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## **PROMOTING SOCIO-ECOLOGICAL TRANSFORMATION:**

### **Exploring sufficiency orientation and its psychological correlates to encourage reduced consumption**

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## SUMMARY

This dissertation is dedicated to a new concept for capturing renunciation-oriented attitudes and beliefs — sufficiency orientation. Sufficiency originates in the interdisciplinary sustainability debate. In contrast to efficiency and consistency, sufficiency considers human behaviour as the cause of socio-ecological crises and strives for a reduction in consumption respecting the planetary boundaries. The present work places sufficiency in a psychological research context and explores it qualitatively and quantitatively. On the basis of five manuscripts, the overarching question pursued is to what extent sufficiency orientation contributes to socio-ecological transformation. Based on one qualitative study and five further quantitative studies, sufficiency orientation is investigated in different behavioural contexts that are of particular importance with regard to CO<sub>2</sub> emissions. In addition, sufficiency orientation is linked to a wider range of psychologically relevant theories that help gain an overview of correlates and possible causes for the development of a sufficiency orientation.

Manuscript 1 uses expert interviews ( $N = 21$ ) to develop a heuristic framework on a transformation towards societal sufficiency orientation including barriers and enablers, as well as ambiguities on such a change. The derived elements are interpreted in the light of the leverage points approach. This framework can serve as a heuristic for future research and to develop measures concerning sufficiency orientation.

As part of an online study ( $N = 648$ ), Manuscript 2 examines the extent to which sufficiency orientation can be embedded in classic models for explaining pro-environmental intentions and behaviour (Theory of Planned Behaviour, Norm Activation Model), and showed a significant contribution to the explanation of intentions and behaviour in the field of plastic consumption.

Manuscript 3 reports two framing experiments (Study 1,  $N = 123$ , Study 2,  $N = 330$ ) to investigate how pro-social justice sensitivity contributes to making sufficiency orientation more salient and promoting it. While sufficiency orientation and pro-social facets of justice



sensitivity were positively related to each other, there was no effect of the framing intervention in the hypothesised direction. The results indicate that justice-related information at least in the presented manner is more likely to generate reactance.

Manuscript 4 presents an online study ( $N = 317$ ) and targets the importance of sufficiency orientation for predicting actual greenhouse gas emissions in relation to flight behaviour and policy support for the decarbonisation of mobility. In addition, the connection between sufficiency orientation and global identity is examined. It turns out that sufficiency orientation is superior to global identity in predicting actual emissions and decarbonisation policies. Contrary to expectations, sufficiency orientation and the form of global identity operationalised in the presented study shows a positive correlation and are compatible.

Manuscript 5 reports a reflective diary intervention ( $N = 252$ ) that should lead to a short- and long-term increase in sufficiency orientation by satisfying basic psychological needs through induced self-reflection. For both groups with or without the intervention, sufficiency orientation increased slightly but significantly. Although no specific effect of the manipulation was found, basic psychological need satisfaction turns out to be the largest predictor for sufficiency orientation. Subjective well-being is positively associated with sufficiency orientation, while time affluence shows no clear associations in the study.

Overall, the results highlight the relevance of sufficiency orientation in relation to socio-ecological transformation and actual behavioural change. Sufficiency orientation is related to low-emission behaviour and support for political measures to decarbonize infrastructures. These results contribute to the discussion on the intention-behaviour gap in regard to impact-relevant behaviour, i.e. behaviour producing high emissions. The present findings suggest, that sufficiency orientation could be related to a strong intention-behavioural consistency. However, further research is needed to validate these results and improve the measurement of sufficiency orientation. Furthermore, the studies provided insights on correlates of sufficiency orientation: justice sensitivity, global identity, subjective well-being and left-wing liberal political

ideologies are all found to be positively related to sufficiency orientation. Moreover, basic psychological need satisfaction was identified as a potential mechanism that can support the emergence of sufficiency orientation, however, causality remains unclear. From these findings, the work derives practical implications how to possibly strengthen sufficiency orientation on the micro, meso and macro levels of society.

Taken together, the dissertation provides important insights into a new and still developing concept, and shows its connectivity to psychological theories. However, future research is required in order to grasp more precisely the complexity of sufficiency orientation and to understand origins and predictors of sufficiency orientation. This work contributes to the interdisciplinary debate on socio-ecological transformation and points out that sufficiency orientation can serve to a future worth living as being related to reduced consumption.

## ZUSAMMENFASSUNG

Diese Dissertation widmet sich einem neuen Konzept zur Erfassung verzichtsorientierter Einstellungen und Überzeugungen — der Suffizienzorientierung. Suffizienz stammt aus der interdisziplinären Nachhaltigkeitsdebatte. Im Gegensatz zu Effizienz und Konsistenz betrachtet Suffizienz menschliche Verhaltensweisen als Ursache von sozial-ökologischen Krisen und strebt eine Reduktion des Konsums als Anpassung an die planetaren Grenzen an. Die vorliegende Arbeit rückt die Suffizienz in einen psychologischen Forschungskontext und untersucht diese sowohl qualitativ als auch quantitativ. Anhand von fünf Manuskripten wird der übergeordneten Frage nachgegangen, inwiefern Suffizienzorientierung zur sozial-ökologischen Transformation beiträgt. Anhand einer qualitativen Studie und insgesamt fünf weiteren quantitativen Studien wird Suffizienzorientierung in unterschiedliche Verhaltenskontexten untersucht, die in Bezug auf CO<sub>2</sub>-Emissionen von besonderer Bedeutung sind. Außerdem wird Suffizienzorientierung mit einem breiten Spektrum an psychologisch relevanten Theorien in Verbindung gebracht, um einen Überblick über Korrelate und mögliche Ursachen für die Entwicklung von Suffizienzorientierung zu erlangen.

Manuskript 1 entwickelt anhand von Experteninterviews ( $N = 21$ ) einen heuristischen Rahmen für einen Wandel hin zu einer gesellschaftlichen Suffizienzorientierung, der Barrieren und Schlüssel sowie Ambiguitäten in Bezug auf einen solchen Wandel umfasst. Die abgeleiteten Elemente werden vor dem Hintergrund des Leverage-Points-Ansatzes interpretiert. Dieser Rahmen kann als Anhaltspunkt für zukünftige Forschung und der Entwicklung von Maßnahmen zu mehr gesellschaftlicher Suffizienzorientierung dienen.

Manuskript 2 untersucht im Rahmen einer Online Studie ( $N = 648$ ) inwiefern Suffizienzorientierung in klassische Modelle zur Erklärung von umweltschützenden Intentionen und Verhaltensweisen eingebettet werden kann (Theorie des geplanten Verhaltens, Norm-Aktivations-Modell) und zeigt, dass sie einen signifikanten Beitrag zur Erklärung dieser im Bereich des Plastikkonsums darstellt.

Manuskript 3 untersucht anhand von zwei Framing-Experimenten (Studie 1,  $N = 123$ , Studie 2,  $N = 330$ ) inwiefern die Aktivierung von Gerechtigkeitssensibilität dazu beitragen kann, Suffizienzorientierung salient zu machen und zu fördern. Während Suffizienzorientierung und pro-soziale Dimensionen der Gerechtigkeitssensibilität positiv miteinander zusammenhängen, zeigt sich kein Effekt der Framing-Intervention in die gewünschte Richtung. Die Ergebnisse weisen eher darauf hin, dass gerechtigkeitsbezogene Informationen in der präsentierten Form Reaktanz erzeugen können.

Manuskript 4 untersucht anhand einer Online Studie ( $N = 317$ ) die Bedeutung von Suffizienzorientierung zur Vorhersage von tatsächlichen CO<sub>2</sub>-Emissionen in Bezug auf Flugverhalten und der Unterstützung politischer Maßnahmen zur Dekarbonisierung der Mobilität. Außerdem wird der Zusammenhang von Suffizienzorientierung und globaler Identität untersucht. Es zeigte sich, dass Suffizienzorientierung der globalen Identität in der Vorhersage von tatsächlichen Emissionen und der Unterstützung politischer Maßnahmen zur Dekarbonisierung überlegen war. Suffizienzorientierung und die in der Studie operationalisierte Form der globalen Identität wiesen – entgegen der Erwartungen – einem positiven Zusammenhang auf und scheinen somit kompatibel zu sein.

Manuskript 5 berichtet über eine Tagebuchintervention mit Reflexionsübungen ( $N = 252$ ), die durch eine induzierte Befriedigung psychologischer Grundbedürfnisse zu einer kurz- und langfristigen Erhöhung der Suffizienzorientierung führen sollte. Unabhängig von der Intervention erhöhte sich in beiden Gruppen die Suffizienzorientierung leicht signifikant. Obwohl kein spezifischer Effekt der Manipulation gefunden werden konnte, zeigte sich die psychologische Bedürfnisbefriedigung als größter Prädiktor für Suffizienzorientierung. Subjektives Wohlbefinden korrelierte positiv mit Suffizienzorientierung, während Zeitwohlstand in der Studie keinen eindeutigen Zusammenhang aufzeigte.

Insgesamt zeigen die Ergebnisse eine Relevanz von Suffizienzorientierung in Bezug auf die sozial-ökologische Transformation und tatsächliche Verhaltensänderung. Suffizienzorien-

tierung hing mit emissionsärmeren Verhaltensweisen zusammen sowie der Unterstützung politischer Maßnahmen zur Dekarbonisierung von Mobilitätsinfrastrukturen. Diese Ergebnisse leisten einen Beitrag zur Diskussion der so genannten Intentions-Verhaltenslücke bei Impact-relevanten Verhaltensweisen, d.h. in Bezug auf emissionsintensives Verhalten. Die Ergebnisse weisen darauf hin, dass Suffizienzorientierung mit einer starken Intentions-Verhaltenskonsistenz zusammenhängen könnte. Jedoch ist weitere Forschung nötig, um die Ergebnisse zu validieren und die Messung von Suffizienzorientierung zu verbessern. Weiterhin lieferten die Studien wichtige Hinweise zu Korrelaten der Suffizienzorientierung: Gerechtigkeitssensibilität, globale Identität, subjektives Wohlbefinden sowie linksliberale politische Ideologien standen im positiven Zusammenhang mit Suffizienzorientierung. Darüber hinaus wurde die Befriedigung psychologischer Grundbedürfnisse als potenzieller Mechanismus identifiziert, der das Entstehen von Suffizienzorientierung unterstützen kann, wobei die Kausalität noch unklar bleibt. Aus diesen Erkenntnissen leitet die Arbeit praktische Implikationen ab, wie die Suffizienzorientierung auf der Mikro-, Meso- und Makroebene der Gesellschaft gestärkt werden kann.

Die Dissertation gibt wichtige Einblicke in ein noch junges und sich entwickelndes Konzept und zeigt dessen Anschlussfähigkeit an psychologische Theorie. Es bedarf jedoch zukünftiger Forschung, um Suffizienzorientierung in seiner Komplexität genauer zu erfassen und Ursachen sowie Prädiktoren der Suffizienzorientierung zu verstehen. Diese Arbeit leistet einen Beitrag zum interdisziplinären Diskurs über die sozial-ökologische Transformation und zeigt, dass Suffizienzorientierung zu einer lebenswerten Zukunft beitragen kann, in dem sie mit einem reduzierten Konsum in Zusammenhang steht.

# PART I

## 1 INTRODUCTION

*We don't have a right to ask whether we are going to succeed or not.  
The only question we have a right to ask is what's the right thing to do?  
What does this earth require of us if we want to continue to live on it?  
- Wendell Berry, cited from Hickel (2020) in his opening of the book "Less is more"*

We currently live in times of multiple crises: environmental degradation, climate change, biodiversity loss, social conflicts and severe consequences from the global Covid-19 pandemic (IPCC, 2021; Pileggi, 2021; Romanello et al., 2021). These crises are not happening out of the blue. They are consequences of how we as humans (inter-)act(ed) within socio-technical systems and are reproducing them. Climate change, for instance, is not a mere abstract physical phenomenon caused by a changed biophysical constitution of the atmosphere. It is caused by socio-technical systems and power constitutions within our society that shape mind-sets and people's activities for a long period of time (e.g. Dunlap & Brulle, 2015; Feygina, 2013). The climate crisis itself and the way people think and act upon it, are a product of history, hierarchies and power relations that shape core beliefs and values within our society (see, for instance, Feygina, 2013; Meadows, 1999; Stoddard et al., 2021). How we care about resources is driven by human-nature relationships which are not based on togetherness and unity but separation and independency legitimizing resource exploitation and extractivism (Radkau, 2013; Seymour, 2016).

Given the many facts that are evident about these crises (IPCC, 2021), it is urgent to *transform* the processes that are causal for the growing instability of socio-ecological systems. As humanity has become a geological, biological, atmospheric force and has driven extinctions and fundamental shifts of ecological systems (Steffen et al., 2007), it will be humans that need to change. Individuals and collectives not only have the responsibility to change the current disruptive and unhealthy systems – they also can have the agentic power to initiate changes

(Abson et al., 2017; Romanello et al., 2021). Thus, understanding the causes that exacerbate major environmental crises from a psychological viewpoint and, in turn, finding keys to promote a socio-ecological transformation is an overarching goal of this dissertation project. This is also where *sufficiency* as sustainability strategy and multifaceted approach towards transformation comes into play (Alfredsson et al., 2018; Haberl et al., 2020), Sufficiency is a transformatory concept as it constituted the "antithesis to the 'faster, further, more' orientation of the consumer society" (Spangenberg & Lorek, 2019, p. 1071) and in the end gives a simple formula as part of the solution to these crises: simply consuming less.

In order to maintain a living space that is conducive for human development and well-being, humanity need to respect 'planetary boundaries' that delineate a 'safe operating space' (Rockström et al., 2009; Steffen et al., 2015). For instance, atmospheric carbon concentration should not breach the 350ppm to remain stable, but 2021 the concentration already reached around 415 ppm (NOAA-ESRL, n.d.). However, there was no immediate shut down. We already transgressed three planetary boundaries: climate change, biodiversity loss, and nitrogen production (University of Leeds, 2018), but self-serving narratives, mostly from Western elites, "help" to delay action (see, for instance, Lamb et al., 2020). Many people remain unaffected by these dramatic inventory of science, politics and economy (Baiardi & Morana, 2021; Stoddard et al., 2021).

