. *Build. Res. Inf.* 43, 750–763. doi: 10.1080/09613218.2015.1036227
- Fernandes, D. (2018). Assessing Job Seekers' Attraction to Working in Green Buildings (2079). Master's thesis, Wilfrid Laurier University. Scholar's Commons @ Laurier.
- Fischer, L. B., and Newig, J. (2016). Importance of actors and agency in sustainability transitions: a systematic exploration of the literature. *Sustain. For.* 8:476. doi: 10.3390/su8050476
- Florida, R. L. (2005). *Cities and the Creative Class*. New York: Psychology Press.
- Foster-Fishman, P. G., Nowell, B., and Yang, H. (2007). Putting the system back into systems change: a framework for understanding and changing organizational and community systems. *Am. J. Community Psychol.* 39, 197–215. doi: 10.1007/s10464-007-9109-0
- Foxon, T. J. (2011). A coevolutionary framework for analysing a transition to a sustainable low carbon economy. *Ecol. Econ.* 70, 2258–2267. doi: 10.1016/j.ecolecon.2011.07.014
- Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technol. Forecast. Soc. Chang.* 152:119894. doi: 10.1016/j.techfore.2019.119894
- Gibson, R. B., Hassan, S., Holtz, S., Tansey, J., Whitelaw, G., and Morrison-Saunders, A. (2005). *Sustainability Assessment—Criteria and Processes*. London: Earthscan.
- Giddens, A. (1984). *The Constitution of Society*. Berkeley and Los Angeles: University of California Press.
- Habitat, U. N. (2013). *State of the World's Cities 2012/2013: Prosperity of Cities*. London: Routledge.
- Hardi, P., and Zdan, T. J. (1997). *Assessing Sustainable Development: Principles in Practice*. Manitoba: International Institute for Sustainable Development.
- Hargreaves, T., Longhurst, N., and Seyfang, G. (2013). Up, down, round and round: connecting regimes and practices in innovation for sustainability. *Environ. Plan.* 45, 402–420. doi: 10.1068/a45124
- Harré, N. (2011). *Psychology for a Better World*. Auckland, New Zealand: Department of Psychology, University of Auckland.
- Heiskanen, E., Laakso, S., Matschoss, K., Backhaus, J., Goggins, G., and Vadovics, E. (2018). Designing real-world laboratories for the reduction of residential energy use: articulating theories of change. *Ecol. Perspect. Sci. Soc.* 27, 60–67. doi: 10.14512/gaia.27.S1.13
- Hofstede, G., Neuijen, B., Ohayv, D. D., and Sanders, G. (1990). Measuring organizational cultures: a qualitative and quantitative study across twenty cases. *Adm. Sci. Q.* 35, 286–316. doi: 10.2307/2393392
- Holland, J. H. (2006). Studying complex adaptive systems. *J. Syst. Sci. Complex.* 19, 1–8. doi: 10.1007/s11424-006-0001-z
- Hügel, S., and Davies, A. R. (2020). Public participation, engagement, and climate change adaptation: a review of the research literature. *Wiley Interdiscip. Rev. Clim. Chang.* 11, 1–20. doi: 10.1002/wcc.645
- James, P. (2015). *Urban Sustainability in Theory and Practice: Circles of Sustainability*. London: Routledge.
- Janda, K. B. (2011). Buildings don't use energy: people do. *Archit. Sci. Rev.* 54, 15–22. doi: 10.3763/asre.2009.0050
- Jensen, B. B., and Schnack, K. (1997). The action competence approach in environmental education. *Environ. Educ. Res.* 3, 163–178. doi: 10.1080/1350462970030205
- Kagan, S. (2018). "Culture and the arts in sustainable development: rethinking sustainability research" in *Cultural Sustainability*. London: Routledge, 127–139.
- Kagan, S., Hauerwaas, A., Holz, V., and Wedler, P. (2018). Culture in sustainable urban development: practices and policies for spaces of possibility and institutional innovations. *City Cult. Soc.* 13, 32–45. doi: 10.1016/j.ccs.2017.09.005
- Kalmar, D. A., and Sternberg, R. J. (1988). Theory knitting: an integrative approach to theory development. *Philos. Psychol.* 1, 153–170. doi: 10.1080/09515088808572934
- King, A. A., and Lenox, M. J. (2000). Industry self-regulation without sanctions: the chemical industry's responsible care program. *Acad. Manag. J.* 43, 698–716. doi: 10.2307/1556362
- Laakso, S. (2019). Experiments in everyday mobility: social dynamics of achieving a sustainable lifestyle. *Soc. Res.* 24, 235–250. doi: 10.1177/1360780418823222
- Lehmann, S. (2010). *The Principles of Green Urbanism: Transforming the City for Sustainability*. London: Earthscan.
- Linnenluecke, M. K., Russell, S. V., and Griffiths, A. (2009). Subcultures and sustainability practices: the impact on understanding corporate sustainability. *Bus. Strateg. Environ.* 18, 432–452. doi: 10.1002/bse.609
- Loorbach, D., and Rotmans, J. (2010). The practice of transition management: examples and lessons from four distinct cases. *Futures* 42, 237–246. doi: 10.1016/j.futures.2009.11.009
- Loorbach, D., van der Brugge, R., and Taanman, M. (2008). Governance in the energy transition: practice of transition management in the Netherlands. *Int. J. Environ. Technol. Manag.* 9, 294–315. doi: 10.1504/IJETM.2008.019039
- Macey, W. H., and Schneider, B. (2008). The meaning of employee engagement. *Ind. Organ. Psychol.* 1, 3–30. doi: 10.1111/j.1754-9434.2007.0002.x
- Marcus, J., Kurucz, E. C., and Colbert, B. A. (2010). Conceptions of the business-society-nature interface: implications for management scholarship. *Bus. Soc.* 49, 402–438. doi: 10.1177/0007650310368827
- Matthews, J., Stanley, T., and Davidson, P. (2018). Human factors and project challenges influencing employee engagement in a project-based organisation (PBO). *Int. J. Manag. Proj. Bus.* 11, 873–885. doi: 10.1108/IJMPB-04-2017-0043
- May, T., and Perry, B. (2006). Cities, knowledge and universities: transformations in the image of the intangible. *Soc. Epistemol.* 20, 259–282. doi: 10.1080/02691720600847290
- Meadows, D. (1999). *Leverage Points: Places to Intervene in a System*. Vermont: The Sustainability Institute.
- Meadows, D. H. (2008). *Thinking in Systems: A Primer*. ed. D. Wright (Vermont: The Sustainability Institute).
- Meuleman, L. (2013). "Cultural diversity and sustainability metagovernance" in *Transgovernance*. ed. L. Meuleman (Berlin, Heidelberg: Springer), 37–81.
- Meyer, J. P., and Gagné, M. (2008). Employee engagement from a self-determination theory perspective. *Ind. Organ. Psychol.* 1, 60–62. doi: 10.1111/j.1754-9434.2007.00010.x
- Mintzberg, H., and Westley, F. (1992). Cycles of organizational change. *Strat. Manage. J.* 13, 39–59. doi: 10.1002/smj.4250130905
- Morrison-Saunders, A., and Therivel, R. (2006). Sustainability integration and assessment. *J. Environ. Assess. Policy Manage.* 8, 281–298. doi: 10.1142/S1464333206002529
- Mullins, L. J. (1999). *Management and Organisational Behaviour*. New Jersey: Financial Times Prentice Hall.
- Murphy, R., and Jones, P. (2020). Leverage analysis: A method for locating points of influence in systemic design decisions. *FormAkademisk-Forskningstidsskrift for Design Og Designdidaktikk* 13, 1–25. doi: 10.7577/formakademisk.3384
- Niedlich, S., Kummer, B., Bauer, M., Rieckmann, M., and Bormann, I. (2020). Cultures of sustainability governance in higher education institutions: a multi-case study of dimensions and implications. *High. Educ. Q.* 74, 373–390. doi: 10.1111/hequ.12237
- Orlikowski, W. J. (1996). Improvising organizational transformation over time: a situated change perspective. *Inf. Syst. Res.* 7, 63–92. doi: 10.1287/isre.7.1.63

- Packalén, S. (2010). Culture and sustainability. *Corp. Soc. Resp. Environ. Manage.* 17, 118–121. doi: 10.1002/csr.236
- Pelletier, L. G., and Aitken, N. M. (2014). “Encouraging environmental actions in employees and in the working environment: a self-determination theory perspective” in *Oxford Library of Psychology. The Oxford Handbook of Work Engagement, Motivation, and Self-Determination Theory*. ed. M. Gagné (Oxford University Press), 314–334.
- Phillips, T. J., and Levin, H. (2015). Indoor environmental quality research needs for low-energy homes. *Sci. Technol. Built Environ.* 21, 80–90. doi: 10.1080/10789669.2014.975056
- Pope, J., Bond, A., Hugé, J., and Morrison-Saunders, A. (2017). Reconceptualising sustainability assessment. *Environ. Impact Assess. Rev.* 62, 205–215. doi: 10.1016/j.eiar.2016.11.002
- Porter, T., and Córdoba, J. (2009). Three views of systems theories and their implications for sustainability education. *J. Manag. Educ.* 33, 323–347. doi: 10.1177/1052562908323192
- Rauschmayer, F., Bauler, T., and Schöpke, N. (2015). Towards a thick understanding of sustainability transitions-linking transition management, capabilities and social practices. *Ecol. Econ.* 109, 211–221. doi: 10.1016/j.ecolecon.2014.11.018
- Reason, P. (2002). Justice, sustainability, and participation: inaugural professorial lecture. *Concepts and Transformations* 7, 7–29. doi: 10.1075/cat.7.1.03rea
- Reed, B. (2007). Shifting from ‘sustainability’ to regeneration. *Build. Res. Inf.* 35, 674–680. doi: 10.1080/09613210701475753
- Riemer, M., and Bickman, L. (2011). “Using program theory to link social psychology and program evaluation” in *Program Theory, Social Psychology and Evaluation*. eds. M. M. Mark, S. I. Donaldson and B. Campbell (New York: Guilford), 104–138.
- Riemer, M., Fernandes, D., and Taylor, A. (2018). Momentum for Change: A Culture of Sustainability engagement manual. Viessman Centre for Engagement and Research in Sustainability.
- Riemer, M., Kelley, S. D., Casey, S., and Taylor Haynes, K. (2012). Developing effective research-practice partnerships for creating a culture of evidence-based decision making. *Admin. Pol. Ment. Health* 39, 248–257. doi: 10.1007/s10488-011-0368-6
- Riemer, M., Lynes, J., and Hickman, G. (2014). A model for developing and assessing youth-based environmental engagement programmes. *Environ. Educ. Res.* 20, 552–574. doi: 10.1080/13504622.2013.812721
- Riemer, M., Reimer-Watts, K., Whitney, S., and Leitan-Claymo, S. (2021). When Visions Converge: The Unique Story of Co-Creating evolv1 as a Disruption to the Building Industry. Viessman Centre for Engagement and Research in Sustainability.
- Riemer, M., and Schweizer-Ries, P. (2012). Psychology and sustainability science: complexity, normativity, and transdisciplinarity in meeting sustainability challenges. *Umweltpsychologie* 16, 143–165.
- Robinson, J. (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecol. Econ.* 48, 369–384. doi: 10.1016/j.ecolecon.2003.10.017
- Robinson, J., and Cole, R. J. (2015). Theoretical underpinnings of regenerative sustainability. *Build. Res. Inf.* 43, 133–143. doi: 10.1080/09613218.2014.979082
- Rogers, E. (2003). *Diffusion of Innovations. 5th Edn.* New York: Free Press.
- Rotmans, J., and Loorbach, D. (2009). Complexity and transition management. *J. Ind. Ecol.* 13, 184–196. doi: 10.1111/j.1530-9290.2009.00116.x
- Salvioni, D. M., Franzoni, S., and Cassano, R. (2017). Sustainability in the higher education system: an opportunity to improve quality and image. *Sustain. For.* 9:914. doi: 10.3390/su9060914
- Schein, E. H. (1985). *Organizational Culture and Leadership*. San Francisco, CA: Jossey-Bass.
- Schwartz, H., and Davis, S. M. (1981). Matching corporate culture and business strategy. *Organ. Dyn.* 10, 30–48. doi: 10.1016/0090-2616(81)90010-3
- Senge, P. M. (1991). *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday.
- Shove, E. (2010). Beyond the ABC: climate change policy and theories of social change. *Environ. Plan. A* 42, 1273–1285. doi: 10.1068/a42282
- Shrubsole, C., Dimitroulopoulou, S., Foxall, K., Gadeberg, B., and Doutsis, A. (2019a). IAQ guidelines for selected volatile organic compounds (VOCs) in the UK. *Build. Environ.* 165:106382. doi: 10.1016/j.buildenv.2019.106382
- Shrubsole, C., Hamilton, I. G., Zimmermann, N., Papachristos, G., Broyd, T., Burman, E., et al. (2019b). Bridging the gap: the need for a systems thinking approach in understanding and addressing energy and environmental performance in buildings. *Indoor Built Environ.* 28, 100–117. doi: 10.1177/1420326X17753513
- Shrubsole, C., Macmillan, A., Davies, M., and May, N. (2014). 100 unintended consequences of policies to improve the energy efficiency of the UK housing stock. *Indoor Built Environ.* 23, 340–352. doi: 10.1177/1420326X14524586
- Smircich, L. (1983). Concepts of culture and organizational analysis. *Adm. Sci. Q.* 28, 339–358. doi: 10.2307/2392246
- Sterling, S. (2004). “Higher education, sustainability, and the role of systemic learning” in *Higher Education and the Challenge of Sustainability: Problematics, Promise and Practice*. eds. P. B. Corcoran and A. E. J. Wals (Dordrecht, The Netherlands: Kluwer), 49–70.
- Sterman, J. (2000). *System Dynamics: Systems Thinking and modeling for a Complex World*. ed. D. Richard (New York: Irwin/McGraw-Hill).
- Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., and Kalof, L. (1999). A value-belief-norm theory of support for social movements: the case of environmentalism. *Hum. Ecol. Rev.* 6, 81–97.
- Thiele, L. P. (2013). *Sustainability*. Wiley.
- Tsoukas, H., and Chia, R. (2002). On organizational becoming: rethinking organizational change. *Organ. Sci.* 13, 567–582. doi: 10.1287/orsc.13.5.567.7810
- Tudor, T. L., Barr, S. W., and Gilg, A. W. (2008). A novel conceptual framework for examining environmental behavior in large organizations—a case study of the cornwall national health service (NHS) in the United Kingdom. *Environ. Behav.* 40, 426–450. doi: 10.1177/0013916507300664
- Tuohy, P. G., and Murphy, G. B. (2015). Closing the gap in building performance: learning from BIM benchmark industries. *Archit. Sci. Rev.* 58, 47–56. doi: 10.1080/00038628.2014.975780
- UNESCO (2013). *Creative Economy Report* (2013). Paris: UNESCO. Available at: <http://unesco.de/kultur/2013/creative-economy-report-2013.html> (Accessed September 27, 2016).
- Van Poeck, K., and Vandenabeele, J. (2014). Education as a response to sustainability issues. *Eur. J. Res. Educ. Learn. Adults* 5, 221–236. doi: 10.3384/rela.2000-7426.rela0111
- van Steenbergen, F., and Schipper, K. (2017). Struggling With Justice in Transitions. In *Drift for Transition*. 1–12. Available at: <https://drift.eur.nl/wp-content/uploads/2017/12/Essay-Struggling-with-Justice-in-Transitions.pdf> (Accessed October 31, 2020).
- Vojnovic, I. (2014). Urban sustainability: research, politics, policy and practice. *Cities* 41, S30–S44. doi: 10.1016/j.cities.2014.06.002
- Wamsler, C., Schöpke, N., Fraude, C., Stasiak, D., Bruhn, T., Lawrence, M., et al. (2020). Enabling new mindsets and transformative skills for negotiating and activating climate action: lessons from UNFCCC conferences of the parties. *Environ. Sci. Pol.* 112, 227–235. doi: 10.1016/j.envsci.2020.06.005
- Wang, J., Yang, M., and Maresova, P. (2020). Sustainable development at higher education in China: a comparative study of students’ perception in public and private universities. *Sustain. For.* 12:2158. doi: 10.3390/su12062158
- Wargocki, P., and Wyon, D. P. (2013). Providing better thermal and air quality conditions in school classrooms would be cost-effective. *Build. Environ.* 59, 581–589. doi: 10.1016/j.buildenv.2012.10.007
- Williams, A. P. O., Dobson, P., Walters, M., and Walters, M. E. (1989). *Changing Culture: New Organizational Approaches*. London: Institute of Personnel Management.
- Worts, D. (2011). Culture and museums in the winds of change: the need for cultural indicators. *Cult. Local Govern.* 3, 117–132. doi: 10.18192/clg-cgl.v3i1.190

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Dreyer, Riemer, Spadafore, Marcus, Fernandes, Taylor, Whitney, Geobey and Dennett. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



How Can Transformative Sustainability Research Benefit From Integrating Insights From Psychology?

Thomas Bruhn*

Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany

Keywords: transformative research, transdisciplinarity, relationality, mental model, leverage points

INTRODUCTION—ESSENTIAL TRENDS IN SUSTAINABILITY RESEARCH

Over the last decades, the field of sustainability science has experienced trends toward (1) a transdisciplinary (Hirsch Hadorn et al., 2006; Jahn et al., 2012) and (2) systemic, relationship-based understanding of transformation (Clark and Harley, 2020) and (3) transformative research (Schneidewind et al., 2016; Fazey et al., 2018; Clark and Harley, 2020). A key feature of these trends is that they emphasize the roles of human subjectivity and agency in transformation processes (Manuel-Navarrete, 2001, 2015; Lang et al., 2017). In the following I would like to briefly introduce these trends as basis for later discussion on how psychology could help address specific challenges in this context.

From Environmental Science to Transdisciplinary Transformation Research

First, sustainability science has moved from focusing on the analysis of environmental issues toward a research field that aims at a transdisciplinary understanding of transformation (Kates, 2011). Discussions about sustainability were initially driven by environmental sciences and led to substantial research on resource efficiency, technological solutions, and their respective governance (Kates and Saito, 2001; Clark et al., 2005). Discussions on sufficiency and lifestyle changes originally attracted much less attention. Recently, this situation has shifted significantly. Many industrialized societies are facing challenges related to psychological health and well-being, stimulating the search for sustainable and mindful lifestyles (Kasser, 2003; Brown and Kasser, 2005). Today, there is broad agreement that human behavior patterns and lifestyles play crucial roles in the current crisis and influence future transformation pathways (Botkin et al., 2014; Lang et al., 2017). In light of this, integrating knowledge from various academic and non-academic sources has become a key feature of sustainability science.

From “Top-Down vs. Bottom-Up” to a Systems-Based Theory of Change

Second, the discourse on sustainability has seen the emergence of new theories of change that are based particularly on an understanding of complex, adaptive systems (Clark and Harley, 2020), integrating insights from various research fields based on relational ontologies (Oberlack et al., 2019). Originally having an emphasis on environmental (i.e., Earth-system) changes, the discourse

OPEN ACCESS

Edited by:

Giuseppe Carrus,
Roma Tre University, Italy

Reviewed by:

Daniel Fischer,
Wageningen University and
Research, Netherlands

*Correspondence:

Thomas Bruhn
thomas.bruhn@iass-potsdam.de

Specialty section:

This article was submitted to
Environmental Psychology,
a section of the journal
Frontiers in Psychology

Received: 06 March 2021

Accepted: 12 May 2021

Published: 17 June 2021

Citation:

Bruhn T (2021) How Can
Transformative Sustainability Research
Benefit From Integrating Insights From
Psychology?
Front. Psychol. 12:676989.
doi: 10.3389/fpsyg.2021.676989

on sustainability used to have a certain bias toward “top-down” analyses and “solutions” to preserve the stability of global ecosystems (Löfbrand et al., 2009). In parallel, bottom-up activities have driven local change processes, leading, for example, to the transition movement and other initiatives. Only in the last decade, these perspectives have become increasingly integrated into what several authors call a “systems view” (Capra and Luisi, 2014) or “relational paradigm” (Walsh et al., 2020; West et al., 2020) of sustainability research and transformation.

From Descriptive Science to Transformative Research

Third, the role of science in society has been shifting toward so-called transformative research that not only provides knowledge from a seemingly objective observer’s point of view, but also actively engages with stakeholders to integrate academic understanding into processes of taking action (Lang et al., 2012). Not long ago, scientific discourse and organizations were largely focusing on research *about* sustainability phenomena, providing results as advice to decision-makers and preserving the “independence” of academia (Mobjörk, 2010). The boundaries of these roles have increasingly become blurred and scientists and research institutions are exploring how to contextualize research processes in multi-stakeholder processes that are normatively oriented toward the common good (Schneidewind et al., 2016; Fazey et al., 2018).

DISCUSSION—WHY AND HOW THESE TRENDS CALL FOR AN INTEGRATION OF PSYCHOLOGY

All these trends are encountering challenges that create opportunities for psychology to contribute to sustainability-related research processes.

Transdisciplinarity—On the Challenge of Overcoming Knowledge Hegemonies

In the context of developing a transdisciplinary understanding of transformation, psychology can contribute a lot of *knowledge* on how to integrate aspects of human behavior into transformation processes and how to understand the generation and representation of knowledge in transdisciplinary research processes.

A key issue of a transdisciplinary understanding of sustainability lies in the field of behavioral change and lifestyles. A lot of scientific advice for decision-makers is being provided based on so-called integrated assessment models (IAMs) that (implicitly or explicitly) include assumptions about collective behavior and behavioral change (van Vuuren et al., 2011; Béatrice et al., 2019). Undoubtedly, psychology can offer important insights and tools to understand the aspects and mechanisms shaping lifestyle choices and collective behavioral changes. Here, psychology scholars should be actively involved in the design of these models, e.g., to examine how the assumptions of these highly influential models are consistent with the latest

psychological findings. For example, it seems crucial to me that sustainability-related discussions go beyond an individualistic understanding of the human being and its health and well-being. This could help create political incentive structures for behavior change that are not based on outdated understandings of the human being, like e.g., notions of a *homo economicus* which is still widespread in fields outside psychology, but widely criticized as inadequate in today’s psychology and sociology literature (Urbina and Ruiz-Villaverde, 2019). While there have already been substantial efforts in the field of psychology to contribute to sustainability, I see a great need for sustainability-related research institutions and programs to integrate psychological perspectives more pro-actively into transdisciplinary research processes to account adequately for the role of human behavior.

Another important contribution could lie in helping to understand the factors that shape processes of effective knowledge integration (Wiek, 2007). Transdisciplinarity aims at integrating various forms of knowledge (i.e., systems knowledge, orientation knowledge, transformation knowledge and process knowledge). In practice, this includes non-academic knowledge and experiential or tacit knowledge, and many research processes are struggling with this ambition because they are lacking expertise on how to examine the factors that “lie behind” the ways different knowledge is being represented. Thus, it is highly relevant to understand the motivations, aspirations, and drivers that shape knowledge representations in these processes. Psychological perspectives can provide valuable expertise on how knowledge is generated and processed, for example through the integration of reflexive practices such as mindfulness in the research process (Lang et al., 2017).

The Systems View—On the Challenge of Integrating Human Subjectivity

In the context of developing a systems-based theory of change, psychology can contribute a rich spectrum of empirical *methods* for investigating deeper systemic leverage points.