Thus, we need to identify the drivers for such a development and to reorganise the system in such a way that we do no longer destabilize the system. One major driver of this current development is the way we consume and how our consumption is embedded in consumerist infrastructures (O'Neill et al., 2018; Tukker et al., 2016) driven by Western affluent systems and dependency on linear economic growth (Hickel & Kallis, 2020; Krausmann et al., 2009). This in turn has built strong mental infrastructures (Welzer, 2011) and lifestyle lock-ins (e.g. Boucher, 2016) incorporating the belief that limitless growth and resource usage should be the major drivers towards psychic, societal, and monetary affluence (Göpel, 2016; Hayden, 2014; Meadows, 1999; Stoddard et al., 2021). But this is a fallacy as currently no country on earth

meets people's needs in a globally just and ecological manner (Fanning et al., 2021; O'Neill et al., 2018). Hence, a reduction of resource consumption would be necessary and desirable in order to promote a socio-ecological transformation and meet the needs for people now and in the future.

Based on these considerations, the dissertation project translates the sufficiency sustainability concept into the psychological sphere and addresses the overarching question: Does a psychological understanding of sufficiency in terms of a *sufficiency orientation* contribute to both understanding and driving a socio-ecological transformation. To answer this question, the dissertation is structured into three parts.

Part I starts with highlighting background information on the general sustainability discourse and its history which is necessary to understand the recent turn towards socio-ecological transformation and the increasingly stronger demand for addressing the sufficiency sustainability strategy instead of solely focusing on efficiency and consistency strategies to reach sustainability. Second, some notions on "degrowth" as a concept and movement which share common goals with sufficiency are presented. Then, sufficiency orientation is introduced and its potential contribution to furthering knowledge to the discussion on pro-environmental intentions and behaviour change is discussed. Then, it is explained why this dissertation focuses on particular fields of action (i.e. plastic consumption, flying), addresses moral roots of sufficiency orientation (i.e. justice sensitivity), investigates potential contradictions (i.e., global identity) as well as corresponding correlates (i.e. basic psychological need satisfaction, subjective well-being, time affluence) and interventions to increase sufficiency orientation and sufficiency-oriented behaviour (i.e. reflective diary approach).

Part I closes by summarizing the overarching research questions followed by a brief critical self-positioning of the presented research.

Part II presents the five manuscripts that shape the core part of this dissertation and contribute to answer the overarching research questions.



Part III starts with summarizing the manuscripts and their results. Core insights are highlighted and overarching research questions will be answered. Afterwards, theoretical contributions are discussed in the light of the literature and in reference to the research questions. To derive implications of this research the multi-level perspective is used as an interpretative framework. Thus, practical implications are given in regard to micro, meso and macro levels. This work closes with a critical reflection on limitations and the scope of the present research itself while outlining future perspectives on a construct of increasing interest.

### 1.1 From sustainability to socio-ecological transformation: Why do we need a socio-ecological transformation?

The term sustainability has a long and influential history. In Germany, roots were found in forestry management in Saxony where Hans Carl von Carlowitz in 1713 advocated for a *sustainable* timber industry and argued to produce only as much timber as can grow back through reforestation in order to secure stable long-term cycles of production and consumption (Grunwald & Kopfmüller, 2012; Stadler, 2017). His idea of sustainability, however, was driven by a human-economic relationship where there are two entities that need to function together and nature is coupled with questions about management and need satisfaction for humans, also neglecting a core value of nature itself. The raise of the sustainability concept started during the second half of the 20<sup>th</sup> century with the Brundtland Report “Our common future” where sustainable development was defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987, p. 43). The definition highlights two justice perspectives: *intergenerational* justice, i.e. society’s responsibility towards future generations, and *intragenerational* justice, which address the equitable distribution of resources in the present. Even though this definition counts as a milestone in history, many ambiguities remain until the present: Which kind of need satisfaction is granted for whom? Which boundary conditions are necessary so that people can satisfy their needs regardless of living place,

age, gender, etc.? What would be the mere and globally fairly shared characteristics of a future-oriented and sustainable way of life – for every human being? Nevertheless, the Brundtland Report raised awareness on the interconnectivity between human need-satisfaction, economic activities and handling of environmental resources both locally and globally. It also recognised negative outcomes of growth-dependency as both environmental degradation and poverty were increasing (Hopwood et al., 2005, p. 20). However, given certain ambiguities on how to meet those needs resulted in less questioning how to introduce systemic changes but in a broad variety of sustainability interpretations depending on peoples' normative and cultural backgrounds (ibid.).

In Germany as well as in the global political discourse on sustainability, the "triple bottom line approach" also labelled as weak sustainability approach became very popular (Biely et al., 2018; Bundeszentrale für Politische Bildung, 2013; Grunwald & Kopfmüller, 2012). Therein three pillars are defined to be part of sustainable development: Ecology and environmental quality, social justice and economic prosperity. However, such a separation of three single components outlines again that the ecosystem and ecological stability are ignored to be prerequisite for human need satisfaction and, thus, can also be ignored in political goals or projects that focus on the other pillars instead. The triple-bottom-line approach not only provides an option to legitimized trade-offs in the past but also constantly transported the belief in decoupling<sup>1</sup> and solving environmental problems with technological improvements only. The opposite is true for a *strong(er) sustainability approach* that rejects this idea of equal partnership between the three components as well as the ingrained belief that technological innovations alone may lead us to sustainability (Grunwald & Kopfmüller, 2012). The triple bottom line approach as a type of weak sustainability approach incorporate an understanding of sus-

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<sup>1</sup> Decoupling contains the idea that economic growth can be sustained while energy consumption and resource use decreases. *Absolute decoupling* indicates that the absolute resource input decreases while the Gross Domestic Product (GDP) still rises. *Relative decoupling* indicates that resource use per unit GDP declines, while the absolute amount of resource usage further increases, but at a slower pace than GDP. In turn, human environmental impact still rises but at a slower rate than overall economic growth (Biely et al., 2018).

tainability that is fueled by dominance and power perceptions of humans over nature and nature to be externalised from humans – a perspective deeply rooted in historical hierarchies, that were reinforced by the emergence of Descartes' Dualism in the 1600s and found their way into Western theologies (Hickel, 2020; Hopwood et al., 2005). The underlying assumption is that if new problems arise, human power and technology will solve the problems afterwards. This "Promethean view" on nature (Dryzek, 1997, as cited in Hopwood et al., 2005, p. 38; see also Keary, 2016) made it possible that people believe they can solve every problem that evolves by treating nature in resource usage terms.

Over the course of time, there have always been pioneers pointing out this deficiency and criticising these ideas of equal partnership between economic growth and ecological safety. For instance, the economist Hernan Daly explicated thoughts on *enoughness* and fundamental changes in economic metabolism when judging 'sustainable growth' as "oxymoronic" in a world of finite resources and ecosystems, and argued in favour of qualitative than quantitative improvements (Daly, 1993; as cited in Hopwood et al., 2005, p. 40). However, these arguments did not successfully enter into the global sustainability debate for a long time. Sustainability in its overarching idea globally gained further interest but was only loosely connected to working solutions for the climate crises and for actual decreases of resource usage; this becomes visible in the fact that emissions continue to rise (see IPCC, 2021). In the light of these developments and a sustainability concept that has lost sharpness and power, the term *socio-ecological transformation* – adopted from Karl Polanyi's description from 1944 "The Great Transformation" reflecting the "comprehensive changes economies undergo in interactive response to global economic structures" (WBGU, 2011, p. 393; see also Aulenbacher et al., 2019) – entered the sustainability discourse. In contrast to sustainability, socio-ecological transformation more radically questions power and domination in the climate change discourse and more overtly requests system changes for a liveable future for all. In Germany, the report "World in Transition – A Social Contract for Sustainability" by the Scientific Advisory

Council on Global Change (WBGU, 2011) represents a central document arguing on a socio-ecological transformation and was launched as a socio-political project.

"The WBGU views this worldwide remodelling of economy and society towards sustainability as a 'Great Transformation'. Production, consumption patterns and lifestyles in all of the three key transformation fields must be changed in such a way that global greenhouse gas emissions are reduced to an absolute minimum over the coming decades, and low carbon societies can develop" (WBGU, 2011, p. 5).

Furthermore, authors argue in favour of strategies that rely on a conscious socio-political design to deal with the multiple crises and not primarily on the capitalist (world) market, which supposedly reacts to the ecological problems by means of technologies and scarcity signals (WBGU, 2011, p. 6). The report highlights the overall importance of human behaviour on all levels of a transformation as well as asks for a mind shift in regard to norms and values (WBGU, 2011, pp. 71-86).

Here, the first notions of sufficiency are developed and a clearer reduction-impetus also on individual levels is signalled throughout the report but nevertheless flanked with a clear stance towards ecological modernizations without profoundly criticizing the roots of extractivism and crises, as also the limits and possibilities of politics in the ongoing age of capitalism, as well as the unsustainable way of life expanding from the global North (Eversberg & Muraca, 2019). Questions of global inequality and the inability of weaker groups to act are marginalised and, therefore, a further broadening of perspectives on transformation is important to understand and reshape the cognitive behavioural logics and 'lock-ins' people adhere to in the current Western affluent system (cf. Boucher, 2016). In response to ongoing increases in CO<sub>2</sub> emissions in spite of efficiency innovations (cf. Santarius & Soland, 2018) and the growing impact of the climate crisis, concerns on fundamental system changes are formulated. The degrowth movement as well as the sufficiency sustainability can be considered as such.

## 1.2 Towards degrowth and sufficiency orientation

Degrowth counts as an umbrella term for more radical approaches on socio-ecological transformation (Schmelzer & Vetter, 2019). Entering degrowth-concepts into the debate of socio-ecological transformation is associated with the growing evidence of the failure of decoupling against all expectations from supporters of green growth and ecological modernisation approaches (e.g. Krausmann et al., 2009; Vadén et al., 2020; Ward et al., 2016). An ongoing belief in a potential decoupling, for instance, through digitization is also argued to increase societal and ecological risks in the future (Albert, 2020). Even relative decoupling (which partly happened, for instance, also during the Covid-19 crisis) presents a basis for continued growth and environmental exploitation (Biely et al., 2018, p. 227).<sup>2</sup>

According to Schmelzer and Vetter (2019, pp. 159–175) there are three goal dimensions uniting several degrowth oriented movements: 1. global ecological justice (e.g. by ending extractivism and instead establishing just ownership relations and reestablishing principles of common resources usage); 2. social justice and increased self-determination (e.g. by negotiating alternative ways of life, by inclusion and participation of all marginalized groups and democratization of economic activities); and 3. independency of growth and logics of growth within society (i.e. transforming institutions and infrastructures so that they are independent of growth).

Over the past years degrowth movements emerged all over the world with very diverse and loosely defined actors (Schmelzer & Vetter, 2019). Also the term *sufficiency* is apparent in the degrowth debate but with a local center within German speaking areas (ibid.). This is rea-

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<sup>2</sup> Biely et al. (2018) illustrate the myth of decoupling by an example from agricultural land use: While the land size used for production may stay the same, the industrification and intensification of agricultural production results in severe ecological damages (e.g., eutrophication, land degradation, sinking water tables, water pollution) through increased usage of fertilizers and energy-intensification. Another example for such problem shifts and risks society produces through merely technology driven innovation approaches can be illustrated by the usage of plastics. While there are many advantages and energy savings that come by the usage of plastics (Andrady & Neal, 2009), environmental pollution has increased and severe health consequences are already detected but still unknown in its extent (Shi et al., 2019; Wright & Kelly, 2017).

sonable, as Wolfgang Sachs introduced the term sufficiency (lat. *sufficere, enough*) into the German sustainability strategy already in the nineties (Sachs, 1993, 1995, 1999). He joins the line of thought given by Hernan Daly and argues on limits for consumption in the face of the growing environmental risks from unlimited consumption and production. Sachs (1993) mentions deceleration and moderated economic activities to serve for personal growth and life satisfaction (Sachs, 1993).

Sufficiency targets absolute reduction of resource and energy consumption through changed patterns of resource usage (Samadi et al., 2017). Thus, the individual effort to reduce absolute impact can account as an expression of *sufficiency-oriented* behaviour. In turn, it means lowering the absolute demand of those products and services that cause these emissions by changed patterns of consumption (Fischer et al., 2013; Hayden, 2019). In its origin, sufficiency is part of a strategic sustainability bundle which is argued to be interconnected with *efficiency* and *consistency* and should to be equally targeted in order to achieve sustainability (Sachs, 1995). However, only efficiency entered the international sustainability discourse based on their compatibility with the globally promoted growth paradigm and the idea of an improved input-output ratio through lowering resource input as an integral component of capitalist economic activities. Thus, the belief in efficiency visible in a large number of flourishing concepts around, such as 'efficiency revolution' or 'ecological modernization' (Bauriedl, 2016). Moreover, efficiency was connectable to the techno-centred sustainability discourse (Keary, 2016), whereas sufficiency did not resonate within the international climate and energy policy (Zell-Ziegler et al., 2021). Absolute limits of production or consumption were not beloved questions for politics as it implies ideas of strong regulation (e.g. lowering meat production by intention and not by demand). However, pressure to act towards climate change has increased due to civil movements (e.g. Fridays for Future movement, Extinction Rebellion) and the degrowth movement became more popular all over the world as one political answer to the climate crises (Ziesemer et al., 2021). Furthermore, recent research increasingly highlights that refraining from resource intensive consumption does not imply mere renunciation but also

serves for psychological and social need satisfaction in the future (Fanning & O'Neill, 2019; O'Neill et al., 2018), thus making sufficiency approaches more appealing.

Given the urgency to reduce emissions (IPCC, 2021), the importance of social sciences to be involved in research on global crises (Klinenberg et al., 2020; Reese et al., 2020) and the need for a socio-ecological transformation, this dissertation project explores the sufficiency sustainability concept from a psychological viewpoint. To do this, sufficiency and sufficiency orientation will be distinguished in order to address and explore the corresponding psychological variable(s) in more detail throughout this work. As the idea of sufficiency questions fundamental drivers of socio-ecological crisis, namely people's behaviour in the first place and their embeddedness in (mental) infrastructures as source for such a behaviour it is important to further understand psychological dimensions of this concept and involve psychological perspectives in interdisciplinary debate. Hence, this dissertation seeks to add (i) empirical insights to the scientific debate around sufficiency as well as (ii) practical implications on how to engender change towards sufficiency orientation on different levels of society. Thus, the overarching research question is:

**RQ:** How does sufficiency orientation contribute to both understanding and driving socio-ecological transformation from a psychological viewpoint?

### 1.2.1 Bridging transformation research to psychology and vice versa

Addressing climate change and a socio-ecological transformation requires behavioural change in all areas of human activity. Psychology as the science of human experience and behaviour targets this to understand and derive theoretical and practical implications, how behaviour might change given certain circumstances. Environmental psychology in particular specifies itself as tackling interdisciplinary issues and applies questions related to climate change. Only recently, a growing awareness of solving current questions and challenges from multi- and interdisciplinary perspectives was expressed by environmental psychologists (Reese et al., 2020;

Whitmarsh et al., 2021; Wullenkord & Hamann, 2021). In contrast, over a long time psychological research remained on disciplinary pathways leading to blind spots regarding the knowledge that is gained by model perspectives that focus on individuals, and in regard to the transformative effects these insights actually have (Shove, 2010; Whitmarsh et al., 2021). According to Whitmarsh et al. (2021, p. 77), there a number of theories that address behavioural change, but they are often "too restricted", "too individualistic", "too linear", too less reflecting the social context that interacts with the people, and still too much built on rational choice models or deliberate decision making instead of respecting the many unconscious influences on actions. Also feedback processes and interactions are only marginally discussed and "social norms" considered as individual perceptions (ibid). Given the fact, that transition research has already contributed broader perspectives of change (e.g. systems thinking and leverage points approach, see Abson et al., 2017; multi-level perspective, see Geels, 2011) it would be valuable to bridge disciplines and integrate both interdisciplinary perspectives and approaching these change theories (Feola, 2015). As sufficiency derives from an interdisciplinary sustainability discourse and to respect for the critique raised by Whitmarsh et al. (2021) on classical psychological research, a wider view and a systems perspective is taken in order to answer the question (see Manuscript 1 and Manuscript 4):

**RQ<sub>a</sub>:** Which major barriers and keys towards individual and societal sufficiency orientation can be identified?

On the way to climate and environmental protection, many terms and concepts already exist. Caring for the environment has manifold dimensions when addressing relevant predictors and behaviour itself. Thus, targeting sufficiency orientation may raise the question why bring up a new term into the already fuzzy and multifaceted landscape of existing psychological constructs? In particular, does sufficiency address something new regarding the overall debate on environmental concern and intention from a psychological point of view? However, three points of interest would make it valuable to investigate sufficiency orientation in psychological



research and, thus, bridge the discourses of emission reductions. First, sufficiency combines both, knowledge about impact from a particular individual behaviour and intentions to care for the environment – but not only for the sake of the environment but for the individual's self (as sufficiency promises to live better with less individually and collectively (Gorge et al., 2015; Lamberton, 2005). In line with Fischer et al. (2013) sufficiency goes beyond mere pro-environmental protection through certain actions but addresses changes in perceived subjective benefits that results from consumption patterns. Further facets of environmental concern and care are widely researched with many definitions co-existing. For instance, Fransson and Gärling (1999) define environmental concern as a positive attitude toward environmentally relevant behaviour and as a value orientation that assigns great importance to concerns about the ecosystem. Sufficiency does not contradict this definition. However, environmentally concerned consumers would have to have good knowledge about the ecological impact of specific products to alter their choices, whereas sufficiency-oriented people would reduce their overall level of consumption, which would presumably affect all products and services. These changes can be perceived as sacrifice but do not need to be. It can also be the better choice, cheaper, more convenient, easier for the individual in itself. This, to my view, is not reflected in traditional measurement of pro-environmental attitudes. Thus, sufficiency orientation should be researched in order to empirically validate its potential contribution.

Second, targeting sufficiency in terms of sufficiency orientation picks up the international trend in discussing important sustainability strategies which sufficiency is originally a part of by targeting the more radical and transformatory strategy as outlined above. I argue that many of the currently used concepts in psychology are well embedded in the traditional sustainability concept and easily connect to the efficiency approach – which sufficiency, however, challenges. For instance, Schultz and Kaiser (2012, p. 2) explicitly address efficiency – not sufficiency – when they circumscribe what they mean by pro-environmental behaviour. They further argue that many of the behaviours must be considered in relation to other behaviours to judge the effectiveness in their total efforts in carbon dioxide reduction. For instance, driving

a car would be less harmful than flying by aeroplane. I agree that what is called pro-environmental always needs some reference points and there will not be the one and only sufficiency oriented behaviour. Driving a car produces less CO<sub>2</sub> than flying. In contrast to Schultz and Kaiser (2012), sufficiency would even go further and argue in favour of none of these mobility activities but will consider to use a CO<sub>2</sub>-free option (such as riding a bike or walking) or refrain from a far-distance trip per se.

Third, and most important, frames matter a lot. Which words we use, which discourses we follow, which arguments we reproduce are of general importance in the climate debate (see Lamb et al., 2020 on tactics of delay in climate change discourses) – and they are important for setting rules, they establish norms in vice-versa production (Gear & Dehm, 2020). In line with Schultz and Kaiser (2012, p. 2), pro-environmental behaviour is "culturally and historically prescribed" indicating that terms could change, former ones could lose their power and following ones could replace former ones that proved to be unsuccessful. Over the past years efficiency based solutions did not help to address the climate crisis adequately, in contrast, they produced even more injustices on a global scale (Cordroch et al., 2022; Hertwich, 2008). The term 'pro-environmental' accounts for the implicit assumption that there is a division between us as humans on the one side and the environment on the other side that needs to be protected by somebody (but perhaps not us). It carries the long history of separating humans from nature and creates artificial lines between activities that target nature or the environment vs. ourselves (see for instance Hickel, 2020 on the powerful and historically grown separation between humans and nature). In line with Gear and Dehm (2020, p. 1) "Frames signal intensities of both focus and of action/inaction, and it seems clear that every framing inevitably involves selection, if not pre-selection – and in that, represents an exercise of power. Contestation, between frames, between the ideological commitments." Therefore, integrating sufficiency more obviously could also raise power to the concept in practice and politics. In my view, both, the broader sufficiency concept and the psychological construct sufficiency orientation are valua-

ble to investigate because sufficiency has emerged as a counter-image to efficiency and constitutes a necessary part to reach strong sustainability and prevent rebound effects (Cordroch et al., 2022; Fischer et al., 2013; Santarius & Soland, 2018). In a technology-driven society with a strong belief in the healing power of efficiency (Rajak, 2020), there is a need for this antithesis (Spangenberg & Lorek, 2019).

Up to now sufficiency is mainly an academic term and not well researched in psychology. In accordance with Verfuert et al. (2019, p. 374), sufficiency orientation can be defined as a person's evaluation of an actual sufficiency-oriented lifestyle. However, as sufficiency only recently entered in the scope of psychological research (see for instance Chamberlin & Callmer, 2021, arguing on variants of sufficiency orientation), this definition and measurements should be empirically tested to evaluate reliability and validity of the construct. Thus, exploring the potential contribution of a measure on sufficiency orientation is valuable for science (i.e. validity, reliability) and practice (e.g. communication, intervention planning) in case there is a specific explanatory power in regard to intentions and behaviour in relevant fields of consumption. Therefore, connecting sufficiency orientation to classical psychological models and theories (i.e. Theory of Planned Behaviour, Ajzen, 1991; Norm Activation Model, Schwartz, 1977; see Manuscript 2) would be of relevance to evaluate the validity of the concept. Thus, the following question was asked:

**RQ<sub>b</sub>:** Does sufficiency orientation contribute predictive power to an integrated behaviour-change model, in particular, in the field of plastic consumption?

### 1.2.2 Crucial fields of action: plastic consumption and flying

Two of the presented manuscripts target specific fields of behaviours, namely plastic consumption and flying. In the following, I argue that both constitute a relevant and particularly interesting fields of consumption in regard to sufficiency orientation based on their recently gained interest in public discourse on socio-ecological problems and their CO<sub>2</sub> impact. Thus refraining from both, using plastic and flying, would be in line with the sufficiency approach.

*Plastic* has become a significant social and environmental issue in recent years, not only because the huge input of marine litter (Geyer et al., 2017; Jambeck et al., 2015) but also because of the growing risks to humans (Bergmann et al., 2015; Galloway, 2015), animals (W. C. Li et al., 2016; Wilcox et al., 2018; Worm et al., 2017) and the economy (Beaumont et al., 2019). Although plastics having many useful properties (Andrady & Neal, 2009), a mere replacement with biodegradable polymers to encounter these far-reaching systemic risks do not suffice (Millican & Agarwal, 2021). Furthermore, CO<sub>2</sub> emissions from plastic production, global supply chains and combustion were underestimated for a long time. Only recently, 4.5% of the world-wide annual carbon emissions were found to result from plastic consumption - which is even higher than the total share of emissions caused by global air travel annually (Cabernard et al., 2021). Thus, understanding and facing the socio-psychological dimensions of plastic consumption is very relevant in regard to a socio-ecological transformation (Heidbreder et al., 2019). Simply consuming less would be part of the solution. People can actually refrain from using plastics in their everyday life, e.g. by reusing fabric bags several times, taking their own bowls for shopping or buying loosely packed fruits (Barr et al., 2001; Clayton & Myers, 2015). Furthermore, zero-waste shopping alternatives reduce infrastructural barriers and make plastic free shopping more available (Beitzen-Heineke et al., 2017). Albeit consumption habits have a strong influence on plastic consumption (Heidbreder et al., 2019), then people actually have the opportunity to get off the normative track and can consciously choose ecological alternatives in case they have the opportunity to do so (Heidbreder et al., 2020). Pahl et al. (2017, p. 697) even argue, that "contrary to some other environmental problems (for example, CO<sub>2</sub> emissions): (1) all plastics are human-made, as there are no 'natural' sources or variability; and (2) the benefits that plastics bring are not directly linked to the emission of plastics to the environment", thus, attributing high agency to individuals and actors in order to transform. Behavioural changes have a direct impact on litter but also the demand for plastic products (Jefferson, 2019) and they could put pressure on the purchasing sector to reduce plastic in their of-

fering (Ma et al., 2020). Albeit sufficiency orientation is not a social convention yet, it is probable that it will drive peoples' intentions and actions to refrain from purchasing and using plastic products in the future (Wiefek et al., 2021). Given these arguments, exploring sufficiency orientation in regard to plastic usage can help to evaluate its contributions explaining intentions and behaviour in regard to plastic consumption (see also RQ<sub>b</sub> Manuscript 2):

**RQ<sub>a</sub>:** Can sufficiency orientation predict behavioural intentions, i.e in the field of plastic consumption?

*Flying* is one of the most carbon intensive behaviour single individuals can produce by their action (Girod et al., 2013). Furthermore, it is a Western elite behaviour, associated with social status and cultural norms (Gössling, 2019; Small et al., 2008), that partly legitimise extremely unequally distributed emissions: only 11% of the global population actually fly and 1% of the worlds' population causes more than a half of the total emissions from passenger air travel (Gössling et al., 2019; Gössling & Humpe, 2020). Normally, frequent air travellers live in affluent countries and are disproportionally wealthy (Gössling & Humpe, 2020; Ivanova & Wood, 2020). In particular, individually perceived social benefits appear to pay off superior to 'green' identities (McDonald et al., 2015) or climate related concerns, for instance, in scientists (Whitmarsh et al., 2020). Only recently, so called "flight shame" partly contributed to an awareness and norm shift in Europe (Becken et al., 2021; Gössling et al., 2020). Given the fact, that many green attitude or green identity measures do not predict actual pro-environmental behaviour (Csutora, 2012; Moser & Kleinhüchelkotten, 2018) the role of people holding a sufficiency orientation would be of particular interest. In theory, sufficiency oriented people would be aware of the impact from flying, the unevenly distributed costs and benefits between people who perform the behaviour but are effected from the consequences, and would adjust their behaviour appropriately. Therefore, investigating sufficiency orientation and peoples' flight travel behaviour should give further insights in the significance of sufficiency orientation to explain actual emissions which former psychological instruments are partly lacking. Based on

these considerations the following overarching research questions were formulated (see Manuscripts 2 and 4):

**RQ<sub>a</sub>:** Can sufficiency orientation predict behavioural intentions and/or CO<sub>2</sub> impact in important fields of socio-ecological behaviour, i.e. plastic consumption and flying?

### 1.2.3 Sources or conflicts for a sufficiency orientation: morality and global identity

As already outlined in the introduction, the sustainability discourse as a whole is closely linked to the question of intra- and inter-generational justice (see definition on sustainability, World Commission on Environment and Development, 1987). Sufficiency, however, focuses more strongly on social issues as a cause and consequence of climate change and seeks an answer in the (self-)limitation of activities that are a source for environmental degradation and socio-ecological questions by taking responsibility for these development (e.g. polluter pays principle, restraint and zero emissions principle, reverse burden, see Princen, 2003). Furthermore, engaging in sufficiency principles for Western cultures is a normative question linked to the understanding of responsibility in the face of the historic development of emissions (Meyer & Roser, 2010) and respecting the fact that consumerism in Western affluent countries is the cause of climate change and need to be limited to reach the Paris agreement (Alfredsson et al., 2018). Asking about 'enough' is an immediate call to justice question as one needs to answer for whom, in which context, in relation to what (Spengler, 2016). Defining limits for wealthy societies is a question that may conflict with definitions of freedom and liberal policy making but is a core question of international distributive justice (Heindl & Kanschik, 2016).