In a systems view, transformation processes are understood to be shaped by changing relationship patterns across systems and different leverage points for systemic change. Here, mental models, i.e., values, paradigms and belief systems, are considered as so-called deep-leverage points (Meadows, 1997; Abson et al., 2017).

Hence, as sustainability researchers are exploring the roles of subjectivity and mental models in transformation processes, they need methods that allow for an examination of these aspects. Psychology can either contribute its own, or help enhance existing non-psychological methods to integrate deeper and more complex understandings of human beings and their interactions in social contexts. As an example for this kind of synergetic work, I see the emerging community of so-called “psycho-social research” (Clarke, 2002, 2006; Clarke et al., 2018) that has integrated insights from psychoanalysis in the design of qualitative social science methods. Psycho-social research aims at reaching beyond narratives of a rational human being and tapping into the messy, contradictory, ambiguous “lived life,” e.g.,

by conducting life history interviews or by working with free associations and dreams (Hoggett, 2013).

Other exciting developments can be observed, for instance, in the context of adapting methods for systems constellations in contexts outside their origins in group or family psychology (Müller-Christ, 2018, 2019; Müller-Christ and Pijetlovic, 2018). Revealing patterns within human subjectivity and how they are reflected and manifested in inter-personal, social and even ecological relationships may play a key role in developing context-specific transformation strategies and practices. Researchers and organizations active in the context of sustainability should be open to the integration of these methods and the inclusion of related experts from psychology.

Transformative Research—On the Challenge of Engaging Meaningfully

In the context of transformative research, I see that psychology has expertise in a broad range of *practice-oriented tools* that could contribute to integrating and improving reflexive elements for engaging stakeholders in research processes.

In transformative research, academics go beyond the notion of a seemingly independent scientific observer and actively engage with relevant stakeholders to co-design responses to present challenges. Specific challenges arise from the fact that the knowledge of the different stakeholders involved may be grounded in very different normative and ontological or epistemological assumptions. This means that the research process may only partly be about generating and evaluating knowledge. Rather, it may likely involve dynamics triggered, e.g., from interpersonal conflicts between different normative notions, values and worldviews or cultural and historical backgrounds. For handling such dynamics and conflicts, it is recommended to include reflexive or diffractive practices that invite all participants to reflect upon the normative implications of their own activities and examine their own subjective biases and how they might influence their notions and actions (Lang et al., 2017; Fazey et al., 2018).

Here, the insights and experiences from psychotherapy and psychodynamics can offer resources for designing formats of interaction and engagement. Often, I have experienced how transformative research processes became dysfunctional not because of lacking or inappropriate knowledge, but because of subtle (often implicit) power and oppression dynamics and subsequent emotional distress on the part of the participants. Sustainability researchers may be largely unaware of these dimensions of their work and scientific institutions often may not have the capacities to include professional facilitators that are trained to handle more profound conflicts and vulnerabilities. My experience is that sustainability-related conflicts—such as experience of injustice, colonialization, oppression, or marginalization—are influencing transformative research processes more than the responsible researchers are aware of. Fostering an understanding for the occurrence and careful handling of these dynamics seems crucial for successful transformative research in the future. Psychological schools have

a successful history and solid evidence base to provide the expertise for addressing this gap.

As final outlook I would like to mention the idea of creating and holding specific spaces in which change agents can explore and transform their own behavior patterns and even institutional settings as part of transformation processes. For example, I have been very inspired by learning about the “carbon conversations” co-initiated by the psychotherapist Rosemary Randell in which citizens can collectively explore the psychological roots of and obstacles to their behavior and learn climate-friendly behavior patterns together (Randall, 2009). Also, in the context of organizational leadership, containment (Bion, 1985) is essential and well-established as a way to navigate change processes. I am wondering to what extent it might be possible to establish such spaces and routines of containment strategically for enabling transformation processes with stakeholder groups. It may seem a farfetched notion now, but in the face of the dawning ecological crises, the exhaustion and distress of the relevant stakeholders and institutions seems obvious to me, and it is becoming essential to open new pathways for working through existing conflicts. Psychological and psychotherapeutic approaches have gained significant expertise in how to design and conduct such processes to support personal health and well-being. For the sake of planetary health (Horton et al., 2014), maybe one day we will witness a kind of “*planetary containment initiative*.”

SUMMARY

I have reflected upon current trends in sustainability science and how psychology-based insights can contribute to addressing specific challenges arising as part of these trends. In the context of moving toward a transdisciplinary and systemic understanding of transformation and toward transformative research, psychology can contribute to a more holistic conceptualization of socio-ecological transformation. In particular, it can offer insights into the nature of human behavior and its interaction with social context dynamics. Moreover, psychology can offer methods to describe patterns of human subjectivity and how they are entangled in larger systems dynamics. On the practical side, psychological practices can provide expertise on how to design and facilitate co-creative learning and meaning-making spaces that go beyond creative practice: by allowing for the exploration and transformation of deeper root causes of conflicts that are often inherent to stakeholder engagement.

AUTHOR CONTRIBUTIONS

TB has conceptualized and written the manuscript.

FUNDING

The IASS Potsdam is funded by the German Federal Ministry for Research and Education and the Brandenburg Ministry for Science, Research and the Arts. My research and all related costs are entirely funded from the core budget of the IASS Potsdam.

ACKNOWLEDGMENTS

I would like to acknowledge helpful discussions with Man Fang and the participants of the dialogues of the WorkFace Berlin

REFERENCES

- Abson, D. J., Fischer, J., Leventon, J., Newig, J., Schomerus, T., Vilsmaier, U., et al. (2017). Leverage points for sustainability transformation. *Ambio* 46, 30–39. doi: 10.1007/s13280-016-0800-y
- Béatrice, C., Christophe, C., and Alain, N. (2019). Organising policy-relevant knowledge for climate action: integrated assessment modelling, the IPCC, and the emergence of a collective expertise on socioeconomic emission scenarios. *Sci. Technol. Stud.* 32:65031. doi: 10.23987/sts.65031
- Bion, W. R. (1985). Container and contained. *Group Relat. Reader* 2, 127–133.
- Botkin, J. W., Elmandjra, M., and Malitz, M. (2014). *No Limits to Learning: Bridging the Human Gap: The Report to The Club of Rome*. Rome: Elsevier.
- Brown, K. W., and Kasser, T. (2005). Are psychological and ecological well-being compatible? the role of values, mindfulness, and lifestyle. *Soc. Indic. Res.* 74, 349–368. doi: 10.1007/s11205-004-8207-8
- Capra, F., and Luisi, P. L. (2014). *The Systems View of life: A Unifying Vision*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511895555
- Clark, W. C., Crutzen, P. J., and Schellnhuber, H. J. (2005). *Science for global sustainability: toward a new paradigm*. Cambridge: Center for International Development, Harvard University. doi: 10.2139/ssrn.702501
- Clark, W. C., and Harley, A. G. (2020). Sustainability science: toward a synthesis. *Ann. Rev. Environ. Res.* 45, 331–386. doi: 10.1146/annurev-environ-012420-043621
- Clarke, S. (2002). Learning from experience: psycho-social research methods in the social sciences. *Qual. Res.* 2, 173–194. doi: 10.1177/146879410200200203
- Clarke, S. (2006). Theory and Practice: Psychoanalytic sociology as psycho-social studies. *Sociology* 40, 1153–1169. doi: 10.1177/0038038506069855
- Clarke, S., Hahn, H., and Hoggett, P. (2018). *Object Relations and Social Relations: The Implications of the Relational Turn in Psychoanalysis*. London: Routledge. doi: 10.4324/9780429477669
- Fazey, I., Schöpke, N., Caniglia, G., Patterson, J., Hultman, J., van Mierlo, B., et al. (2018). Ten essentials for action-oriented and second order energy transitions, transformations and climate change research. *Energy Res. Soc. Sci.* 40, 54–70. doi: 10.1016/j.erss.2017.1.1026
- Hirsch Hadorn, G., Bradley, D., Pohl, C., Rist, S., and Wiesmann, U. (2006). Implications of transdisciplinarity for sustainability research. *Ecol. Econ.* 60, 119–128. doi: 10.1016/j.ecolecon.2005.12.002
- Hoggett, P. (2013). “Doing psycho-social research,” in *Métodos Socioanalíticos Para la Gestión y el Cambio en Organizaciones*, eds E. Acuña and M. Sanfuentes (Santiago de Chile: Editorial Universitaria de Chile).
- Horton, R., Beaglehole, R., Bonita, R., Raeburn, J., McKee, M., and Wall, S. (2014). From public to planetary health: a manifesto. *Lancet* 383:847. doi: 10.1016/S0140-6736(14)60409-8
- Jahn, T., Bergmann, M., and Keil, F. (2012). Transdisciplinarity: between mainstreaming and marginalization. *Ecol. Econ.* 79, 1–10. doi: 10.1016/j.ecolecon.2012.04.017
- Kasser, T. (2003). *The High Price of Materialism*. Cambridge: MIT press. doi: 10.7551/mitpress/3501.001.0001
- Kates, R. W. (2011). What kind of a science is sustainability science? *Proc. Natl. Acad. Sci. U.S.A.* 108, 19449–19450. doi: 10.1073/pnas.1116097108
- Kates, R. W., and Saito, O. (2001). Sustainability science. *Science* 292, 641–642. doi: 10.1126/science.1059386
- Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., et al. (2012). Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustainab. Sci.* 7, 25–43. doi: 10.1007/s11625-011-0149-x
- Lang, D. J., Wiek, A., and von Wehrden, H. (2017). Bridging divides in sustainability science. *Sustainab. Sci.* 12, 875–879. doi: 10.1007/s11625-017-0497-2
- Lövbrand, E., Stripple, J., and Wiman, B. (2009). Earth system governmentality. Reflections on science in the anthropocene. *Glob. Environ. Change* 19, 7–13. doi: 10.1016/j.gloenvcha.2008.10.002
- Manuel-Navarrete, D. (2001). *Approaches and Implications of Using Complexity Theory for Dealing With Social Systems*. New Haven, CT: Yale University.
- Manuel-Navarrete, D. (2015). Double coupling: modeling subjectivity and asymmetric organization in social-ecological systems. *Ecol. Soc.* 20:26. doi: 10.5751/ES-07720-200326
- Meadows, D. (1997). Places to intervene in a system. *Whole Earth* 91, 78–84. doi: 10.2307/2265925
- Mobjörk, M. (2010). Consulting versus participatory transdisciplinarity: a refined classification of transdisciplinary research. *Futures* 42, 866–873. doi: 10.1016/j.futures.2010.03.003
- Müller-Christ, G. (2018). *Komplexe Systeme erkunden: Antworten ohne zu fragen durch Systemaufstellungen*. Munich: Zwischen Ohnmacht und Zuversicht.
- Müller-Christ, G. (2019). “Aufstellungsarbeit in der Wissenschaft und Konturen einer Aufsteller/innen-Wissenschaft,” in *Praxishandbuch Aufstellungsarbeit: Grundlagen, Methodik und Anwendungsgebiete*. eds C. Stadler and B. Kress (Wiesbaden: Springer Fachmedien Wiesbaden). doi: 10.1007/978-3-658-18152-9_44-1
- Müller-Christ, G., and Pijetlovic, D. (2018). *Komplexe Systeme Lesen - Aufstellungen in Wissenschaft und Praxis*. Heidelberg: Springer Gabler. doi: 10.1007/978-3-662-56796-8_2
- Oberlack, C., Thomas, B., Markus, G., Nicole, H., and Karl, H. (2019). Theories of change in sustainability science: understanding how change happens. *GAIA* 28, 106–111. doi: 10.14512/gaia.28.2.8
- Randall, R. (2009). Loss and climate change: the cost of parallel narratives. *Ecopsychology* 1, 118–129. doi: 10.1089/eco.2009.0034
- Schneidewind, U., Singer-Brodowski, M., and Augenstein, K. (2016). “Transformative science for sustainability transitions,” in *Handbook on Sustainability Transition and Sustainable Peace* (Heidelberg: Springer). doi: 10.1007/978-3-319-43884-9_5
- Urbina, D. A., and Ruiz-Villaverde, A. (2019). A critical review of homo economicus from five approaches. *Am. J. Econ. Sociol.* 78, 63–93. doi: 10.1111/ajes.12258
- van Vuuren, D. P., Lowe, J., Stehfest, E., Gohar, L., Hof, A. F., Hope, C., et al. (2011). How well do integrated assessment models simulate climate change? *Clim. Change* 104, 255–285. doi: 10.1007/s10584-009-9764-2
- Walsh, Z., Böhme, J., and Wamsler, C. (2020). Towards a relational paradigm in sustainability research, practice, and education. *Ambio* 2020, 1–11. doi: 10.1007/s13280-020-01322-y
- West, S., Haider, L. J., Stalhammar, S., and Woroniecki, S. (2020). A relational turn for sustainability science? Relational thinking, leverage points and transformations. *Ecosyst. People*. 16, 304–325. doi: 10.1080/26395916.2020.1814417
- Wiek, A. (2007). Challenges of transdisciplinary research as interactive knowledge generation—experiences from transdisciplinary case study research. *GAIA Ecol. Perspect. Sci. Soc.* 16, 52–57. doi: 10.14512/gaia.16.1.14