In turn, acting in line with a sufficiency principle may imply perceptions of fairness and (in)justices as a prerequisite. Without an awareness in regard of socio-ecological injustices provoked by Western lifestyles it would be unlikely to personally engage in self-restriction and reduced consumption at least for the sake of the environment. For instance, Syme et al. (2002) found justice perceptions to play a crucial role in fairness judgements, commitment to pro-environmental policies and pro-environmental behaviours in a cross cultural analyses,

whereas group or individual self-interest was less influential. Morality and environmental attitudes seem to be closely related (e.g. Feinberg & Willer, 2013) and moral arguments to be very influential as also polarizing in political communication (Feinberg & Willer, 2015). Moral attitudes predict anticipated guilt and intentions to engage in climate protective behaviour (Wang, 2017). For example, Jia et al. (2017) found a range of moral cognitive evaluations to be associated with pro-environmental behaviour and perceived personal responsibility to act, such as benevolence and universalism concerns, concern for other species, vigilance for the environment and also disgust towards environmentally irresponsible others. In general, witnessing injustices that happen to other people can cause moral cognitions and emotions (e.g. existential guilt or moral outrage) and in turn increase the readiness to pro-social activities to disadvantaged people (Montada & Schneider, 1989). In a similar vein, this could be the case when people perceive environmental injustices, in particular, from a third-person perspective (i.e. from an observer's, perpetrator's or beneficiary's perspective). Therefore, the role of justice sensitivity as a personality trait (Baumert & Schmitt, 2016; Schmitt et al., 2005) that influences how people process and evaluate justice related information (Baumert et al., 2011) was examined more closely, as this potentially relates to the formation of a sufficiency orientation. The question was (see Manuscript 3):

**RQ:** How does justice sensitivity relate to sufficiency orientation? Is justice sensitivity a correlate of sufficiency orientation?

Social identities and norms strongly influence how people act (see, for instance, Dono et al., 2010; Farrow et al., 2017; Fritsche et al., 2018). However, some social identities may contradict others (e.g. Murtagh et al., 2012). In particular, this might be the case in regard to globalized thinking and some patterns of mobility which were found to embody cultural norms and identities that outperform green identities (Gössling, 2019; Kim, 2017; Richards, 2015). In Western societies with globalised flows of processes being part of everyday life, self-identifying as a globalized or cosmopolitan person is a cultural norm. This might be very common and an

essential part of modern thinking. Thus, being a global citizen could be associated with internationality, connectedness to other people all over the world, and open-mindedness. However, such a cultural identity might be a reason why certain behaviours in society are (still) unquestioned and create high-emission path dependencies, i.e. cause emissions that we do not reflect on or legitimize them as they are part of self-enhancing strategies. Travelling around the world became symbolic for international trade and individualistic freedom – a value that is important in Western individualistic cultures but may be in conflict in the face of climate change and perceptions of freedom (Font & Hindley, 2017). Being confronted with conflicting identities such as on the one hand a pro-environmental one and on the other hand the global citizen would potentially cause dissonance or processes of responsibility rejection to change one's own behaviour (cf. Schrems & Upham, 2020). People who identify as being a global person hold a cultural norm that would potentially be associated with high emissions as travelling would serve to self-affirm one's identity (Sherman & Cohen, 2006). Given the fact that that long-distance travelling is rarely possible without using fossil fuel based modes of transport, this would be a conflict for people who self-identify as a green person. Although the globalization is recognized as part of the problem, people in Western cultures argue that thinking global is a key for pro-environmental change (see for instance Leung et al., 2015 whose argumentation can also be criticised as culture imperialistic when discussing the relevance of travel behaviour and intercultural exchange for learnings on sustainability) – but such global thinking might be related to global mobility behaviour patterns and mostly also fossil fuel based (transnational) mobility. In fact, green identities show counterintuitive impacts on CO<sub>2</sub> emissions (McDonald et al., 2015; Moser & Kleinhüchelkotten, 2018; Whitmarsh et al., 2020). Therefore, it is an important question if such a global citizen approach contradicts to lower carbon emissions and constituting a 'carbon-lock-in'. Therefore, investigating both global identity and sufficiency orientation helps to gain sharpness regarding the value and contribution of sufficiency orientation. The respective research question is (see Manuscript 4):



**RQ<sub>e</sub>:** How does global identity and sufficiency orientation interrelate? Are they contradictory to each other?

#### 1.2.4 Interventions for sufficiency orientation respecting the role of basic psychological need satisfaction, subjective well-being and time affluence

The role of needs is an increasingly discussed aspect in scientific sustainability debate and there are several findings about the incompatibility of long-term need satisfaction with the growing risks from environmental degradation (Fanning & O'Neill, 2019; Gorge et al., 2015; Heyen et al., 2013; O'Neill et al., 2018; Vita et al., 2019). Furthermore, materialism and classical measurements of societal well-being (i.e. Gross Domestic Product, GDP) seem to be unrelated to long-term life satisfaction and several indicators of well-being (Bergh, 2009; Easterlin, 1974; Fanning & O'Neill, 2019). Given one of the early definitions on sufficiency from a German research group (i.e. sufficiency as the "modification of consumption patterns that help to respect the Earth's ecological boundaries while aspects of consumer benefit change", Fischer et al., 2013, p. 10) it is argued that sufficiency is also about a shift in the perceived utility aspects of consumption. Nevertheless, Fischer et al. (2013) refrain from making a normative evaluation of these shifts. However, a change in individual benefits through consumption is probably linked to questions about which kind of needs are a driver for the respective consumption and ultimately, by reflecting on this, to rethink consumption decisions and realign modes of consumption in such a way that needs are satisfied but in a less carbon intensive manner or even by refraining from the particular behaviour per se. However, this perceived utility is not independent from social norms in regard to which needs are of particular interest for oneself as part of the society. Furthermore, to rethink and adapt perceived utilities of a certain behaviour would imply a high degree (or opportunity) of (self-)reflection (see Manuscript 5 for details) and infrastructures or situations that support peoples' basic psychological needs. Therefore, it could be promising to (a) initiate such a process of (self-)reflection that (b) strengthens peoples' need for autonomy and potentially serves to realign ones behaviour. This argumentation is based on research on Self Determination Theory and the role of basic psychological needs in

goal pursuit (Deci & Ryan, 2000; Ryan & Deci, 2020). Self Determination Theory emphasises the universal quality of satisfying basic psychological needs to be intrinsically motivated and to cope with challenges in the face of personal threats, for instance. Therein, three innate basic psychological needs, namely autonomy, social relatedness and competence serve as fundamental prerequisites for long-term and intrinsic motivation. Furthermore, the satisfaction of these basic psychological needs are argued to be essential for human functioning, well-being, and long-life satisfaction. In turn, a frustration of these needs prevent people to act self-determined and humans get self-defensive. Only recently, this theory was embedded into the discussion of climate change and climate change related (in)action (Wullenkord, 2020).

According to this argumentation, the relationships between supporting individuals' basic psychological need satisfaction and considering further closely related need thwarting variables, i.e. subjective well-being and time affluence, the following research questions is addressed:

**RQ:** How can sufficiency orientation and sufficiency oriented consumption be promoted and which roles do psychological need satisfaction, subjective well-being and time affluence potentially play?

### 1.3 Overview of research questions

The sufficiency strategy is a marginalized concept in the sustainability debate due to its ostensible incompatibility with current societal norms and growth-oriented economic principles in Western affluent countries. But it is an important concept intertwined with the degrowth and transition movements, as it tries to reconfigure consumption and production and downsize absolute impact by behavioural changes (Hayden, 2019). Therefore, it is important to address sufficiency from a psychological viewpoint and find ways how a change towards sufficiency in terms of actually consuming less could happen. It is also important to build bridges to im-

portant psychological theories but also those that are highlighted in the interdisciplinary sustainability debate, such as leverage points (Meadows, 1999) and the multi-level perspective (Geels, 2011; Geels & Schot, 2007). This dissertation investigates the empirical and practical value of “sufficiency orientation” as a newly developed construct in the psychological debate about climate change which is related to a reduction oriented shift in consumption of goods and services. The dissertation focuses on meso and macro-level considerations by asking about societal barriers and drivers towards collective sufficiency orientation. Moreover, the present research focuses on micro-level systems and niches by detecting psychological correlates of sufficiency orientation and investigating potentially conflicting identities (i.e. global identity). As the psychological debate on sufficiency orientation is only at the beginning, further evaluation and discussion of its ecological validity and contribution to the general debate of pro-environmental attitudes and behaviour is necessary. Therefore, the overall research question was formulated:

**RQ:** Does sufficiency orientation contribute to both understanding and driving socio-ecological transformation from a psychological viewpoint?

Furthermore, more detailed research questions are addressed throughout this dissertation:

**RQ<sub>a</sub>:** Which major barriers and keys towards individual and societal sufficiency orientation can be identified?

**RQ<sub>b</sub>:** Does sufficiency orientation contribute predictive power to an integrated behaviour change model, in particular, in the field of plastic consumption?

**RQ<sub>c</sub>:** How does justice sensitivity relate to sufficiency orientation? Is justice sensitivity a correlate of sufficiency orientation?

**RQ<sub>d</sub>:** Can sufficiency orientation predict behavioural intentions and/or CO<sub>2</sub> impact in important fields of socio-ecological behaviour, i.e. plastic consumption and flying?

**RQ<sub>e</sub>:** How does global identity and sufficiency orientation interrelate? Are they contradictory to each other?

**RQ<sub>f</sub>:** How can sufficiency orientation and sufficiency oriented consumption be promoted? Which roles do psychological needs, subjective well-being and time affluence potentially play?

#### 1.4 Critical self-positioning of the present research

Before diving into the conducted research, it is important to 'zoom out' and consider the general viewpoint from which this research has been conducted. The studies conducted within this dissertation project all emerged from Western perspectives. The argumentation for this research originated in theories and discussions rooted in Eurocentric viewpoints albeit claiming to encompass a global justice perspective. But this is a view from western perspectives as well (see for a similar critique on degrowth Eversberg & Muraca, 2019). Sufficiency is a concept located in Western research communities and whose research objects are mainly situated in affluent consumerist cultures. This project is mainly addressed to people who are responsible for resource exploitation and share a history as colonizers. This, at least partly legitimised the focus on consumerist cultures that needs to be decarbonized and whose practises should no longer be dependent on continuous colonial infrastructures are of interest. Nevertheless, this perspective is locked into systems that provoked the socio-ecological crises - and it would be questionable whether we can really find just solutions from such a perspective.

The same applies to my own knowledge, which I as researcher have brought into the studies. My knowledge is shaped by gender, racial and national norms, (re)produced by Western communities in which I grew up. Although, science in general shares the goal of being as objective as possible, I am not a neutral actor and cannot avoid to embody Western values through socialization in European 'elite' universities. This clearly narrows the perspective and contribution of this research and also discriminates certain cultures and people living therein. The studies are not culturally sensitive and cannot be interpreted across cultures. Furthermore, sustainability science is normative and also this dissertation is normative by pursuing

the goal to aid humanity in its transition towards sustainability by favouring sufficiency orientation and practise as an overarching goal.

## 2 STRUCTURE AND OUTLINE OF THE MANUSCRIPTS

Figure 1 gives an overview of the five manuscripts included in this dissertation. It outlines the major questions, theoretical approaches, links to scientific and societal discourses addressed in each manuscript, as well as fields of behaviour that are targeted and the respective methodological approach used in each study. Furthermore, major outcomes are already mentioned but will be summarized and interpreted conjointly in the discussion section.

The first manuscript addresses macro and meso levels of society (Geels, 2011; Geels & Schot, 2007) and the possibility of a change towards sufficiency orientation at these levels. In contrast, all other manuscripts look more closely into micro levels of society (so called niches, i.e. individuals and smaller groups of people according to the multi-level perspective). However, all manuscripts integrate considerations of sufficiency orientation from a psychological perspective and embeds it into the interdisciplinary sustainability debate.

The first manuscript (Tröger & Reese, 2021, Chapter 3) focuses on sufficiency experts from several fields of professions and practises in order to better understand the current discourse around sufficiency as a whole. We asked them about the definition of the sufficiency concept in contrast to efficiency, elaborated barriers and key factors for change towards societal sufficiency orientation from their point of view and analysed the implicitly expressed ambiguities in the debate around sufficiency from the interview material. From this subjective expert perspectives, we interpreted them and developed a heuristic framework of keys and barriers towards a sufficiency oriented society. This should give an overview of some major fields of action to foster sufficiency orientation for various actors within the society. Furthermore, the leverage points systems thinking approach by Donella Meadows (1999) was applied and the results were interpreted in light of this theoretical approach, which helps to give the depicted key factors a relative significance in terms of their power to serve as leverage point

towards sufficiency orientation within the current system. This qualitative study set an overarching frame for the subsequent studies that formulate closer psychological research questions focusing on the individual whilst still respecting their embeddedness in wider systems and using quantitative research methods to explore them.

Manuscript 2 (Heidbreder et al., in press, Chapter 4) investigates a bundle of psychological factors to predict intentions and behaviours in regard to single-plastic usage. As a theoretical framework, we used an extended version of the Theory of Planned Behaviour (TPB, Ajzen, 1991) in combination with the Norm Activation Model (NAM, Schwartz, 1977) and depicted relevant constructs for our purposes. We include sufficiency orientation in order to assess its additional predictive value to explain intentions and behaviour in regard to plastic consumption within the private- and public-sphere (Stern, 2000). Data from an online-survey is analysed in order to investigate an integrated behaviour change model in the field of plastic consumption including sufficiency orientation as a new construct.

Manuscript 3 (Tröger et al., unpublished manuscript) picks up several justice arguments (i.e. distributive justice, ecological justice) that build groundwork for the general sufficiency sustainability debate. When defining and testing sufficiency orientation as psychological construct, we argue that justice sensitivity as a personality disposition presents an important correlate of sufficiency orientation and we empirically tested the relationship within two experimental studies. We analysed a justice message based framing intervention in order to test justice sensitivity to serve as important moderator variable when being confronted with justice related information in the context of climate change. We argue that the persons' individual level of (pro-social) justice sensitivity can potentially serve to increase situational sufficiency orientation and, thus, peoples' intentions to protect the environment.

Manuscript 4 (Loy et al., 2021, Chapter 6) looks more closely at the predictive value of sufficiency orientation on actual high impact consumption and CO<sub>2</sub> emissions in regard to private flying mobility. Flying is a high impact behaviour that recently gained a lot of public interest as it is a climate damaging behaviour that disproportionately causes social and ecological

inequalities (Gössling & Humpe, 2020). Furthermore, global identity as a partially controversially-discussed concept in the field of pro-environmental behaviour was addressed in this study. We analysed the potential (in-)compatibility of global identity with sufficiency orientation and discussed both concepts in the light of the multi-level perspective (Geels 2011).

Finally, Manuscript 5 (Tröger et al., 2021, Chapter 7) presents an intervention study. We aimed to increase individual sufficiency orientation and related behaviour through a one-week daily diary reflection task. Within the sufficiency and degrowth discourse three concepts gained interest and were in the scope of this manuscript: basic psychological need satisfaction (Taljaard & Sonnenberg, 2019; Wullenkord, 2020), subjective well-being (Büchs & Koch, 2019; Zawadzki et al., 2020) and time affluence as potentially causing and resulting in a sufficiency oriented lifestyle (Geiger et al., 2021; Kasser & Sheldon, 2009). Again, implications to increase sufficiency orientation through a reflective diary intervention are discussed in course of this manuscript.