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Bruhn. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



FridaysForFuture as an Enactive Network: Collective Agency for the Transition Towards Sustainable Development

Denis Francesconi^{1,2*}, Vasileios Symeonidis³ and Evi Agostini^{4*}

¹Danish School of Education, Aarhus University, Aarhus, Denmark, ²Department of Teacher Education, University of Vienna, Vienna, Austria, ³Institute of Education Research and Teacher Education, University of Graz, Graz, Austria, ⁴Department of Teacher Education and Department of Education, University of Vienna, Vienna, Austria

OPEN ACCESS

Edited by:

Daniel Fischer,
Wageningen University and Research,
Netherlands

Reviewed by:

Mandy Singer-Brodowski,
Freie Universität Berlin, Germany
Marlyne Sahakian,
Université de Genève, Switzerland
Juergen Budde,
University of Flensburg, Germany

*Correspondence:

Denis Francesconi
denis.francesconi@univie.ac.at
Evi Agostini
evi.agostini@univie.ac.at

Specialty section:

This article was submitted to
Special Educational Needs,
a section of the journal
Frontiers in Education

Received: 30 November 2020

Accepted: 04 May 2021

Published: 28 June 2021

Citation:

Francesconi D, Symeonidis V and
Agostini E (2021) FridaysForFuture as
an Enactive Network: Collective
Agency for the Transition Towards
Sustainable Development.
Front. Educ. 6:636067.
doi: 10.3389/feduc.2021.636067

In this article, we provide a theoretical conceptual analysis of FridaysForFuture (FFF) and of its effort in promoting the governance of socioeconomic transition toward sustainable development. FFF is a social movement that has received outstanding public recognition and visibility across the world in the last 2 years and is of great interest to educational research because it is largely composed of youngsters and appears to play a paideutic role in societal innovation. There is a growing but still limited body of investigation of FFF's structures, genealogy, and behavior. The same goes for its theoretical and ethical background and principles. Its efforts to promote social change by going beyond individual agency toward collective agency deserve greater attention from educational scientists. We argue that FFF is a complex, self-organizing, informal network, which we define as an enactive network for its ability to retrieve scientific knowledge and transform it into lived meaningful knowledge, and for its capacity to mobilize masses and influence public discourse under a specific ethical umbrella. We provide six macro categories to describe and explain FFF: 1) nested emergent network, 2) collective social agency and leadership, 3) political impact, 4) science-based learning and activism, 5) paideutic function, and 6) ethical (normative) stance. We stress the FFF capacity to recruit high-level scientific knowledge without direct support from schools, and embody strong ethical stances with specific references to the ethics of responsibility and care for the interaction between humanity and the natural world. Finally, we suggest that FFF can be interpreted as an enactive network with the ability to affect collective identity and empower collective agency by encouraging communities into a more scientific, evidence-based, and ethical public discourse.

Keywords: FridaysForFuture, enactive network, collective agency, education for sustainable development, climate change, enactive embodied cognition, systems theory, socio-ecological systems

INTRODUCTION

Recent socioeconomic and ecological crises, such as COVID-19 and climate change, have presented serious challenges to human systemic homeostasis, safety, and continuity, and require prompt and adequate responses from human communities. The response of human systems to such novel and profound crises, however, cannot consist of the mechanical implementation of a preestablished set of behaviors or values, as normally happens in the context of standard emergency procedures with the

automatic implementation of detailed preplanned actions (e.g., emergency evacuation of a ship). The current crisis in which the whole of humanity find itself is new, profound, and dramatic, and standard responses do not seem adequate in the face of such situations (Steffen et al., 2015; Walker et al., 2020). Human communities' capacity to respond should rather be conceived of as a dynamic, iterative process of coevolution between the response itself and the evaluation of the effects of previous responses, as is the case with continuous behavior monitoring (Clark, 2013). Moreover, the coevolution of action and response evaluation is usually supervised by normative ethical stances intended to provide intentional teleology and values frameworks that make evaluation possible. No collective and systemic human actions are neutral in their assumptions—or in their consequences—as they tend to derive from a set of ethical principles that guide practical decision-making, at least formally. It is well established that profound crises such as the current one require new ethical frameworks that are capable of prompting new responses and strategies (Folke et al., 2005; Steffen et al., 2015; Walker et al., 2020).

In this study, we provide a theoretical conceptual analysis of *FridaysForFuture* (FFF) and its intended aim of effecting socioeconomic and ecological changes through the promotion of sustainable development in its various forms. FFF is a macro-social movement that has received outstanding public recognition worldwide and gained visibility over the last 2 years. It is of great interest to educational research since it is largely composed of youngsters and seems to play a *paideutic* role in relation to societal innovation, being able to autonomously collect and share complex forms of scientific knowledge, transforming them and then enacting them in society in order to trigger collective awareness and agency. In contrast with formal schooling, FFF is a bottom-up movement, an emergent self-organizing network, providing pedagogical activities to peers and adults to support the sustainability discourse and promote social engagement at all levels of society (Kühne, 2019; Stratton, 2021). We argue that FFF is a complex, nested, and informal network, which we define as an *enactive network* due to its capacity to retrieve scientific knowledge and transform it into *lived knowledge* enacted in the real world. FFF aims to distribute such knowledge, mobilize large numbers of people, and influence public discourse under an explicit though nonhomogeneous ethical umbrella.

Social movements are powerful arenas for learning how to initiate societal change, gain transformative agency, and develop critical thinking (Kajamaa and Kumpulainen, 2019). The motivational and interactional intensity of social movements is often seen as a desirable model for human learning and education in general (Sannino et al., 2016). There is vast literature in the field of learning and social movements. However, little research has been conducted from the point of view of enactive theory and enactive learning within social movements, especially within FFF. With our study, we want to contribute to establish enactive theory as a paradigm for the study of learning within social movements. Our hypothesis is that FFF represents an innovative model for connecting learning and activism, education and politics, embodied and virtual life, and individual and collective

perspectives, and for promoting students' agency as well as student–scientist collaboration on sustainable social innovation.

So far, there has been scarcely any investigation of FFF's structures, genealogy, and behavior (Cattell, 2021). The same goes for its theoretical, pedagogical, political, and ethical background and principles (Biswas and Mattheis, 2021). As highlighted by Shove (2010), issues of climate change are often (politically) framed in terms of individual behavior and personal responsibility. However, values and ideals do not often result in action, attitude, or behavioral change. Nonetheless, the efforts of FFF to promote social and ecological change through collective agency go beyond mere individual agency and deserve more attention from educational scientists. We use *embodied and enactive cognition theory* (EC) (Gallagher and Francesconi, 2012; Varela et al., 2016) and *systems theory* (Folke et al., 2005; Papachristos et al., 2013) as theoretical frameworks for analyzing the collective agency and pedagogical–ethical implications of FFF.

In line with the theme of this special section, we aim to describe the primacy of collective agency over individual agency in FFF in the face of the increasing urgency of sustainability-related transformation and to provide theoretical conceptual insights as the basis for further educational research. Instead of focusing exclusively on intraindividual behavior analysis, we propose the enactive and systemic approach to frame and explain how collective agency is becoming predominant in the development of solutions to the crisis. Such a comprehensive perspective not only increases the ecological credentials of psychological and educational research but also provides fruitful insight into guiding real-world transformation processes toward sustainability. Our study undertakes theoretical conceptual analysis (Kahn and Zeidler, 2017) of the FFF's structure and behavior in order to provide specific answers.

This article focuses on three points. First, it explains why systemic and enactive approaches can provide new insights into FFF's embodied knowledge and agency. Second, it develops six analytic descriptors of FFF in order to offer a richer description of FFF that should be of use to the scientific community in the context of further theoretical and empirical analyses of this and similar social phenomena. Third, drawing on our theoretical conceptual analysis, we provide insights into, and interpretations of, the role of FFF. The article concludes with suggestions for research to foster sustainable development.

ENACTIVE NETWORK: EMBODYING KNOWLEDGE

A range of environmental psychology and education research has explored sustainability-related learning and behavior at the level of the individual (Giusti et al., 2017; Albrecht, 2020). Various theories from social and behavioral psychology and the educational sciences have been applied to gain an understanding of the awareness, motivation, and normative aspects underlying the ecologically and socially responsible use of resources (Roczen et al., 2014). Non-reductionist approaches

such as the embodied cognition theory and enactivism have also been brought to the exploration of these topics, but they continue to focus on the individual and on small-scale aspects of sustainability (Giusti et al., 2017; Albrecht, 2020). We apply embodied and enactive cognition theory (EC) (Thompson, 2007; Francesconi and Tarozzi, 2012; Gallagher and Zahavi, 2012; Varela et al., 2016) to FFF as a social movement that is keen to draw attention to sustainability issues.

EC is a relatively new research program within cognitive science that has spread into philosophy, psychology, neuroscience, and education (Di Paolo et al., 2010; Francesconi and Tarozzi, 2012; Agostini and Francesconi, 2020; Ryan and Gallagher, 2020). It is strongly critical of both Cartesian dualism—the ontological separation of body and mind and subject and nature—and computationalism—the view of the mind as an information-processing computer (Froese and Di Paolo, 2011; Gallagher, 2014). Enactivism looks at the mind and cognition as the process that emerges from the nonlinear interaction of the brain–body–environment (Thompson, 2007; Francesconi and Tarozzi, 2012; Gallagher and Zahavi, 2012; Varela et al., 2016). The enactive approach emphasizes biological embodiment and social interaction as the sources of real-life goals and concerns. Mind is viewed as active sense-making in the context of embodied interaction with the world. Enactive cognition means that knowledge is acted out in the real *lived world* (*Lebenswelt*) in a constant attribution of sense to the lived experience (Gallagher, 2014; Kiverstein and Rietveld, 2018). In this sense, the enactive approach does not consider the mind merely as a receptacle for information. The enactive mind, although undoubtedly involved in the cybernetic cycle of information input and output, goes far beyond that, suggesting that cognition represents the capacity of the subject as an agent to produce sense from *being-in-the-world*, in the ongoing subjective experience defined by a specific body, a specific environment, and in a specific moment (Thompson, 2007; Kiverstein and Rietveld, 2018; Ryan and Gallagher, 2020). Thus, knowledge is not represented as if in a mirror but instead is embodied and carried forward in interaction with the world. Enactive cognition helps to bridge the gap between mind and nature and between the individual and the collective, and can support the study of the interplay between collective agency and social structures (Froese and Di Paolo, 2011; Maiese and Hanna, 2019; Ransom and Gallagher, 2020). This theoretical position is now widely accepted by cognitive scientists, philosophers, and psychologists engaged in describing and studying the individual mind (Shapiro, 2014; Newen et al., 2018). Nevertheless, what can enactive cognition say about the collective mind, and collective movements and organizations? This theme has had less investigation and has been less extensively clarified.