Summing up, the focus of this dissertation lies on sufficiency orientation as a newly introduced and marginalized concept in the sustainability debate. The dissertation investigates how sufficiency orientation contribute to both understanding and driving socio-ecological transformation by applying mixed methods. The dissertation project also seeks to derive theoretical and practical implications in order to increase sufficiency orientation on several societal levels in the future. The presented studies connect to the interdisciplinary debate about ecological sufficiency and sufficiency sustainability on the one hand by working on transition theories (i.e. leverage points, see Manuscript 1; multi-level perspective, see Manuscript 4) but also connects to psychological theories on pro-environmental behavioural change (Theory of Planned Behaviour, TPB; Norm Activation Model, NAM, in Manuscript 2). Furthermore, important psychological correlates and potential drivers of sufficiency orientation are investigated (i.e. justice sensitivity, see Manuscript 3; global identity, see Manuscript 4; basic psychological needs, see Manuscript 5). Overall, these studies seek to contribute to the question of

how sufficiency orientation could be further integrated in psychological as well as interdisciplinary theories on intention and behavioural change. The previous chapters provided the theoretical background for this dissertation and the focus of the single studies presented in each manuscript in a nutshell. More detailed theoretical assumptions and rationales for the empirical work with its methodological procedures are elaborated in the respective manuscripts.



Figure 1 Overview of the manuscripts with main questions and main results included in this dissertation project

Main questions	Integrated theories	Scientific discourse	Action fields	Method	Main results
Which major barriers and keys towards individual and societal sufficiency orientation can be identified? (RQ <sub>a</sub> )	<b>Manuscript I:</b> Talkin' bout a revolution: an expert interview study exploring barriers and keys to engender change towards societal sufficiency orientation				Heuristic framework with barriers and keys (e.g., social norm, infrastructures, narratives)
	Leverage Points	Socio-ecological transformation	Collective and societal change	Expert interviews, qualitative	
Does sufficiency orientation contribute predictive power to an integrated behaviour change model? (RQ <sub>b</sub> )	<b>Manuscript II:</b> Reducing plastic consumption: Exploring psychological antecedents of private and public behaviour towards ecological transition in consumerist sphere				Sufficiency orientation predicts policy support intentions and actual behaviour.
	Theory of Planned Behaviour; Norm Activation Model	Private vs. public sphere behaviour	Plastic consumption	Survey	
How does justice sensitivity relate to sufficiency orientation? (RQ <sub>c</sub> )	<b>Manuscript III:</b> When moral roots and attitudinal shift dissociate – the case of sufficiency orientation				Sufficiency orientation correlates with pro-social dimensions of justice sensitivity.
	Justice sensitivity	Personality x situation (Framing)	Sufficiency orientation	Field study, experimental	
Can sufficiency orientation predict CO <sub>2</sub> impact? (RQ <sub>d</sub> ) How does global identity and sufficiency orientation interrelate? (RQ <sub>e</sub> )	<b>Manuscript IV:</b> Global citizens – global jet setters? The relation between global identity, sufficiency orientation, travelling, and socio-ecological transformation of the mobility system				Sufficiency orientation predicts actual flying behaviour. Sufficiency is not contradictory to global identity.
	Global identity	Globalized Western identities	Flying and travel behaviour	Survey	
How can sufficiency orientation be promoted? (RQ <sub>f</sub> )	<b>Manuscript V:</b> Can reflective diary-writing increase sufficiency-oriented consumption? A longitudinal intervention addressing the role of basic psychological needs, well-being, and time-affluence				Sufficiency orientation is intertwined with basic psychological need satisfaction and subjective well-being.
	Basic psychological needs (Self-Determination Theory)	Interventions for individual (and collective) change	Subjective well-being, time affluence	Field study, experimental	

## PART II

### 3 MANUSCRIPT 1 – TALKIN’ BOUT A REVOLUTION: AN EXPERT INTERVIEW STUDY EXPLORING BARRIERS AND KEYS TO ENGENDER CHANGE TOWARDS SOCIETAL SUFFICIENCY ORIENTATION

Tröger, J., Reese, G. (2021). Talkin’ bout a revolution: an expert interview study exploring barriers and keys to engender change towards societal sufficiency orientation. *Sustainability Science*, 16(3), 827-840. <https://doi.org/10.1007/s11625-020-00871-1><sup>3</sup>

Date of submission: 3<sup>th</sup> of December, 2019

Date of acceptance: 5<sup>th</sup> of October 2020

#### **Abstract**

Representative studies report high levels of acceptance of environmental protection and approval for stricter political measures to ensure a liveable future. However, in the last years, climate-damaging emissions did not decrease in accordance with the Paris Agreement, and important societal actors failed to implement effective strategies that could promote a socio-ecological transformation. Sufficiency with its underlying ‘mind-set’ can be seen as leverage point for transformation and thus is targeted within our qualitative study. To explore barriers that prevent the implementation of knowledge about the sufficiency approach and ways to encourage sufficiency orientation on a societal level, we conducted interviews with experts from science, politics and economy ( $N = 21$ ). Using qualitative content analysis, we identified keys for change, i.e. narratives, rewards and recognition, time structures and responsibilities that could have a leveraging effect towards system transformation. We propose an exploratory framework that points out main barriers, keys in terms of levers and experts’ visions towards a sufficiency-oriented society. Furthermore, we outline that the sufficiency discourse contains ambiguities and varieties concerning the experts’ perceptions regarding effective levers for a transformation. Through brief discourse pattern analysis, we highlight different perceptions regarding the role of technology, social responsibility and the societal change and time. The proposed framework can inspire future research and policy-making on sufficiency.

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## **Keywords**

Sufficiency orientation, leverage points, intention-behaviour-gap, behaviour change, collective action, future narratives

## **1. Introduction**

Climate change and biodiversity loss urge humanity to radically decrease CO<sub>2</sub> emissions (IPCC 2018; Steffen et al. 2015). Before the Covid-19 pandemic, global emissions were still rising (Le Quéré 2020). In Germany, the consumption of plastics (UBA 2019a) and motorized individual mobility patterns increased over the last years (Nobis and Kuhnimhof 2018). At the same time, representative surveys conducted across Europe report high levels of acceptance for environmental protection through political measures (European Commission 2019; UBA 2019b). Thus, it would seem that various barriers prevent people and societies from engaging in sustainable action. In this paper, we focus on sufficiency as a sustainability strategy, whose main target is to substantially lower climate-damaging emissions. As such, sufficiency can be seen as a leverage point in itself as it is a contrasting mind-set to the current growth-oriented mind-set. We explore sustainability experts’ arguments and ideas about how to achieve a sufficiency-oriented society. Based on the experts’ perspectives from their fields of work, we identify central barriers that prevent transformation and extract key factors that would work as leverage points within the current system and contribute to the great mind-shift towards societal sufficiency orientation. We also analyze discourse patterns that experts use within in their argumentation to better understand on which ground ambiguities and conflicts may arise in the discourse about change and the implementation of certain measures.

### **1.1. Sufficiency orientation: a leverage point towards a sustainable society?**

Sufficiency, in terms of ‘enoughness’, seeks to substantially change lifestyles into more sustainable ones by producing and using less resources. In the past this ‘having enough’ was discussed from both maximum and minimum thresholds. Sustainability research, however, is more concerned with the upper limits of consumption based on the premise that resources are limited

and a fair distribution within the ecological limits should be the goal to ensure a livable future. The lower limits of consumption are rather considered from abstract philosophical viewpoints and consider various need theories (Spengler 2016). In our analysis, we mainly address ‘having enough’ in terms of maximum thresholds for consumption. In the sustainability debate, sufficiency was originally introduced together with efficiency and consistency as part of a strategic bundle for reaching sustainable development (Alcott 2008; Linz 2004; Sachs 1999). Meanwhile, the sufficiency approach counts as part of the global degrowth movement having a center in the European and German sustainability discourse (Schmelzer and Vetter 2019; Toulouse et al. 2019). It shares common goals with the global degrowth movement that seeks to (a) accomplish an ecologically just societal structure through democratic processes, (b) reinforce social justice and self-determination through the change of the societal metabolism and (c) reshape institutions and infrastructures to be independent of (economic) growth (Schmelzer and Vetter 2019, p. 158). Over the past 30 years, however, the global sustainability debate has concentrated on efficiency and consistency approaches to solve the climate crisis. Sufficiency in terms of “Doing less was and is simply not in the cards, anywhere or for anybody” (Göpel 2016, p. 40). Climate change was framed as a ‘physical problem’ that is judged to be solved by technical and market-ready solutions in its foreground (Bauriedl 2016; Lakoff 2010). As a consequence, total emission rates did not decrease and potential savings were eaten up by different, alternative or increased consumption patterns described as rebound effects (Santarius and Soland 2018; Schmelzer and Vetter 2019; Wilhite and Norgard 2004). The associated idea of decoupling environmental and material consumption from economic growth that accompanied the efficiency approach proved ineffective to solve the climate crisis (Parrique et al. 2019).

Nowadays, the sufficiency approach receives increasing attention from various disciplines. A Europe-wide network was established (ENOUGH-Network, see Toulouse et al. 2019), where multidisciplinary perspectives were brought together and practical implications discussed (Rijnhout and Mastini 2018). What is still missing, however, is a systematic analysis of

psychological barriers that prevent implementation of sufficiency on both individual and collective levels and an understanding of how behaviour might be changed on a larger scale (Spangenberg and Lorek 2019). Sufficiency-oriented lifestyles already emerged in niches (Speck and Hasselkuss 2015), but many social contexts prevent adapting sufficiency-oriented every day practices. Sufficiency orientation stays widely unattractive or even aversive because of negative labelling effects (Drews and Reese 2018; Reese et al. 2019). Spangenberg and Lorek (2019) even argue sufficiency to be “the antithesis to the ‘faster, further, more’ orientation of the consumer society” (ibid., p.1071), and to our common social practices that continuously conflict with the socio-economic system people are embedded in. We argue that a larger scope on the intention-behaviour gap is necessary to understand societal barriers that prevent collective behavioural shifts towards sufficiency.

## **1.2. The intention-behaviour gap in light of the leverage points concept**

The relationship between pro-environmental intentions and actual impact-oriented behaviour is one main research field in environmental psychology (Bamberg and Möser 2007; Kollmuss and Agyman 2002). Various models highlight the relevance of individual intentions towards ecological behaviour change and have been well supported empirically across various types of pro-environmental behaviour (e.g. Harland et al. 1999; Heath and Gifford 2002; Tonglet et al. 2004). Within a comprehensive model by Klöckner (2013), intentions, perceived behaviour control and habit strength are the most relevant components to explain behaviour. The latter two factors depend on infrastructures and societal structures making it more or less easy to establish habits or give the perceived sense of having control over one’s behaviours. Especially, when it comes to high impact behaviour, intentions do not predict behaviour to a substantial extent. Moser and Kleinhüchelkotten (2018) found income to be a stronger predictor of impact relevant behaviour, compared to pro-environmental intentions and identity scores, which, on the contrary, correlated slightly positive with impact. This result is less surprising given that people are embedded in social contexts that make pro-environmental action very hard and

costly. Such contexts can be ‘material’ like different transportation systems and structures within a city. For instance, in the case of lacking infrastructures for bike mobility, fewer people will use their bike to commute (Rayaprolu et al. 2018). Infrastructural barriers prevent people from choosing climate-friendly alternatives, because they are not designed along the criteria of strong sustainability (for instance, Yuriev et al. 2018). Barriers can also be more immaterial and implicitly guiding impact-relevant decisions. Social norms or values shared within (international) communities guide people’s perceptions regarding available decision options (e.g. air travelling as part of a scientific community norm to attend meetings). To achieve societal change towards sustainability, Donella Meadows identified twelve leverage points as “places within a complex system (a corporation, an economy, a living body, a city, an ecosystem), where a small shift in one thing can produce big changes in everything” (Meadows 1999, p. 1). Intervening into a social, natural or technological system would be challenging and not intuitive, as the outcome of a specific intervention would be hard to anticipate due to system complexities. According to Meadows, physical structures are leverage points that work on the surface, but the more human interaction is needed, the deeper and more influential the leverage might unfold its effects. Most important are the goals of the system as well as the mind-set or paradigms out of which the system arises.

In our understanding, intentions are a part of people’s mind-set, yet they arise and depend strongly on group influences (Göpel 2016; Fritsche et al. 2018). In the context of transition research, mind-sets are understood in a more overarching and general sense than psychological research generally outlines.<sup>4</sup> Mind-sets are “[t]he shared idea in the minds of society, the great big unstated assumptions—unstated because unnecessary to state; everyone already knows them—constitute that society’s paradigm, or deepest set of beliefs about how the world works” (Meadows 1999, p. 17). They capture whole mental models, which in turn reflect the beliefs, values and assumptions that we (or a certain group or a much larger system such as

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<sup>4</sup> For instance, regarding individual volition and successful behaviour performance mind-sets are “phase-typical cognitive orientation that promotes task completion” within certain action phases (Gollwitzer, 1990, p. 63).

the Western society) hold, and they strongly influence our reasons for doing things the way we do (Kim 1999; Maani and Cavana 2007). Thus, we argue sufficiency orientation to serve as a leverage point as it formulates a goal and captures a paradigm itself that would help to bridge intentions to according behaviour. Taking this as a tenet, we explored sufficiency experts’ argumentations and identified key factors for the transformation towards a sufficiency-oriented society.

## **2. Methodology**

We conducted semi-structured interviews with experts from the German sufficiency community, coming from various backgrounds in the field of sufficiency practice and research.

This very specific group of people researching this topic or people having established a sufficiency-oriented business are, by definition, highly personally involved in the debate. After conducting the interview, the material was transcribed and analysed using content-oriented analysis (Mayring 2010). Two people conducted coding in consultation. Our scientific interest was to explore subjective viewpoints and meanings within the process of change and to detect more informal and implicit knowledge from the experts’ viewpoints.

### **2.1. Participants**

Interviewees were recruited through snowball method, i.e. personal contact, desktop research and recommendations by other interviewees. Potential participants were pre-screened by profession, age and institutional background or field of work. All of them were German native speakers and worked in Germany. Our aim was to categorize and list people into three different expertise-clusters: (a) science and education, (b) politics and administration, and (c) economy and business. We included experts in our list if they had already realised a scientific or practical project that addressed sufficiency orientation and social-ecological transformation. Our total list of experts contained 57 people. They were all contacted via email, in which we announced that we sought to obtain detailed information about their views on sufficiency, its barriers and

key factors for change. In total, we conducted 21 semi-structured interviews. Of these interview partners, 12 were female and 9 were male. We had 12 interview partners from the scientific sector (4 male), 4 from the economic sector (2 male) and 5 from the politics and administration sector (3 male). Ages ranged from 27 to 65 years. Interviews were conducted via telephone between February and June 2018; however, four interviews were conducted in written format. Albeit knowing that this option somehow conflicts with the idea of in-depth interviewing, we accepted this drawback for the benefit of receiving these experts’ perspectives on sufficiency.

## **2.2. Procedure and interview guideline**

The interviews followed a general structure of bottom-up, open-ended questions about different aspects of sufficiency orientation, including an introductory question about the relation of sufficiency and efficiency, followed by perceived barriers and enablers of change and ideas for change towards a stronger sufficiency orientation and structurally embedding this in society. The questions were formulated in a way that general concepts, personal ideas and visions could be made; we provided no pre-defined definitions on sufficiency. The interviews took between 40 and 60 min including explanations, signing the consent form and debriefing. All interviews were audio-recorded, anonymised, fully transcribed, cross-checked with the audio recording, and analysed using MAXQDA 2018 (VERBI Software 2017).

## **2.3. Data analysis**

We chose a content oriented analysis method for analysing the data, since it provides the opportunity to run exploration-oriented research. It is a flexible method that allows both inductive (data-driven) and deductive (theory-driven) analysis and helps to identify discourse patterns (Braun and Clarke 2006; Mayring 2010). It also supports research that is linked to phenomenological approaches by concentrating on people’s subjective experiences and meaning. Content oriented analysis is an appropriate way to find codes and develop themes based on the



raw data of the interviews. Important parts can be found, for instance, by analysing the frequencies of themes people brought up during the interviews, finding co-occurrences with other topics, or statements that show the broad variety of meaning within the data set (Fugard and Potts 2015). If a code occurs in several interviews, a category, which can explain a certain aspect of transformation towards sufficiency orientation, is created. The concept of content oriented analysis has been developed to transfer data into theories that are grounded within this specific data (Guest et al. 2014) allowing the presentation of plausible theoretical and empirical founded modes as well as types of sufficiency orientation and discourse patterns. This procedure helps to highlight important categories that allow us to make significant statements in that specific case.

### **3. Findings**

#### **3.1. Relationship between sufficiency and efficiency**

In the opening part of the interview, we asked interview partners about their definitions of sufficiency and efficiency. By contrasting both terms, we wanted to see if we could outline differences on how the experts described the terms and how they were interrelated to each other. We assumed this could already be ‘symptomatic’ for why sufficiency remains unattractive for practice and communication up to now.

In the experts’ descriptions efficiency contains a narrower and clearer definition. The following definition of efficiency characterizes the overall responses:

It is defined as the optimization of the input–output ratio of material consumption. A process is labelled as ‘efficient’ when you get more output from the same input or the same output from less material input. (Interview 04SIWI—scientific expert)

This statement shows that the definition remains in a technical sphere. The input–output formula of material resources serves as the basis of the definition and is cited by every interviewee. Reflecting on how to monitor this process of efficiency, for most experts the efficiency-strategy relies on two points: (a) the use of innovation and technology to increase the

efficiency effect and (b) to develop technological-oriented management processes to measure, monitor and operate efficiency outcome. Following this, the idea of efficiency in most of the cases contains the mind-set of growth, incorporating the idea that spared resources are used to produce more goods and services. The absolute saving of resources for the sake of producing less and stopping extractivism is not part of the efficiency approach by definition. This, in turn, may result in rebound effects:

Efficiency measures often have the problem in the personal consumption area that they lead to rebound effects, [...] that people tend to use the saved money to buy even more stuff. (Interview 08VOWI—scientific expert)

For sufficiency, there were no such clear definitions, but rather loosely connected descriptions and examples of appropriate behaviour. Among the experts, definition attempts varied between “nudging people to consume less” and reaching “other ways” of consumption behaviour. Experts exemplified sufficiency practices, such as gardening or repairing things to keep them long in use. Furthermore, there is the notion that people very consciously use fewer products and services by individual renunciation and thus live a more “qualitatively good life”. The first two variations have been described as more “indirect sufficiency”- pathways by one respondent. Therefore, the last one could be described as ‘true or direct sufficiency’ by implication.

Through analysing the relationship between sufficiency and efficiency, both terms gain sharpness. For some of the respondents, the concepts are complementary to each other. This view tackles the rebound effect by underlining that an efficiency strategy can only save resources when it contains a sufficiency-oriented approach likewise.

[...] Reducing lifestyle to a mandatory level of resource consumption without forgoing a certain level of prosperity. (Interview 04SIWI—scientific expert)

This quote shows the central argument of the complementary approach that the necessary reduction of material consumption will not significantly change the way of life. Some interviewees judge prosperity to go hand in hand with sufficiency and those respondents prefer technological solutions that enable people to consume less:

[...] [I]t cannot mean that politics withdraws from such questions [of responsibility] and says, 'Yes it is completely up to the consumer [...]'. What we need are enabling policies and enabling technologies that make sufficiency easier. In addition, one has to make it much harder not to live sustainably at all by accordingly designed material and non-material infrastructures. (Interview 29PAPO—political expert)

Enabling technologies in this sense are those technologies that support people in finding new ways to solve current problems in society, like computers or the internet. In a broader sense, they are cultural technologies based on social interactions. These interactions are a complex process whose primary goal is to anchor and evolve within society. They consist of a multitude of group dynamic processes that are mostly often self-organised and supported by a specific technology (Guest et al. 2014).

Other interviewees saw the relationship between efficiency and sufficiency more in opposition to another. They emphasised that sufficiency is, first of all, a question of lifestyle and the mode of reflexivity:

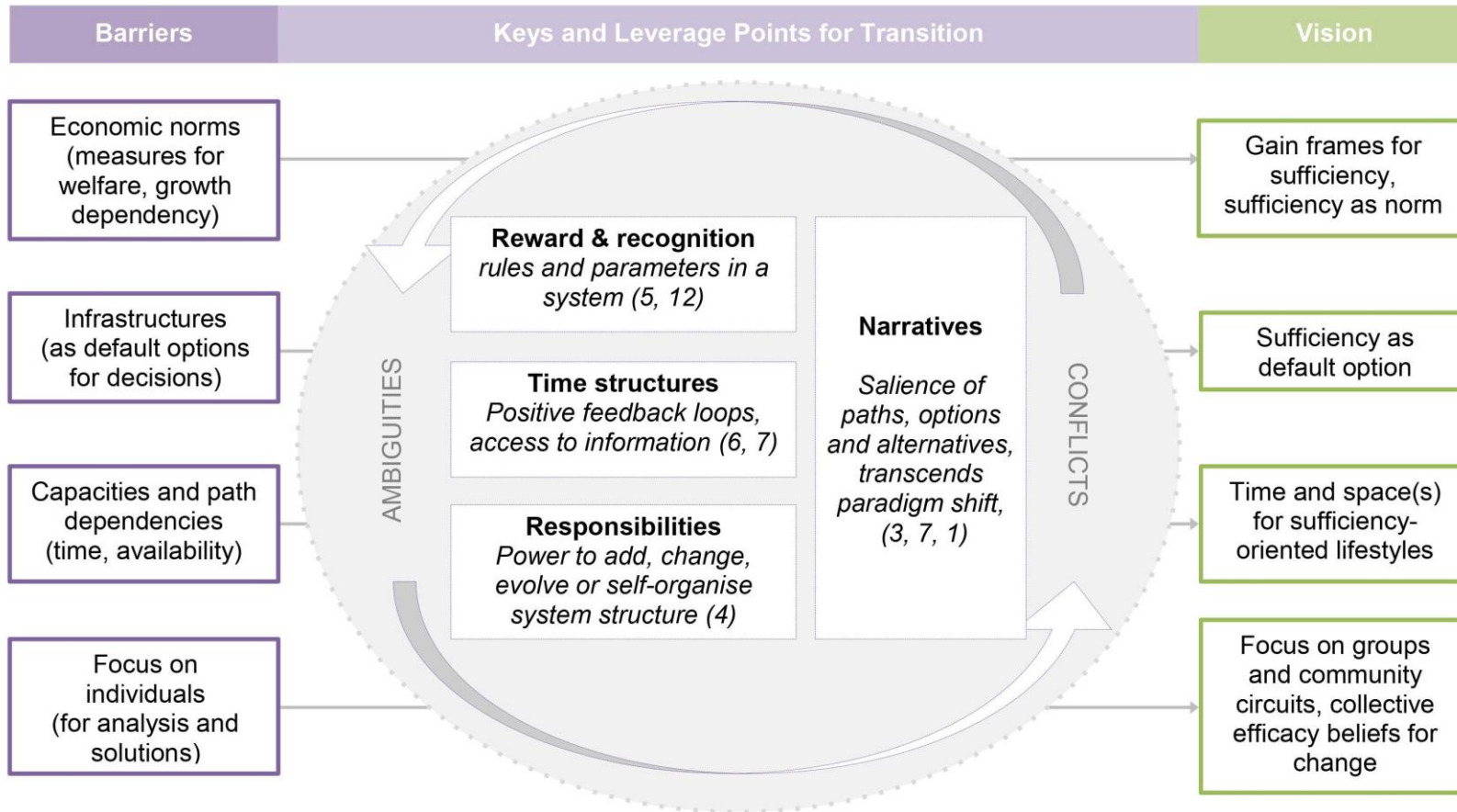
While regarding efficiency you ask [...], for example, about the most efficient way to get to Barcelona for vacation considering questions like costs or perhaps environmental impact. But following the idea of sufficiency, there's a complete other starting point one needs to think about: Do I even have to go to Barcelona to fulfil my need for a vacation? (Interview 29PAPO— political expert).

From that view, efficiency and sufficiency are two different ways to look at the situation. Respondents in favour of this approach saw sufficiency increasingly associated with individual decisions and actions.

### **3.2. Framework for transition towards sufficiency orientation**

In the second step, we analysed possible pathways towards a sufficiency-oriented society and aimed to synthesize relevant factors for system change within a framework. We focused on relevant themes that were commonly articulated by the experts. We structured them in accordance with our preliminary category scheme given by the interview guideline consisting of visions for sufficiency orientation, followed by status-quo descriptions and barriers, followed by key factors and drivers. We also listed conflicts that were mentioned by our interview partners and might influence the transition in a non-linear trend. While describing the status quo, experts immediately stated what they judge as core barriers or pathways to change the status quo. Structuring these answers, we derived categories that were compatible to build a summarizing framework of their statements (see Figure 2).

Figure 2 Illustration of a framework for a transition towards societal sufficiency orientation derived from the expert interviews



*Note.* Key points are supposed to engender transformation and can be applied to the original leverage point’s model. Numbers in brackets refer to the original leverage point’s concept by Donella Meadows (1999), i.e. the lower the number the higher the power to change the system. Ambiguities and cognitions disturb transition and produce backlashes. They need to be considered in general when looking at the pathways from the status quo and the barriers towards realizing a sufficiency-oriented society.

## **(1) Barriers**

Speaking about the status quo, experts commonly mentioned four core barriers: (1) Economic norms and rules, (2) infrastructural barriers in terms of default structures for decision-making processes, (3) capacities and path dependencies and (4) the narrow focus on individuals in analysis and solutions for transition.

(1) A crucial barrier can be summarised under the category economic norms and rules that mainly refers to the dominant economic model of market-orientation and neoliberal capitalism, like monetary welfare measurements or growth-dependency. This barrier is also mentioned as ideological ‘mind-set’, which is deeply internalised in peoples’ thinking and behaviour on small but also on larger-scales. It shapes perceptions of many people in our society and therefore prevents from thinking and acting outside the box. Experts from the economic and business sectors, for instance, struggle with the question on how to establish sufficiency practices within a competition based and consumption growth-oriented market environment.

In my opinion, it would be a cultural revolution. I think it would mean another logic within our society. [...] These growth-oriented lifestyles that are based on the idea of more, faster, higher, need to be changed completely. [Interview 12BAWI – scientific expert]

(2) Infrastructures often hinder individuals to act environmentally friendly. For example, technological devices offer ecological functions as an extra option, but not as a default option. Mobility was named as one of the biggest challenges in this sense. The current system structure is based on fossil fuels and its usage. All respondents highlighted that ecological mobility needs to be prioritised over fossil-based mobility concepts. Ecologically friendly investments into bicycle lanes and infrastructure, alongside other green mobility concepts, would give people incentives to change mobility behaviour patterns and support cleaner cities and healthier lives.

(3) Experts judged capacities in terms of time restrictions and related path dependencies such as the lack of availability of ecological alternatives in situations of restricted capacities as central barriers. It is a question of time and flexibility to produce one’s own vegetables at home, and there are only a few people who would or are able to reduce their working hours to reallocate time resources. These path dependencies limit the perceived ability to change lifestyles from one day to another.

(4) Furthermore, the experts perceived a focus on individual activities and behaviours as a target in discussing environmental consumption and behaviour in different fields of society. This is judged as a narrow view about how to enable change.

Costs of behaviour are very much less for environmentally unfriendly behaviour. As we see in the case of flying: it is cheap, it is fast, and it is possible! Even the eco-concerned people choose this option. This is a psychological intervention - but the other way around and with the wrong target behaviour. Self-efficacy for flying increased extremely. [Interview 14FRWI – scientific expert]

In the discourse, and also in many research areas on how to tackle climate change, individuals are seen as decisive. However, their embeddedness into societal and collective structures is neither considered enough nor well integrated in modelling how future prospects look like in a sustainable world. Such individualized perspectives work also as guiding principles for designing alternatives or communicating pro-environmental change, but probably prevent collective changes and restrict views for new solutions. Group dynamics and the influence of (peer) groups on individuals are only marginally considered in the public environmental protection debate. Only recently, perspectives on how groups and group processes shape responses to environmental crises have begun to emerge (see for instance Bamberg et al 2015; Fielding and Hornsey 2016; Fritsche et al. 2018, Reese et al. 2020).