Against this background, collective agency in the context of climate change as seen in FFF can be understood as a dynamic counterweight to formal education since it is based on the provision of opportunities for children to learn directly from peers and scientists. This social movement also invites us to rethink the formal boundaries of education systems/schools and challenges us to investigate further the pedagogical potential of

bottom-up informal networks (see *FridaysForFuture: An Enactive Network?* section). Whereas the systems theory is relatively common in environmental and ecological studies (Folke et al., 2005), the choice of EC is original because, so far, embodied and the enactive theory has generally been applied to the study of intrapersonal, personal, or small group activities and not to larger scale intersubjective social movements, organizations, or institutions. This is partially understandable as EC was developed within the cognitive sciences during the 1990s, when the study of the mind was dominated by experimental psychology, neuroscience, and biology. Research at that time was focused on intrapersonal and personal descriptions rather than social, collective, and political ones. However, the lack of attention given by EC to macro-social activities is surprising when we consider that the original text on EC—entitled “The Embodied mind. Cognitive science and human experience” (Varela et al., 2016)—devoted an entire chapter to the theme of *social mind* as seen from the enactive perspective (see chapter 6). Only recently, some initial attempts have been made to extend the application of enactivism to macro-social phenomena. Relevant examples are Maiese and Hanna’s enactive approach to political science and politics (2019), and a few attempts to take an enactive approach to institutions and economics (Petracca and Gallagher, 2020; Ransom and Gallagher, 2020). Our study follows the same line of thinking, which we believe has potential for the social sciences and educational science; we adopt EC as a theoretical lens through which to consider FFF and explore its attempts to bridge the gaps between mind and nature, the individual and the collective, and the personal and the social, from a normative, political, and ethical perspective.

In doing so, the first points to consider in terms of convergence of individual enactivism and macro-social phenomena are that even macro-social phenomena—such as *FridaysForFuture* and others—have identity and intentionality, intrinsic beliefs, norms, and thoughts, and demonstrate future-oriented, predictive behavior framed in a way that is meaningful for the network (Petracca and Gallagher, 2020; Ransom and Gallagher, 2020). Such networks are of necessity embodied by specific individuals, embedded in a given physical and social environment, and enacted in the real world through consciousness and intentionality.

Now, the capacity to govern the transition at the systemic level, more than the transition itself, is said to be a critical issue for our times (Walker et al., 2020). There is a lack of systemic governmental capacity to direct collective agency in an inclusive, participative, and responsible manner (Lima, 2019). The capacity to control human systems during socio-ecological transitions has been related to the cognitive and learning capacities of systems themselves (Folke et al., 2005; Smith et al., 2005). Acquiring and distributing knowledge, advocating for a specific common ethical narrative and teleology, and calling for a global identity and awareness are all enactive features brought by FFF to the table of public discourse. In the following section, we discuss six theoretical conceptual features of FFF from the EC and systemic perspectives.

FRIDAYSFORFUTURE: AN ENACTIVE NETWORK?

On August 20, 2018, the then 15-year-old student Greta Thunberg posted an image of herself outside Sweden's parliament holding a handmade cardboard sign reading "Skolstrejk för klimatet" (school strike for climate). She was demonstrating alone against the lack of action on climate change by the Swedish government. Soon afterward, the hashtags #FridaysForFuture (FFF) and #SchoolStrikeforClimate went viral and became a worldwide social movement involving thousands of young people and adults both online and in the streets, and attracting media and political attention. In 2019, several other networks emerged in support of FFF, such as *ScientistsforFuture* (S4F), *EntrepreneursforFuture* (E4F), *SchoolsforFuture*, *TeachersforFuture*, and *ParentsforFuture*. The initial activity of just one teenager—more recently supported by other communities and interests coming together, for example, the degrowth movement and the green economy—has snowballed hugely and inspired many others, growing from one individual to thousands of people all around the world in only two years. Today, there are over 200 regional, national, and international FFF Social Media channels (Instagram, Twitter, YouTube, and Facebook) with over 20 million followers (FridaysForFuture, 2020a). The school strikes in the last year before the COVID-19 emergency involved millions of people all around the world, making FFF one of the biggest social movements in human history (FridaysForFuture, 2020b). The 2019 Global Week for Future, for instance, was a series of 4,500 strikes across more than 150 countries, focused around Friday 20 September and Friday 27 September. Likely the largest climate strikes in world history, the 20 September strikes, attracted roughly 4 million protesters; many of them were schoolchildren (idem).

One study has shown that FFF is composed of very young people, mostly female (Wahlström et al., 2019), and another recently revealed that FFF is contributing to climate change awareness (Deisenrieder et al., 2020). *FridaysForFuture* has spread through both the embodied and the virtual dimensions. The embodied dimension consists of real actions such as school strikes, discourses, initiatives (e.g., *Lausanne Declaration* and *Unite Behind Science* initiative), and educational activities (FFF's training campus and courses, e.g., *Smile Campus* 2019) (FridaysForFuture, 2020a). The virtual dimension arose immediately after Greta Thunberg's first strikes, with the twitter hashtags starting to spread quickly within the online community. With the onset of the COVID-19 pandemic, the virtual dimension has become even more important. Consisting mostly of a community of digitally literate youngsters, FFF adapted immediately to the new situation, switching to virtual strikes, online training and learning activities, and digital activism (Hunger and Hutter, 2020).

Below, we present six categories that we have adopted as analytic descriptors of FFF and that could also be adopted in qualitative and quantitative empirical studies in further educational and psychological research into the nature, functions, and impact of FFF's collective agency or other

emergent enactive movements. The six categories emerged from the theoretical conceptual analysis (Kahn and Zeidler, 2017) of FFF documents and websites.

Nested Emergent Network

The complex systems theory and enactive cognition suggest that FFF can be considered as a complex dynamic network composed of a range of other nested networks; it is like a meta-network with a fractal structure based on multilevel agency and distributed learning (Castellano et al., 2009; Clark, 2013; Rodi et al., 2015). Such a meta-network operates as an informal network and also aims to bring innovative potential to typical school structures, which are often centralized, hierarchical, and disembodied (Francesconi and Tarozzi, 2012). FFF has a nested and fractal structure both internally and externally (extended). Despite the existence of a central core represented by *FridaysForFuture International*, there is no strict hierarchical organization. Instead, it espouses bottom-up activism and personal collaborative engagement (FridaysForFuture, 2020a; Whang, 2020). Indeed, there are a number of smaller groups operating as sibling nodes of the macro FFF network. Such nodes are themselves nested and fractal. Consideration of one of them, for instance, FFF Italy, reveals a number of sub-nodes operating under distributed logic, such as FFF Rome, FFF Milan, and FFF Naples. This kind of fractal structure extends downward to individual schools or even classrooms and students.

This aspect—the highly interconnected and entangled internal structure of FFF—is of relevance for at least two reasons: first, it demonstrates a high capacity for self-organization based mostly on nonhierarchical and distributed leadership and agency. This is a rare attribute in vast and complex international networks and is something many formal organizations and companies constantly seek to achieve but hardly ever accomplish. Second, all layers of the systems appear to be interconnected both in reality and virtually. This increases knowledge transmission and improves the coordination of action but also boosts participation and engagement (Deisenrieder et al., 2020). In addition to its internal structure, FFF has developed an external network that extends into other fields such as science and economy but also draws in schools and parents. Indeed, FFF has created collaborations with a new range of networks—which are similar to FFF and emerged as one of the concrete side effects of FFF—such as *Scientists4Future*, *Entrepreneurs4Future*, *Teachers4Future*, and *Parents4Future*. Such expansion is vital for FFF. For instance, it is from the connection with *Scientists4Future* that FFF gains most of the technical and scientific knowledge used in its discourses and initiatives, and that it then disseminates *via* its own social media accounts. Moreover, it is in partnership with entrepreneurs, teachers, parents, and politicians—and again with scientists—that FFF has developed most of its specific sustainability solutions (FridaysForFuture, 2020a).

In this sense, the extended organization of FFF amplifies its capacity to put collective ideas into action, and to bring collective sustainability ideals and ethical values into the real world (Di Paolo et al., 2010; Zabern and Tulloch, 2020). FFF is both an embodied and a digital movement, and it brings enactivism as

knowledge-in-action to both the real and the virtual world, showing that the two dimensions are not only compatible but can actually reinforce each other in a nexus of interactions that would certainly merit further investigation. The movement began with an embodied—and solitary—action by Greta Thunberg, but this action soon reverberated in the virtual world, and from there, in a self-reinforcing loop, it grew rapidly to become one of the most relevant social movements of the last decade (FridaysForFuture, 2020b). That first embodied action had an impact on the online world, and the online world then triggered more embodied actions in the real world, and so on for 2 years, creating the highly interconnected structure of FFF today (Brünker et al., 2019).

Collective Social Agency and Leadership

Combining collective agency with strong iconic leadership is a complicated undertaking, but FFF seems to have succeeded. Collective agency means that a system is able to act as a unity, to behave in a coordinated manner in line with a common narrative, and to pursue common goals (Brünker et al., 2019). The relationship between individual intentionality and its behavior is often not linear and unclear; group's agency is even more problematic due to the high number of individuals—and therefore the many individual purposes—that it is composed of. The bigger the system, the harder it is for it to feel and behave like a unity. Size is a direct indicator of group cohesion or division (Castellano et al., 2009). Like many other social movements in history, but probably more so than many, FFF demonstrates significant capacity to combine the empowerment of bottom-up collective agency and identity with a strong and highly recognizable leadership (Stratton, 2021). FFF appears to behave as a coherent unit, integrated in terms of meaning and distributed in terms of agency over a very large number of nodes all around the planet (Scheitle, 2020). The governance of such a massive network can be problematic *per se*, but in the case of FFF governance, as well as in many other social movements, in fact, it equates to self-governance. In this context, rather than guiding the network, the leadership primarily reinforces it.

Along with its leadership, probably one of the key aspects promoting FFF self-governance is its strong sense of mission-oriented engagement, a greater collective ethical aspiration in which all members are deeply immersed (Moor et al., 2020). The causes of climate change, the drive for sustainability, and the sense of urgency that often goes along with it are among the reasons that are behind the internal cohesion of the movement, and the motivation and involvement of thousands of youngsters. Like any movement or large group, FFF needs to reinforce its identity and remain internally compact and solid in order to cope with its dispersion. This is achieved through short, constant, and coherent messages on online platforms that enable FFF to retain its core purpose and the critical mass required to have a tangible impact on public discourse and policy stakeholders at a macro-level. Collective agency can only function if large numbers of the internal nodes of the network are operational and are moving in the same direction. This is not easy to maintain over a long period. It will be interesting to monitor FFF going forward for any

signs of decline or contraction in terms of collective organization and participation, as some researchers have already started to observe (Hunger and Hutter, 2020).

Greta Thunberg, who is a rare example of a young female being known worldwide as the leader of a massive social movement (Stratton, 2021), often explains that she is not the leader but only the spokesperson (Whang, 2020). Indeed, despite her determination and motivation, she appears to be very far from the stereotypical model of resolute, strong, and symbolically masculine leadership that is so common in Western organizations and networks. Nevertheless, or perhaps because of this discrepancy, the coordination of the school strikes and all the other initiatives around the world in the course of the last 2 years was astonishing, particularly considering that the large majority of organizers were underage students. This shows that FFF has a high capacity for self-organization and bidirectional internal coordination and decision-making, from the center to the periphery of the network and back (Meade, 2020).

Political Impact

FFF has also had a significant impact on politics and policy at an international level. Many important figures have started citing or quoting *FridaysForFuture* and Greta Thunberg as the source of, and inspiration for, new national and international policies. Among them, German Chancellor Angela Merkel has declared that “The seriousness with which Greta, but also many, many other young people, are telling us that this is about their lives has led us to approach the matter more resolutely” (Gaida, 2019). In her *Agenda for Europe*, the president of the European Commission, Ursula von der Leyen, states that she has been “inspired by the passion, conviction, and energy of the millions of our young people making their voice heard on our streets and in our hearts. They are standing up for their future and it is our generational duty to deliver for them” (European Commission. Directorate General for Communication and Leyen (2019)). On March 15, 2019, UN Secretary-General António Guterres admitted that his “generation has failed to respond properly to the dramatic challenge of climate change. This is deeply felt by young people. No wonder they are angry” (Guterres, 2019). On June 7, 2019, *FridaysForFuture* and Greta Thunberg became recipients of Amnesty International's Ambassador of Conscience award, and more recently, Greta Thunberg has been nominated for the Nobel Peace Prize. These and many other statements show that FFF has succeeded in conquering public political discourse and the worldwide media, and that the FFF narrative has become part of political agendas, documents, and resolutions. The extent to which such conquer is actual and not simply political/policy “green-washing” is beyond the scope of this study but would undoubtedly be worth further investigation and empirical analysis.

FFF has also provoked bitter criticism from politicians and hate speech from certain parts of the internet. Australian Prime Minister Scott Morrison told Parliament that “what we want is more learning in schools and less activism” (Wilkinson, 2018). United Kingdom former Prime Minister Theresa May criticized the strikes, saying that “Everybody wants young people to be engaged in the issues that affect them most so that we can build a

brighter future for all of us. But it is important to emphasize that disruption increases teachers' workloads and wastes lesson time that teachers have carefully prepared for" (McGuinness, 2019). On their website, FFF responded: "Why are kids striking? School children are required to attend school. But with the worsening Climate Destruction, this goal of going to school begins to be pointless. Why study for a future which may not be there? Why spend a lot of effort to become educated, when our governments are not listening to the educated?" (FridaysForFuture 2020a)

Is it true that FFF does not provide educational and learning experiences and that it is a waste of time? Does less activism mean more learning? What kind of knowledge and learning does FFF provide, if any? The extent of FFF's impact on the political agenda and public policy is vast, and it is clear that FFF has helped to place climate change at the core of political debate, challenging those in power to address FFF requests and forcing them to respond, although the quality of the response remains to be assessed. This is very much political learning as it relates to public responsibility, responsible citizenship, democratic participation, and continuous critical thinking. Political engagement and responsibility of this nature on the part of younger generations are believed to be highly relevant for the sustainable and just transformation of society (Sannino et al., 2016; Kajamaa and Kumpulainen, 2019; Hurrelmann and Albrecht, 2020).

Science-Based Learning and Activism

In 2015, the Sustainable Development Goals (SDGs) were approved by the General Assembly of United Nations through Resolution 70/1 entitled "Transforming our World: the 2030 Agenda for Sustainable Development," shortened to *Agenda 2030* (United Nations, 2015). Since then, the scientific and political attention given to climate change and sustainability has increased, including in education (e.g., Education for Sustainable Development ESD). However, while the SDGs are well-investigated top-down policies—indeed, many scholars now study and discuss the SDGs—*FridaysForFuture* derives from a rapid bottom-up dynamic. One of the most interesting aspects of FFF is its explicit recognition of, and declared dependence on, science, in particular but not exclusively ecological and climate science, for its themes, data, and even the terms adopted for its public campaigns (FridaysForFuture 2020a; Fisher, 2019; Stratton, 2021; Whang, 2020). One example of this is the *Unite Behind Science* campaign that FFF launched recently. In August 2019, Greta Thunberg sailed across the Atlantic Ocean from Europe to New York to participate in the United Nations General Assembly under the slogan "Unite Behind Science." Since the very beginning of the movement, FFF has always extolled the primacy of science over any other discourse, including the political. As far as FFF is concerned, the world should take heed of scientific warnings and indicators relating to the state of the planet and the scientific actions that need to be taken to deal with it (Whang, 2020). The trust that FFF places in science might appear naïve and uncritical, as pointed out by some scholars (Evensen, 2019; Fisher, 2019); however, it is remarkable that FFF has had the capacity to interact and collaborate so closely with scientists on a dialogic, critical, and practical basis (Kühne, 2019).

In response to the critics, *ScientistsforFuture* published a letter in *Science* in early April 2019, affirming that the climate strikers' concerns were "justified and supported by the best available science" (Hagedorn et al., 2019a). The letter was signed by more than 3,000 scientists. Some scientists have pointed out the rhetorical limitations of the *FridaysForFuture* movement and its initiatives and discourses (Evensen, 2019), while others have remarked on its relevance (Fisher, 2019). However, FFF has certainly generated a heated debate within the scientific community and has forced many to take a public position in some of the world's most important scientific journals.

It must be said that FFF does not create most of the scientific content it disseminates. Instead, it derives much of its technical and scientific knowledge directly from the scientific community, and then distributes it internally and externally. In this sense, FFF plays the role of bidirectional mediator and translator between science and society (Hagedorn et al., 2019b; Kühne, 2019), introducing theoretical knowledge and enactive engagement to the real world and generating a common language for it, for example, decarbonization initiatives. The scientific statements of the *FridaysforFuture* movement are often actively confirmed and supported by climate researchers (Hagedorn et al., 2019a; Hagedorn et al., 2019b; Fisher, 2019). Researchers agree on the extent of the greenhouse effects caused by man-made carbon emissions and conclude that increasing greenhouse gas emissions have resulted in an overall warming of the earth's climate (Hagedorn et al., 2019a). They further conclude that global warming will continue to increase if drastic measures to decrease greenhouse gas emission are not implemented worldwide. This kind of knowledge and enaction are replicated by FFF and passed on through its internal and external networks, thus demonstrating the solid foundations and reliability of the knowledge it is sharing. A strong connection with, and dependence on, scientists is therefore a key feature of FFF; this is not a trait it shares with many other social movements over the course of the last century.

Paideutic Function

Ontologically speaking, enactive systems are based on an extended and inclusive conception of the mind and on the role of knowledge and learning (Francesconi and Tarozzi, 2012; Ryan and Gallagher, 2020). In order to keep functioning, individual minds need to transform continuous incoming knowledge and to derive implicit or explicit meaning from it. In autopoietic enactive systems, knowledge is not processed as an input–output chain but is rather conceived as the capacity to adapt to the environment and shape the ecological niche (Kiverstein and Rietveld, 2018). In such systems, learning plays a twofold and crucial role: on the one side, as standard knowledge feeding of the system itself (self-feeding), where the system provides the knowledge it needs in order to continue to function; and on the other side, in the form of constant online updates on the dynamics involved with the construction of the niche and the relative adaptation (Folke et al., 2005), or, in other words, the constant monitoring of the self-environment coupling. *FridaysForFuture* credentials as a learning network are more

fundamental, in that it acquires knowledge and distributes it to network participants. However, it is also much more than that. FFF has shown that it has the capacity to teach peers and adults, to direct others' learning and development, and to recommend behavior, attitudes, and terminology, which are paideutic functions. This is because FFF is normative—as a paideutic agent usually is. It distributes knowledge internally to peers and externally to society, but it also takes on an educational role in order to increase awareness and generate a sense of identity, belonging, activism, engagement, and ethical and political commitment (Reinhardt, 2019; Rucht and Sommer, 2019). All of these are pedagogical functions and goals. This is why we regard this activity as part of FFF's explicit paideutic role, and one that is directed toward peers and also adults.

In order to be able to take on a pedagogical function, it is necessary for FFF to do some preliminary work, such as knowledge partitioning (cutting knowledge into small stock of information) and knowledge sharing, and distribution through educational tools and strategies. This is evident on many FFF websites where educational resources are abundant but also through discourses and concrete behavioral examples (Wahlström et al., 2020). Initial data on this point indicate that peers are simulating the behavior and adaptive responses of the leader, Greta Thunberg, and more generally absorbing FFF messages (Deisenrieder et al., 2020). The paideutic role of FFF is exercised in constant interaction with the social environment, transferring scientific knowledge into the real world, building the capacity to learn, and providing *ad hoc* educational materials—which are easily accessible from their website and other platforms—to promote the incorporation of knowledge into new behaviors. In all these senses, it appears that it is possible to describe FFF as a network with paideutic properties, or even a paideutic network. As a paideutic network, FFF is capable of autonomously retrieving complex and high-quality scientific knowledge, partitioning and transforming it, and then enacting it and distributing it to society in order to try to trigger behavioral change, identity awareness, and embodied and digital activism. Behavioral change, here, refers to a wide spectrum of behavior. In particular, FFF is believed to induce change in the following areas: active knowledge seeking, engagement with climate change issues, energy and water consumption, waste separation, food consumption, consumption in general, and inclusive action to safeguard the future of the planet (Deisenrieder et al., 2020). It also means becoming acquainted with social discourses such as ecological reform, green capitalism, anti-capitalism, democratization, social justice, and much more (Marquardt, 2020). Enacting knowledge, in this case, means that FFF merges ideological reflections with everyday life, transforming it into lively topics to promote collective discussion and engagement, with a strong emphasis on what needs to be done or prevented, thus embodying the normative function so typical of educational work. In doing so, FFF contributes to the creation of the new cognitive, social, and emotional niche necessary for the establishment of the new narrative and the changes to the landscape, where new generations will grow and adopt new language, ideas, values, and behaviors (Geels and Schot, 2007; Raven et al., 2016).

Ethical (Normative) Stance

A final point in our analysis is the role of FFF as an ethical agent. As noted, FFF has the capacity to produce and enact narratives with clear goals. However, as previously stated, no action can be valued neutral, and every action derives from or is inserted *post hoc* into a framework of ethical values. In the case of FFF, the ethical framework and the direct connection of actions and ethics are explicitly declared: they are the ethics of responsibility and care for the human–nature connection (Reinhardt, 2019; Whang, 2020; Stratton, 2021). FFF is the embodiment of such ethical perspectives in the specific form of pragmatic wisdom (Whang, 2020; Stratton, 2021). An enactivist approach usually involves the application of practical ethics or wisdom (*phronesis*) (Gallagher, 2007; Gallagher, 1993). *Phronesis* refers not to the important role of motor skills or to the capacity to act, which is called *praktognosia*, but to the ability to consider value issues rationally, starting with the wisdom derived from the knowledge we (should) gain from *lived bodily experiences* (Di Paolo et al., 2010; Gallagher and Zahavi, 2012). In this sense, FFF's ethical approach is strongly grounded in the lived experience of the individual and the collective.

Despite the young age of its participants and leadership, FFF has demonstrated a capacity to situate practical actions, scientific knowledge, and pragmatic ethical norms within a coherent framework, and has given them a new social meaning. This kind of normative framework indicates the direction that FFF believes society, the economy, and science should follow. The alignment between all these sectors may also help to explain the vast success of FFF. FFF links everyday life with scientific knowledge and ethical statements, and places them all in a functional teleological narrative that aims to modify the governance of socio-ecological systems so that they transit toward sustainability. Despite the fact that FFF tends to emit short, clear messages—as is typical of Twitter, FFF's primary communication channel—this does not affect or diminish the power of its complex ethical messages.

As has been highlighted, FFF's general ethics are grounded in the tradition of sustainable development and care for the natural world. However, within such a general framework, it is possible to identify the variety of positions that are part of the movement. For instance, the FFF ethical framework includes *deep ecology* (a somewhat radical approach to ecological and climate issues) alongside anti-capitalism, green growth, and degrowth, to name but a few. Regardless of the terminological, conceptual, and philosophical variety, FFF has been able to instill a strong sense of commitment and belonging in the young population and beyond, as participation in their initiatives clearly demonstrates. It is interesting to note that a sort of reverse dynamic is underway in which young people call on adults to assume their responsibility for human development and sustainability thus far (Maier, 2020). FFF emphasizes the ethical responsibility assumed by young people and, by contrast, the lack of responsibility demonstrated by the adult world in a sort of intergenerational mismatch (Hurrelmann and Albrecht, 2020; Whang, 2020). In the competition for the dominant narrative in the limited space of public discourse, FFF has taken a pragmatic ethical approach and supported the sustainable development

model and narrative, at least those in line with *ScientistsForFuture* and the *Paris Agreement* (FridaysForFuture, 2020a). In order to do so, and in the attempt to lobby and advocate for one ethical discourse above the many others that are available, FFF has clearly taken the normative decision to promote its own (multifaceted) perspective on the need for change in the ethics and behavior of its members and of society as a whole.