## **(2) Key factors as leverage points for transition**

We derived four key factors from the interview material and summarized them in the following manner: (a) narratives, (b) reward and recognition, (c) time structures, and (d) responsibilities. These keys were seen as such points having the power to overcome aforementioned barriers and to get closer towards experts’ visions. They capture areas of the society where people work within their professions and which can be addressed through instruments, tools and by certain actors in itself (see Figure 2).

a) Experts agree that changing growth-oriented narratives into degrowth-oriented ones and evolving narratives on good life without material prosperity would be a powerful key above all. Ways of communicating about climate change as well as setting the right frames towards sufficiency orientation are necessary to increase salience and acceptance of new norms and paths towards change. Current lifestyles that are communicated to people need to be re-framed, for instance:

Travelling makes you smarter and educates you. This is a counterproductive narrative.  
[Interview 14FRWI – scientific background]

In this regard, transparency and honesty were named as important characteristics of such communication that would make sufficiency more comprehensible and practicable at all. As related drivers for this key factor, experts mentioned classic public communication through media instruments but also private and personal communication as important. Additionally, narratives serve to communicate all other leverage points and monitor system change to establish positive feedback loops.

In the case of (b) reward and recognition, experts emphasize that ecological choices need to automatically be seen and strengthened by the system itself, i.e. by certain powerful actors within the community, by important groups and the norm itself. Economic incentives need to be given clearly for the ecological option, for instance by implementing carbon pricing,



which would support ecologically friendly choices and sanction ecologically unfriendly behaviour automatically (see also Maestre-Andrés et al. 2019). In fact, the experts mainly mentioned such policy instruments as effective means.

(c) Time structures were seen as a key factor because they highly affect how people organise their lives. Time structures determine which path dependencies manifest in everyday life and how people could use their own power to break free of established structures. Some experts mentioned that a sufficiency mind-shift needs time to reflect, to try out, and to break out of the everyday structures. As appropriate enablers, experts referred to changes in general working time reduction (i.e. by policy-making) and also pioneers of change that serve as role models.

(d) As a fourth key factor, experts mentioned the allocation of responsibilities within a system. These responsibilities refer to who is made responsible for what and who is explicitly addressed when talking, for example, about changes in consumption patterns. Second, also political measures that need implementation do need taking over of responsibility by the denominated actors within our democratic structure, for instance, when people vote for getting out of coal mining, political actors should also seek to implement it. Thus, processes of participation play a significant role to engender change. Furthermore, experts mentioned regional circuits of production and consumption to work in favour of increasing ‘shared responsibilities’. As a leverage point, responsibilities capture the lever of who has the power to add, change and reorganise the system. In the case of shared responsibilities, people are much more integrated into the change itself and could feel as agents within the transformation process.

### **(3) Vision**

For most experts, the future narrative of a sufficiency-oriented society has to tackle the barriers of the present. When economic norms constitute barriers, an appropriate alternative to an economic gain-frame, namely, an alternative that supports sufficiency, would be the appropriate vision. Likewise, if available time is strongly restricted and prevents from spending time

for sufficient production or consumption patterns, then policies need to promote ways of living that free spaces for self-determined time usage. Working time reduction models were mentioned as important triggers to increase people’s engagement in sufficiency practises. In the experts’ visions, ecological sufficiency works as a guiding principle when transforming infrastructures for services or production.

Furthermore, the role of collectives and communities has changed in the experts’ visions towards increased participation (e.g. through solidarity-based agriculture projects) and regionalization regarding production and consumption processes (e.g. regional food, local renewable energy production and consumption).

#### **(4) Conflicts and ambiguities**

Some experts also mentioned more general and psychologically important conflicts and ambiguities that prevent transition processes. Emotional states were regarded as such. For example, some experts mentioned that people might have the feeling of being unable to cope with actual crises in a pro-active manner as they feel themselves not capable to shift a whole system. Furthermore, various uncertainties exist about the processes of change. Which future lifestyles are desirable being not clear at all. One expert stated: *“We don’t want back to the caves”*. Moreover, it was mentioned that societal change needs time and will come with disadvantages and conflicts: *“Disruption may come independently of what we do”*. It was also argued that the assigned role of technologies in the change process might arise conflicts. It was argued that *“technophobia of sufficiency supporters”* often contradict to the *“technical enthusiasm”* by efficiency supporters and thus integration of both perspectives becomes harder.

### **3.3. Deepening the analysis: discourse patterns for sufficiency transformation**

In addition to the presented barriers and key factors that may serve as leverage points towards system change, we have also found patterns of how these keys may unfold within the discourse on sufficiency that became apparent within our sample. We examined patterns that allow an

actor and argumentative oriented discourse analysis (Benford and Snow 2000; Hajer 1995). We looked for semantic and argumentative patterns, frames, references that have been made, or justifications with which the interviewees position themselves in the discourse. It is not only important what the interviewees said, but also the order in which they built up their own story-line (Hajer 1995) regarding sufficiency-oriented transformation. This makes it possible, for example, to understand the dynamics and developments the interviewees refer to and which negative scenarios they may omit. By doing this, further structures within the argumentation became apparent and differences in the meaning of these can be shown using the experts’ lines of argumentation. This can be used to understand which structures of meaning in the sense of motives underlie certain keys and barriers (Hajer 1995). Furthermore, the analysis shows which argumentative conditions for certain identified keys are necessary to implement them effectively and on which argumentative basis the experts respond to the barriers and keys for transformation. By doing this, the discourse strategies (ibid.) and the positioning of the interviewees can be better understood. Based on these identified discourse patterns, the locations for possible interventions can be identified and the chain of effects of the intervention can be anticipated.

We extracted the following categories that were helpful to define different discourse patterns in the experts’ argumentation regarding the transformation. These categories are (1) technology-orientations, defined as the role technology plays to support or prevent a societal shift, (2) the level of responsibility by individuals and/or societal actors, and (3) the perception of societal dynamics towards social change. These types exemplify also the ambiguity of the different sufficiency-oriented debates and positions within the discourse that were captured by the experts.

### **(1) Role of technology**

Technology plays a major part in discussions about socio-ecological transformations. All experts mentioned technology as a key element to sustainable development. However, they did

have a broad range of interpretations of technology’s role in a sufficiency-oriented society and for changing the system. For a broad group of nine participants, technology became the main role for a transformation process. They see environmental problems solvable by green and efficient technologies that will reduce emissions of carbon dioxide significantly. Talking about their visions of a future state of society, they refer to technological-oriented pictures, where people use renewable energies, electrified mobility systems and smart digital technologies, to name a few. These visions seem to be determined mainly by technological developments.

In this [a sufficiency-oriented] society, there is no or only very little unusable waste, food production takes place [or is possible] by [the help of] new technologies. The energy supply is exclusively renewable; all products are durable and repairable. Transport takes place exclusively by electrically operated by public transport systems, supplemented by a fleet of self-driven and electric vehicles. Air travelling by planes is fossil-free. [Interview 29WAWTX – economic background]

In this technology-driven scenario, the future society is above all an efficiency-oriented society and is in contrast to a strong sufficiency-orientation since people would be able to continue their way of life without constraints or major shifts.

As a sharp counterpart, another group of eight respondents presented a more critical view on technology. For them, technological solutions for environmental problems would not solve them; instead, they could cause new and unforeseeable side effects that could create new environmental problems.

New technologies always bring side-effects no one can know. I do not say they cannot solve problems. But often new problems occur together with new technologies. [Interview 13FIWT – economic expert]

This discourse can be related to the Risk Society by Ulrich Beck (1992), who states that late-modern societies (re)create their own negative side-effects and societal risks by new technological developments (e.g. nuclear energy). Furthermore, technologies that lead to efficiency savings will likely suffer from the rebound effect. Future visions of this expert group are there-

fore framed by changes in people’s everyday routines and practices as well as means of production and social cohesion. Locally embedded, based on a subsistence economy, lower need for lifestyle consumption and the overcoming of capitalism’s inherent need for economic growth, it showed another model of society compared to today. Concepts of post-growth/degrowth and a solidarity-based economy were mentioned among this group. When technology is mentioned, it plays a supporting role, i.e. where new technologies could support a sufficiency-oriented lifestyle, it is seen as a tool, but it is not an end in itself.

A third group of five respondents took an intermediate position when it came to technology. They tried to combine efficiency improvements by new technologies and a sufficiency approach with new lifestyles (i.e. a complementary approach). Technology played the role of a catalyst for lower-consumption and new sustainable lifestyles. For example, new developments of autonomous and digital technologies that could be used for production and routine tasks are able to reduce the number of working hours people have to spend daily. Technology is used to change infrastructures to support sufficiency-oriented lives. Because the respondents also saw the risk of rebound effects caused by efficiency improvements, they emphasized the role of behavioural changes to compensate or prevent possible negative side effects, bringing together efficiency- and sufficiency-orientation.

In these discourse patterns about the role of technology, it becomes visible that experts from political and economic background strongly tended to be part of the first group, while scientific experts mainly emphasized the critical views on technology, as part of the second group. The third group included experts from every background alike.

## **(2) Level of responsibility**

Another discourse pattern we found to be significant is the level of responsibility: Who is or should be responsible for concrete actions towards a sufficiency-oriented society? On the one hand this could be political or societal actors as concrete ascriptions, where a responsible institution or third actor is mentioned (like political parties or actors, enterprises etc.). On the

other hand, it could be vague and indirectly ascribed responsibility (like ‘the society’). This category is separated into two dimensions, which occurred from the interview data.

The first group of 14 participants sees a strong responsibility for actors that are able to change societal frames and conditions on a broader scale. Political actors (like government, political decision-makers) or economical players (like big industrial companies) are mainly named here. These actors were perceived as having substantial power to alter and transform existing frames and patterns in society; referring to Meadows (1999), the “*power to transcend paradigms*” is the most important leverage point in her hierarchy. Therefore, we described this dimension as a top-down approach. Respondents of this approach demanded economic framework conditions set by politics to create incentives for people and firms to act environmentally friendly, like CO<sub>2</sub> pricing or trading, investments into renewable energy and new forms of mobility as well as subsidies for research for new innovative technologies and products. People were still free to choose their way of life, but the state should increase the price to sanction polluting behaviour.

And that can only be avoided by having rules. Be it economic or cultural or legal rules that ensure that just the bad and negative behaviour is sanctioned. At the moment it is rewarded. And that's why it's hard to do the right thing. Because those who do not do the right thing will somehow be rewarded for it. I think that is a very significant obstacle. [Interview 03ESWI – scientific expert]

An orientation towards technological approaches as shown before occurred very strongly within this group. Changing economic conditions would accelerate technological innovation and simplify the switchover to greener technologies.

I think if the technology develops, I do not need to win the customer in that sense, I do not need to re-educate him and I do not have to impose somehow that somehow he has to behave ecologically, but he can no longer behave un-ecologically. [Interview 14WAWT – economic expert]

This approach sees people embedded in a market economy and does not question general economic functionalities or principles. New technologies have to be marketable, meaning that they compete with other old and non-environmentally friendly products. Consumers were

seen as price-driven and not willing to change their behaviour for the greater good not knowing whether others would follow them or not.

The interviewees from this group present a very vague idea of social responsibility. They did not believe that people will change their behaviour or firms change their business models fast enough on their own.

Ultimately, a shared understanding of how much responsibility the individual has and how much society has to take. And you cannot, so I would say in any case, you cannot change from today to tomorrow or through any advertising campaigns and something like that. But something is only possible in the longer term. [Interview 27COWI – scientific expert]

On the one hand they did not reject the idea of personal responsibility but saw it as unrealistic for effective and short-term changes towards a sufficiency-oriented society. On the other hand, they formulate a general problem that responsibilities remain abstract and are allocated to an anonymous ‘third person’ or institution like ‘the state’, ‘the market’ or ‘the politicians’.

Some people can only insult the state, they are so fixated on the fact that this must be directed from someone above, just anyone who has to do something. [Interview 23ROWT – economic expert]

In comparison to this, the second group of 6 interviewees showed a stronger attitude towards individualistic approaches of responsibility and emphasize personal behaviour as a main source of change towards sufficiency. Focusing on the individual, they saw a personal change in attitudes and consumption patterns as an effective and primary way. Where the first group was vague on concrete attributions of responsibility, this group saw a clear principle of action for every member of society to act for the greater good of a sustainable future. Where individual approaches attempt to fail, they preferred the state to intervene and to set clear rules and incentives for pro-environmental behaviour. Therefore, one could call this group – in comparison to the first one – as bottom-up oriented.

[It is a] neoliberal strategy and is also communicated by politics as such, to say you are individually responsible for the world rescue [...] political action and political strategies focus only on this individual consumption, then I believe that there is a great danger, so to speak, that the political component will be left out. [04SIWI – scientific expert]

Nevertheless, there was a strong ambiguity in this group. On the one hand, they believed in the good of people and that radical change is possible by the very own self-interest of the people for a sustainable environment. In addition, they saw pro-environmental attitudes and corresponding value-shifts as well as the reflexive capacity to change behaviour. On the other hand, they saw the individual imprisoned into the constraints of a market economy that continuously sets wrong incentives, with people staying unable to break out of their habitual performances regarding (re)production and consumption, often in a fatalistic way. The market economy, as it is today, is perceived as controlled by powerful companies, which will not give up their place and are able to dominate and influence political and legislative processes (lobbying). Politicians who are not willing enough to face these structures of power, may it be because of their own interest or political weakness, are no ally in this context.

And then, at the same time, we have a policy that thinks in legislative terms. And think about re-election. Nobody can make the decision we need to make us fit for harvest in twenty years. [...] It is a general political dilemma, shifting responsibility backwards, economic power structures. And what we need are, of course, responsible politicians with visions. [Interview 07AHPO – political expert]

Therefore, this group looked for sufficiency-oriented solutions outside of a market-economy system. These solutions were found in local and community-based projects, like local sharing groups, urban gardening or new forms of living and working. Individual responsibility, commitment and reflexivity are important categories that were mentioned during the interviews. Relationships and social ties between people are described by reciprocity and redistribution depending on one's personal needs and the possibility to participate and contribute.