CONCLUSION

The aim of this study was to provide a theoretical conceptual analysis for *FridaysForFuture* as an example of collective agency that is ethically and pragmatically engaged into the heated debate about sustainable development. *FridaysForFuture* is a massive and recent social phenomenon that has gained widespread public visibility and attention. It is a movement made up mainly of young people, but it targets and reaches a large audience and high-level political agencies and institutions. It also has a tangible impact on national and international policies. The specific socioeconomic strata represented in FFF are not clear, but initial studies suggest that it may be based on the middle and upper classes and made up of young, female, well-educated individuals (Hunger and Hutter, 2020). FFF claims to be highly inclusive and repeatedly invites youngsters from all socioeconomic strata to participate. In addition, as we have shown, it actively builds networks with other related movements such as scientists, teachers, and parents. However, it is still relatively distant from other large-scale social movements such as Black Lives Matter. In this sense, the extended dimension of FFF as enactive network—the intention and capacity to reach out and bond with other non-environmental movements—is not yet fully understood. Clearly, overextending the boundaries of the movement's identity and the themes at its core could put at risk its ability to create and maintain a specific and easily recognizable cultural niche and sense of belonging, and this is a risk that every movement needs to assess carefully.

Deploying embodied and the enactive cognition theory and systems theory, we have described the *FridaysForFuture* movement as a complex social network with a nested and extended organization and function. As such, it demonstrates a high capacity for self-organization and proactive agency, the ability to enact knowledge in real life, and the ability to introduce specific ethical initiatives to promote the transformation of society. We have defined FFF as an enactive network since it has an embodied collective agency and aims to create a new social meaning and discourse by combining scientific knowledge and ethical activism. FFF brings knowledge to the social and political realms and elevates the public narrative. This movement has not only been able to create a highly nested and hyper-connected internal environment but also to extend vital connections beyond its boundaries toward other communities such as scientists, policy-makers, stakeholders, schools, students, and entrepreneurs. FFF declares itself willing to depart from earlier models of human development by stimulating informed reflection on and awareness of new models based on sustainability and the need to combat climate change.

We also suggest that *FridaysForFuture* has a pedagogical role. Indeed, in the context of the ever-increasing complexity of knowledge in contemporary society, FFF has demonstrated relevant skills in 1) recruiting high-level scientific knowledge without direct support from schools/teachers and in direct communication with scientists and 2) embodying strong ethical stances that specifically reference the ethics of sustainable responsibility and care for nature, and a new kind of interaction between humans and nature. FFF can therefore be interpreted as a network with transformative and normative paideutic properties that is willing to influence collective identity, awareness, and behavior, and empower collective agency by involving multilayered and nested communities in a more scientific, evidence-based, and ethical public discourse. As such, the pedagogical function of FFF goes well beyond knowledge transmission that is part of school life and reveals interesting and relevant informal, emergent, and distributed forms of learning.

Finally, we suggest that education research should devote more attention to FFF in order to address the following questions: Could formal school systems learn anything from examples such as *FridaysForFuture* with regard to commitment to common causes, collective agency, and engagement in order to safeguard and promote ethical values? Is there any possibility of collaboration and mutual enrichment between social movements and formal school systems? Is *FridaysForFuture* a replicable experience? And with what aim? We believe that FFF can stimulate formal education systems to rethink youngsters' collective agency, identity, and engagement. However, as with all emergent nonlinear processes, it could be fruitless to attempt to replicate FFF on a large scale. FFF's viral trajectory could certainly not be planned or identified in advance. Instead, it was an emergent dynamic process that, like the majority of social movements, "laid down the path by walking," starting small, and ending big. Analysis of nonlinear processes has to be often a *posteriori* analysis. From the day when Greta Thunberg demonstrated alone in front of the government building to today, the FFF network has grown unevenly but rapidly, branching out and spreading throughout the real and digital world. Probably, the only feasible option would be to attempt to replicate FFF's rise on a smaller scale, for example, at the school or local level, supporting students' autonomous activism and taking that as the basis for trying to impact the broader landscape where macro-dynamics happen (Geels, 2002; Geels and Schot, 2007).

The rise of FFF has had an impact on the landscape at the micro-, meso-, and macro-levels; however, schools have generally been left out. Indeed, although it has established links with informal networks of scientists, teachers, and parents, thus far FFF has shown little or no interest in dialogues with schools as formal institutions. Could this be a sign that FFF is critical of schools as formal systems? Further research is needed into how schools reacted to FFF and if and how they attempted to collaborate with the movement. It would surely be relevant from schools' point of view, and potentially innovative, to try to understand if and how it would be possible to replicate "the spirit" of FFF or respond to existing niches that can "provide the

seeds of change” (Geels, 2002: 1,261) and eventually be scaled up. Future research should also focus on the emergence of FFF in different contexts around the world, to enhance understanding of niche and regime dynamics and FFF’s ability to impact the dynamics of the *landscape level* (Geels, 2002).

More data and increased consideration of FFF from a theoretical perspective would advance the study of educational networks and communities (Leiviska and Pyy, 2020), especially informal ones, and clarify any potential relationship between informal student networks and formal school/educational systems. However, it will also be necessary to bear in mind the risks of regulation and control that could result from collaboration between FFF and/or other bottom-up social movements, and formal educational institutions. Collaboration with schools should therefore be given careful consideration before it goes ahead. In addition, for the future, it would seem to be of great value to monitor, study, and model the virtual and embodied interaction among *FridaysForFuture*,

Scientists4Future, and *Entrepreneurs4Future* to understand their approaches and dynamics and to consider ways in which society, science, and business can work fruitfully and ethically toward the common good.

AUTHOR CONTRIBUTIONS

DF has contributed for ideation, draft of the paper, writing the paper, revision of the paper, and final check. VS has contributed to writing the paper. EA has contributed to writing the paper, revision of the paper, and final check.

FUNDING

This research has been supported by a Marie Skłodowska-Curie Individual Fellowship (IF) under contract number 799779.

REFERENCES

- Agostini, E., and Francesconi, D. (2020). Introduction to the Special Issue “Embodied Cognition and Education”. *Phenom Cogn. Sci.* 20 (3), 417–422. doi:10.1007/s11097-020-09714-x
- Albrecht, N. J. (2020). “Nature-based Mindfulness and the Development of the Ecological Self when Teaching in Higher Education,” in *Exploring Self toward Expanding Teaching, Teacher Education and Practitioner Research*. Editors O. Ergas and J. K. Ritter First edition (Bingley: Emerald Publishing), 157–177. doi:10.1108/s1479-36872020000034010
- Biswas, T., and Mattheis, N. (2021). Strikingly Educational: A Childist Perspective on Children’s Civil Disobedience for Climate justice. *Educ. Philos. Theor.* 1–14. doi:10.1080/00131857.2021.1880390
- Brünker, F., Deitelhoff, F., and Mirbabaie, M. (2019). *Collective Identity Formation on Instagram – Investigating the Social Movement Fridays for Future*. arXiv preprint arXiv:1912.05123.
- Castellano, C., Fortunato, S., and Loreto, V. (2009). Statistical Physics of Social Dynamics. *Rev. Mod. Phys.* 81, 591–646. doi:10.1103/RevModPhys.81.591
- Cattell, J. (2021). “Change Is Coming”: Imagined Futures, Optimism and Pessimism Among Youth Climate Protesters. *CJFY* 13, 1–17. doi:10.29173/cjfy29598
- Clark, A. (2013). Whatever Next? Predictive Brains, Situated Agents, and the Future of Cognitive Science. *Behav. Brain Sci.* 36, 181–204. doi:10.1017/S0140525X12000477
- Deisenrieder, V., Kubisch, S., Keller, L., and Stötter, J. (2020). Bridging the Action Gap by Democratizing Climate Change Education-The Case of k.i.d.Z.21 in the Context of Fridays for Future. *Sustainability* 12, 1748. doi:10.3390/su12051748
- Di Paolo, E. A., Rohde, M., and De Jaegher, H. (2010). “Horizons for the Enactive Mind: Values, Social Interaction, and Play,” In *Enaction: Toward a New Paradigm for Cognitive Science*/ed. J. R. Stewart, O. Gapenne, and E. A. Di Paolo (Cambridge, Mass., London: MIT Press), 32–87. doi:10.7551/mitpress/9780262014601.003.0003
- Evensen, D. (2019). The Rhetorical Limitations of the #FridaysForFuture Movement. *Nat. Clim. Chang.* 9, 428–430. doi:10.1038/s41558-019-0481-1
- Fisher, D. R. (2019). The Broader Importance of #FridaysForFuture. *Nat. Clim. Chang.* 9, 430–431. doi:10.1038/s41558-019-0484-y
- Folke, C., Hahn, T., Olsson, P., and Norberg, J. (2005). ADAPTIVE GOVERNANCE OF SOCIAL-ECOLOGICAL SYSTEMS. *Annu. Rev. Environ. Resour.* 30, 441–473. doi:10.1146/annurev.energy.30.050504.144511
- Francesconi, D., and Tarozzi, M. (2012). Embodied Education. *Studia Phaenomenologica* 12, 263–288. doi:10.7761/SP.12.263
- FridaysForFuture (2020a). “FridaysForFuture Website.”. <https://fridaysforfuture.org/>. Accessed November 30, 2020.
- FridaysForFuture (2020b). “Strike Statistics.”. <https://fridaysforfuture.org/what-we-do/strike-statistics/list-of-countries/>. Accessed November 30, 2020.
- Froese, T., and Di Paolo, E. A. (2011). The Enactive Approach. *Pe&C* 19, 1–36. doi:10.1075/pc.19.1.01fro
- Gaida, L. (2019). *Beim Klimaschutz zeigt sich Merkel von Greta Thunberg inspiriert*. Welt.
- Gallagher, S., and Francesconi, D. (2012). Teaching Phenomenology to Qualitative Researchers, Cognitive Scientists, and Phenomenologists. *Indo-Pacific J. Phenomenology* 12, 1–10. doi:10.2989/IPJP.2012.12.3.4.1112
- Gallagher, S. (2007). Moral Agency, Self-Consciousness, and Practical Wisdom. *J. Conscious. Stud.* 14, 199–233.
- Gallagher, S. (2014). PRAGMATIC INTERVENTIONS INTO ENACTIVE AND EXTENDED CONCEPTIONS OF COGNITION. *Philosophical Issues* 24, 110–126. doi:10.1111/phis.12027
- Gallagher, S. (1993). The Place of Phronesis in Postmodern Hermeneutics. *Philos. Today* 37, 298–305. doi:10.5840/philtoday199337318
- Gallagher, S., and Zahavi, D. (2012). *The Phenomenological Mind*. 2nd ed. New York: Routledge.
- Geels, F. W., and Schot, J. (2007). Typology of Sociotechnical Transition Pathways. *Res. Pol.* 36, 399–417. doi:10.1016/j.respol.2007.01.003
- Geels, F. W. (2002). Technological Transitions as Evolutionary Reconfiguration Processes: a Multi-Level Perspective and a Case-Study. *Res. Pol.* 31, 1257–1274. doi:10.1016/S0048-7333(02)00062-8
- Giusti, M., Svane, U., Raymond, C. M., and Beery, T. H. (2017). A Framework to Assess where and How Children Connect to Nature. *Front. Psychol.* 8, 2283. doi:10.3389/fpsyg.2017.02283
- Guterres, A. (2019). The Climate Strikers Should Inspire Us All to Act at the Next UN Summit. *The Guardian: International Edition*. Available at: <https://www.theguardian.com/commentisfree/2019/mar/15/climate-strikers-urgency-un-summit-world-leaders> (Accessed June 20, 2021).
- Hagedorn, G., Kalmus, P., Mann, M., Vicca, S., van den Berge, J., van Ypersele, J.-P., et al. (2019a). Concerns of Young Protesters Are Justified. *Science* 364, 2–140. doi:10.1126/science.aax3807
- Hagedorn, G., Loew, T., Seneviratne, S. I., Lucht, W., Beck, M.-L., Hesse, J., et al. (2019b). The Concerns of the Young Protesters Are Justified: A Statement by Scientists for Future Concerning the Protests for More Climate protection. *GAIA - Ecol. Perspect. Sci. Soc.* 28, 79–87. doi:10.14512/gaia.28.2.3
- Hunger, S., and Hutter, S. (2020). *Online Strikes with the Usual Suspects: How Fridays for Future Has Coped with the Covid-19 Pandemic*. LSE European Politics and Policy (EUROPP) blog. . Available at: <http://eprints.lse.ac.uk/id/eprint/105403> (Accessed June 20, 2021).
- Hurrelmann, K., and Albrecht, E. (2020). *Generation Greta: Was sie denkt, wie sie fühlt und warum das Klima nur der Anfang ist*. Weinheim: Beltz.
- Kahn, S., and Zeidler, D. L. (2017). A Case for the Use of Conceptual Analysis in Science Education Research. *J. Res. Sci. Teach.* 54, 538–551. doi:10.1002/tea.21376

- Kajamaa, A., and Kumpulainen, K. (2019). Agency in the Making: Analyzing Students' Transformative agency in a School-Based Makerspace. *Mind, Cult. Activity* 26, 266–281. doi:10.1080/10749039.2019.1647547
- Kiverstein, J. D., and Rietveld, E. (2018). Reconceiving Representation-Hungry Cognition: an Ecological-Enactive Proposal. *Adaptive Behav.* 26, 147–163. doi:10.1177/1059712318772778
- Kühne, R. W. (2019). *Climate Change: The Science behind Greta Thunberg and Fridays for Future*. Charlottesville, VA: Center for Open Science.
- Leiviskä, A., and Pyy, I. (2020). The Unproductiveness of Political Conflict in Education: A Nussbaumian Alternative to Agonistic Citizenship Education. *J. Philos. Edu.* 00, 1–16. doi:10.1111/1467-9752.12512
- European Commission. Directorate General for Communication and Leyen, U. v. de. (2019). *A Union that Strives for More: My Agenda for Europe : Political Guidelines for the Next European Commission 2019–2024*. Luxembourg: Publications Office of the European Union.
- Lima, V. (2019). The Limits of Participatory Democracy and the Inclusion of Social Movements in Local Government. *Soc. Mov. Stud.* 18, 667–681. doi:10.1080/14742837.2019.1629277
- Maier, B. M. (2020). No Planet B': An Analysis of the Collective Action Framing of the Social Movement Fridays for Future. Master thesis. Jönköping University. Available at: <http://hj.diva-portal.org/smash/get/diva2:1393821/FULLTEXT01.pdf>.
- Maiese, M., and Hanna, R. (2019). *The Mind-Body Politic*. Cham, Switzerland: Palgrave Macmillan. doi:10.1007/978-3-030-19546-5
- Marquardt, J. (2020). Fridays for Future's Disruptive Potential: An Inconvenient Youth between Moderate and Radical Ideas. *Front. Commun.* 5, 48. doi:10.3389/fcomm.2020.00048
- McGuinness, A. (2019). *Theresa May Criticises Pupils Missing School to Protest over Climate Change*. Sky News. Available at: <https://news.sky.com/story/theresa-may-criticises-pupils-missing-school-to-protest-over-climate-change-11638238> (Accessed June 20, 2021).
- Meade, P. (2020). "Reaktionen auf Schüler*innenrebellion: Adultismus im Diskurs um Greta Thunberg und die "Fridays for Future"-Bewegung," in *Childhood And Children's Rights between Research and Activism: Honouring The Work of Manfred Liebel*. Editors R. Budde and U. Markowska-Manista (Wiesbaden: Springer VS Springer Fachmedien Wiesbaden), 85–119. doi:10.1007/978-3-658-29180-8_7
- Moor, J. de., Uba, K., Wahlström, M., Wennerhag, M., and Vyd, M. de. (2020). *Protest for a Future II : Composition, Mobilization and Motives of the Participants in Fridays for Future Climate Protests on 20-27 September, 2019, in 19 Cities Around the World*. Charlottesville, VA: Open Society Foundations (OSF). doi:10.17605/OSF.IO/ASRUW
- Newen, A., Bruin, L. de., and Gallagher, S. (2018). *The Oxford Handbook of 4E Cognition*. First Edition. Oxford: Oxford University Press.
- Papachristos, G., Sofianos, A., and Adamides, E. (2013). System Interactions in Socio-Technical Transitions: Extending the Multi-Level Perspective. *Environ. Innovation Societal Transitions* 7, 53–69. doi:10.1016/j.eist.2013.03.002
- Petracca, E., and Gallagher, S. (2020). Economic Cognitive Institutions. *J. Institutional Econ.* 16, 747–765. doi:10.1017/S1744137420000144
- Ransom, T. G., and Gallagher, S. (2020). Institutions and Other Things: Critical Hermeneutics, Postphenomenology and Material Engagement Theory. *AI Soc.* 1–8. doi:10.1007/s00146-020-00987-z
- Raven, R., Kern, F., Verhees, B., and Smith, A. (2016). Niche Construction and Empowerment through Socio-Political Work. A Meta-Analysis of Six Low-Carbon Technology Cases. *Environ. Innovation Societal Transitions* 18, 164–180. doi:10.1016/j.eist.2015.02.002
- Reinhardt, S. (2019). Fridays For Future – Moral und Politik gehören zusammen. *GWP – Gesellschaft. Wirtschaft. Politik* 68 (2), 159–162. doi:10.3224/gwp.v68i2.01
- Roczen, N., Kaiser, F. G., Bogner, F. X., and Wilson, M. (2014). A Competence Model for Environmental Education. *Environ. Behav.* 46, 972–992. doi:10.1177/0013916513492416
- Rodi, G. C., Loreto, V., Servidio, V. D. P., and Tria, F. (2015). Optimal Learning Paths in Information Networks. *Sci. Rep.* 5, 10286. doi:10.1038/srep10286
- Rucht, D., and Sommer, M. (2019). Fridays for Future. Vom Phänomen Greta Thunberg, medialer Verkürzung und geschickter Mobilisierung: Zwischenbilanz eines Höhenflugs. *Internationale Politik* 74, 121–125UR. <https://www.econstor.eu/handle/10419/222255>.
- Ryan, K. J., and Gallagher, S. (2020). Between Ecological Psychology and Enactivism: Is There Resonance? *Front. Psychol.* 11, 1147. doi:10.3389/fpsyg.2020.01147
- Sannino, A., Engeström, Y., and Lemos, M. (2016). Formative Interventions for Expansive Learning and Transformative Agency. *J. Learn. Sci.* 25, 599–633. doi:10.1080/1058406.2016.1204547
- Scheitle, M. (2020). "Does "Fridays for Future" Really Matter? A Case Study about the Success of the Social Movement in Germany. Master thesis. Uppsala University. Available at: <http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1435800&dsid=9509>.
- Shapiro, L. (2014). *The Routledge Handbook of Embodied Cognition*. London, New York: Routledge.
- Shove, E. (2010). Beyond the ABC: Climate Change Policy and Theories of Social Change. *Environ. Plan. A.* 42, 1273–1285. doi:10.1068/a42282
- Smith, A., Stirling, A., and Berkhout, F. (2005). The Governance of Sustainable Socio-Technical Transitions. *Res. Pol.* 34, 1491–1510. doi:10.1016/j.respol.2005.07.005
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., et al. (2015). Planetary Boundaries: Guiding Human Development on a Changing Planet. *Science* 347, 1259855. doi:10.1126/science.1259855
- Stratton, C. (2021). *Greta Thunberg: Climate Activist*. Lake Elmo MN: Focus Readers. doi:10.1158/1538-7445.sabcs20-sp147
- Thompson, E. (2007). n. 1. in *Mind in Life: Biology, Phenomenology, and the Sciences of Mind/Evan Thompo*. paperback ed. Cambridge, Mass., London: Harvard Univ. Press/The Belknap Press of Harvard University Press.
- United Nations (2015). *Transforming Our World. The 2030 Agenda for Sustainable Development*. Paris: United Nations.
- Varela, F. J., Thompson, E., and Rosch, E. (2016). *The Embodied Mind: Cognitive Science and Human Experience*. revised edition. Cambridge Massachusetts, London England: MIT Press.
- Wahlström, M., Kocyba, P., Vyd, M. de., Moor, J. de., Adman, P., Balsiger, P., et al. (2019). "Protest for a Future: Composition, Mobilization and Motives of the Participants," in *Fridays for Future: Surveys of Climate Protests on 15 March, 2019 in 13 European Cities*. doi:10.17605/OSF.IO/XCNZH
- Wahlström, M., Moor, J. de., Uba, K., Wennerhag, M., Vyd, M. de., Almeida, P., et al. (2020). *Surveys of Participants in Fridays for Future Climate Protests on 20-28 September, 2019, in 19 Cities Around the World: Open Science Framework*. Charlottesville, VA: Open Society Foundations (OSF). doi:10.17605/OSF.IO/ASRUW
- Walker, B., Carpenter, S. R., Folke, C., Gunderson, L., Peterson, G. D., Scheffer, M., et al. (2020). Navigating the Chaos of an Unfolding Global Cycle. *E&S* 25. doi:10.5751/ES-12072-250423
- Whang, O. (2020). Greta Thunberg Reflects on Living through Multiple Crises in a 'post-truth Society'. *National Geographic*. doi:10.21437/interspeech.2020-2153 Available at: <https://www.nationalgeographic.com/environment/article/greta-thunberg-reflects-on-living-through-multiple-crises-post-truth-society> (Accessed June 20, 2021).
- Wilkinson, B. (2018). Australian School Children Defy Prime Minister with Climate Strike. *CNN*. Available at: <https://edition.cnn.com/2018/11/30/australia/australia-school-climate-strike-scli-intl/index.html> (Accessed June 20, 2021).
- Zabern, L. von., and Tulloch, C. D. (2020). Rebel with a Cause: The Framing of Climate Change and Intergenerational justice in the German Press Treatment of the Fridays for Future Protests. *Media, Culture & Society* 43 (1), 23–47. doi:10.1177/0163443720960923 CrossRef Full Text

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2021 Francesconi, Symeonidis and Agostini. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Advantages of publishing in Frontiers



OPEN ACCESS

Articles are free to read
for greatest visibility
and readership



FAST PUBLICATION

Around 90 days
from submission
to decision



HIGH QUALITY PEER-REVIEW

Rigorous, collaborative,
and constructive
peer-review



TRANSPARENT PEER-REVIEW

Editors and reviewers
acknowledged by name
on published articles

Frontiers

Avenue du Tribunal-Fédéral 34
1005 Lausanne | Switzerland

Visit us: www.frontiersin.org

Contact us: frontiersin.org/about/contact



REPRODUCIBILITY OF RESEARCH

Support open data
and methods to enhance
research reproducibility



DIGITAL PUBLISHING

Articles designed
for optimal readership
across devices



FOLLOW US

@frontiersin



IMPACT METRICS

Advanced article metrics
track visibility across
digital media



EXTENSIVE PROMOTION

Marketing
and promotion
of impactful research



LOOP RESEARCH NETWORK

Our network
increases your
article's readership