Towards new technologies, they showed a critical attitude. While they did see advantages that may be brought by new technologies, they were always objects to a reservation



of unforeseeable side effects, in particular the rebound effect. But where technology and political solutions were perceived as positive, the respondents emphasized positive aspects of these when it comes to empowering people to live sufficiency-oriented more easily.

Within this discourse pattern, experts from the field of economics tend to the top-down approach, while the bottom-up approach is emphasised by scientific experts. Interviewees with a political background are much divided in this question.

### **(3) Perception of societal dynamics towards social change**

The last category is characterized by a combination of the perception of societal change and time perspectives. It refers to how the experts, on the one hand, speak and perceive the way the society changes, and on the other hand, how their visions enrol on a time scale. The first point contains an analysis of the verbal language that was used during the interviews, while the second dimension shows where on a time scale these changes are located.

One group of 11 participants showed a very active use of language describing societal change. They strongly used first-person related words to emphasize their personal relationship and relatedness to sufficiency as well as action-oriented words and statements that demanded actions and decisions in the present. For them, social change is currently happening in a way that one can say that they have a strong tendency to an optimistic view of society. Even so, they stress and reflect their own role. They also refer to society as a higher good for everyone. When it came to their visions of the future, they verbally concentrated on an immediate future. Thereby, their goals and visions were more concrete and reachable, full and rich with details when it came to planning or decision-making and strategically adaptable to the present. Their future narrative is for them a functional motivation and a legitimization for their own values and actions towards sufficiency.

Then one talks about the splitting of the landscape with wind energy, but nobody speaks of a picture of how the future looks after the energy turnaround. [...] And then when I

think about lifestyles, of sufficiency, then it is more about designing [and communicating] a picture that represents a better life. [Interview 07AHPO – political background]

On the contrary, nine of the respondents showed quite the opposite tendency. Their use of language is much more passive when it came to societal change. Instead of using first-person expressions, they referred to no specific target group who will stand for social change, mentioned non-personal subjects like society, politicians and ‘the system’ in general or just ‘somebody’ who has to do ‘something’. This results in a pessimistic and sometimes fatalistic view whether a sufficiency-oriented society will ever occur or not. Change often seemed almost unreachable due to ‘higher powers’ that are stronger in enforcing their interests because of financial or political power. They also did not believe that people will change on their own, whether fast enough or by intention, so that they have to be nudged by economic incentives and frames.

Their plans and visions were very broad and universal, often only mentioned as buzzwords (e.g. ‘more renewable energies’ or ‘less pollution by industry’) that were not backed with concrete ideas or actions. Furthermore, their future narratives were very far located in time, so that they neither serve a personal motivational function in the present nor as a guiding principle for the society as a whole. They often emphasized their visions of a better future, but miss a concretization of them that demonstrate that real change is possible. They envisioned a better societal system; however, at the same time, they feel overwhelmed and suppressed by the actual system.

I think the majority of society is again aware that the survival strategy for our planet is to live sufficiently [...]. One also needs more green energy, more environmentally friendly things. I don’t know what this looks like. [...]. But this is all against the power and profit interests of the chemical industry [...] and other players. [Interview 16GRPOX – political background]

Experts with scientific background tend to be stronger represented in the first group, as well as most of the political experts. The second group slightly tends to be consisted by economic experts. However, we find all expert groups in both categories.

#### **4. Discussion**

In this paper, we argued that sufficiency-orientation can serve as a leverage point for societal transformation. It needs to be assisted by further strategies and instruments that touch deep as well as shallow leverage points (Abson et al. 2017). To explore such places to intervene, we explored barriers and key factors of such a mind-shift. We conducted expert interviews and analysed them using qualitative content analysis. As barriers, we identified rules and norms, the setup of current infrastructures, capacities in terms of time and availability and the focus on individuals as actors, each preventing in a certain degree from spreading sufficiency-orientation within our society. These findings underline that crucial barriers (such as the growth dependency in our economy) do not change easily. We, furthermore, derived important keys that could be implemented to release change: narratives, rewards and recognition, time structures and responsibilities. Addressing these by political strategies or measures would be very powerful as they target both deep and shallow leverage points within the Meadows’ hierarchy (cp. Figure 2). Targeting these keys has the potential to change the system more fundamentally (Abson et al. 2017) and would make future visions on sufficiency-orientation more likely.

We analysed how experts defined sufficiency versus efficiency and confirmed that sufficiency (independently of the experts’ background) remains fuzzy in contrast to the technical definition of efficiency. Talking about sufficiency, however, has produced vivid and emotional statements by the experts as they described behaviours and exemplified how to live sufficiency-oriented in terms of future perspectives. We argue that the openness of the concept is valuable because it frees creativity for solutions and new approaches but also includes the risk to communicate the concept. But as we have seen in the interviews as well, a clear differentiation between sufficiency and efficiency gets harder when it comes to sufficiency as practise. This is also a common view in current research. Especially when talking about energy sufficiency, elements of (socio-technical) efficiency are automatically captured and must be discussed interrelated (e.g. Samadi et al. 2017). Furthermore, the sufficiency perspective has to deal with the criticism of running the risk of rebound effects as efficiency also has to (Sorell et

al. 2020). It would, therefore, be important to better understand the differences between the academic and the practical or activist discourse as well as their insights into concrete projects and/or best practise examples. Future research should extend the research to experts who are less involved in the academic sufficiency debate and/or who take an activist viewpoint. These insights would help to explore mechanisms that are important in everyday life to maintain sufficiency-oriented practises (for example such as the role of basic psychological needs, see Kasser 2017). Also, conducting a study on a sample of researchers that work on efficiency and who are more sceptical about sufficiency would be of interest to deeper understand where the limits of sufficiency are and how rebound effects could be prevented (Sorell et al. 2020). In any case, if sufficiency is increasingly integrated into the sustainability debate, the definition would become sharper bringing clarity about how sufficiency-oriented life would look like and which role efficiency would play in it.

Our findings connect nicely to current questions of environmental psychology and the attitude-behaviour gap (Reese et al. 2020). Many of the experts in our sample pointed out that to understand how a sufficiency-oriented society could look like, we need to address societal and infrastructural barriers increasingly to shift behaviour and mind-sets. These, however, are sometimes hard to define and not generalizable. Technological inventions for one stakeholder group may reflect barriers for another relevant group (for a case study on sufficiency business model see Brocken et al. 2020, Sovacool et al. 2018). To us, it seems important to understand the interfaces between barriers and keys in different societal groups and areas to gain a better understanding where effective levers could be set and by which concrete measure. There are well-established and manifold received connections between technological development and a responsible political sphere and their ability to set incentives and change frames to progress transition towards sustainability (Spangenberg and Lorek 2019). What all experts and discourse patterns share was the conviction that it needs a political and societal supported possibility for enabling other lifestyles, may it be through “enabler technologies” or frameworks for carbon reduced and environmentally friendly behaviour. A sound ‘principle to enable’ could be

a guiding maxim for (political) decision-makers that considers the intention-behaviour gap and works on closing it.

An important question is which role psychological research and practise play within the sufficiency and transformation debate. Psychological insights help to examine how individual sufficiency-orientation actually drives low-impact behaviour (Verfuerth et al. 2019, Frick et al. 2020). It can also explore peoples’ visions about how a sufficiency-oriented society could be achieved, and offer deeper understandings of how such vision work in favour of a socio-ecological transformation.

## **5. Conclusion**

Experts formulated central key points that need to be addressed to overcome current barriers and drive the transition towards societal sufficiency-orientation. The proposed framework (see Figure 2) derived from the experts’ statements also points out that inter- and transdisciplinary approaches incorporating both top-down and bottom-up strategies are necessary to address these outlined key factors and fill them with life. In practise, political measures could be valued in the light of these key factors. Any legislative proposal or initiative could be measured by whether it aims to enable individuals and collectives to live sufficiency-oriented and is measured by the power to actually reduce harmful effects on the climate. Of course, the presented framework is still open for development and research. Best practice examples should be discussed regarding their effectiveness to shift behaviour and raise both collective and individual sufficiency-orientation. The framework may inspire practitioners, policymakers and scientists alike to explicitly target the elements and implement strategies that address the key factors. We hope that this study contributes to the debate about the potential of sufficiency-orientation as a leverage point, and inspires further research on it.

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#### 4 MANUSCRIPT 2 – EXPLORING THE PSYCHOLOGICAL ANTECEDENTS OF PRIVATE AND PUBLIC SPHERE BEHAVIOURS TO REDUCE HOUSEHOLD PLASTIC CONSUMPTION

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##### **Abstract**

In the last few years, plastic has become an issue of current interest as tremendous ecological effects from plastic littering have become visible. Taking the role of consumers into account, activities comprising purchasing decisions and political engagement are expected to help prevent plastic pollution. The goal of this study was to examine antecedents of three potential plastic reduction activities: purchasing, activism, and policy support. Based on well-established psychological models of pro-environmental behaviour (i.e. theory of planned behaviour, norm activation model), an online survey ( $N = 648$ ) was administered and analysed via structural equation modelling. Results revealed that personal norms were a relevant predictor of all three intentions. Whereas sufficiency orientation and collective efficacy predicted only activism intention and policy support intention, perceived behavioural control was the strongest predictor of purchasing intentions. Regarding behaviour, people with high activism intentions and sufficiency orientation were more likely to choose a plastic-free incentive instead of the conventional shopping voucher. This study highlights psychological antecedents of plastic reduction. An integrated model showed that rational cost-benefit considerations as well as morality serve as drivers of reducing plastic consumption. Implications for the promotion of plastic-free consumption are discussed.

##### **Keywords**

Environmental psychology, pro-environmental intentions, plastic consumption, sufficiency orientation, TPB

## **1. Aims and background**

Plastic pollution is a major global crisis: Worldwide, 359 million tons of plastic are produced every year (PlasticsEurope, 2019). It is estimated that 79% of the plastic waste that humans have generated has ended up in landfills or in the natural environment (Geyer et al., 2017). Once plastic is released into the environment, animals ingest it, become sick, and die (Li et al., 2016; Sigler 2014). Plastic residuals have also been detected in human bodies (Galloway, 2015). A reduction in plastic production and consumption is necessary to stop the plastic contamination of marine and terrestrial ecosystems (Horton et al., 2017; Jambeck et al., 2015). Here, the consumer plays a decisive role.

According to the *Sustainable Development Goals*, sustainable consumption and production means “doing more and better with less” (Reisch et al., 2016, p. 234). Thus, taking the waste hierarchy into account, promoting a reduction in plastic use is an important step towards tackling the plastic problem (Gharfalkar et al., 2015). Whereas many studies have focussed on recycling behaviour, only a few have examined reduction-oriented behaviours in the field of purchasing decisions (Heidbreder et al., 2019). The factors that motivate people to reduce plastic consumption are still understudied. The current study fills this gap by examining psychological factors that determine behaviours that are oriented towards plastic reduction.

When referring to plastic pollution, current concerns primarily focus on single-use plastic with a short life and a fast subsequent disposal. As 40% of the demand for plastic in Europe can be traced to packaging (PlasticsEurope, 2019), this study examined single-use plastic. The European Commission has also tackled single-use plastic and proposed a directive to target the single-use plastic products that are most often found on European beaches (European Commission, 2018). Like many other areas of consumption, the current use of plastic needs to be transformed to meet global sustainability goals (Bengtsson et al., 2018). People in the roles of consumers, citizens, and responsible members of the public (European Commission, 2018) can engender change not only through private but also through political behaviour

(Stern, 2000). Therefore, it is important to take several types of consumer responses into account and examine them in parallel. There is a lack of studies that have integrated several behavioural strategies to address plastic pollution in both the private and public spheres.

To fill this gap, this paper first reviews relevant literature on relevant psychological antecedents for lowering plastic consumption. Then the study presents an integrated model based on the literature review. The model is designed to contribute to a comprehensive understanding of various anti-plastic activities in both the private and public spheres. Based on the results from the tests of a structural equation model and the estimated parameters, theoretical and practical implications of the study are presented.

### **1.1. Literature review**

To capture important antecedents of single-use plastic reduction, available theories that have been proposed to explain pro-environmental behaviour need to be consulted. First, the theory of planned behaviour (*TPB*; Ajzen, 1991) provides important predictors. It uses a rational choice approach to explain when and why people engage in pro-environmental behaviour. The theory proposes that intention is a direct predictor of behaviour. Attitude (in terms of cost-benefit considerations about a behaviour), perceived behavioural control (the belief that one is capable of performing the behaviour), and social norms (perceived social pressure to perform the behaviour) indirectly influence behaviour via intentions (Armitage & Conner, 2001). Furthermore, perceived behavioural control is expected to have a direct impact on behaviour.

The *TPB* has been widely applied to the context of sustainable behaviour (Si et al. 2019), such as recycling behaviour (Cheung et al., 1999; Nguyen et al., 2019; Tonglet, Phillips, & Read 2004; Valle et al., 2005). So far, however, the *TPB* has only rarely been applied to both plastic use and consumption reduction (Si et al. 2019). A few studies have explored components of the *TPB*, such as social norms to predict the use of cloth bags instead of plastic bags (Ari & Yilmaz, 2017) or to predict waste minimisation (Tonglet et al., 2004). Beyond such private-sphere behaviours, *TPB* variables have been found to explain environmental activism (Fielding et al.,

2008), indicating that people with positive attitudes towards environmental activism and stronger social norms were more likely to engage in pro-environmentalism.

In several studies, constructs from additional theories, such as personal norms (i.e. feeling a moral obligation to act), have predicted pro-environmental intentions (Bamberg et al., 2007; Klöckner, 2013; Ravis et al., 2009). Hence, pro-environmental behaviours result not only from rational cost-benefit analyses as proposed in the TPB but also from moral choices. According to a meta-analysis, TPB variables supplemented by personal norms explained 52% of the variance in pro-environmental behavioural intentions (Bamberg & Möser, 2007). In the context of plastic use, TPB variables in combination with personal norms predicted recycling behaviour (Ofstad et al., 2017; Pakpour et al., 2014; Tonglet et al., 2004). In the case of packing choices, personal norms were influential and were an even stronger predictor than TPB variables (Thøgersen, 1999). On the basis of the stable finding that personal norms uniquely affect various kinds of pro-environmental behaviour, Klöckner (2013) proposed an integrated model that included personal norms, attitudes, perceived behavioural control, and social norms as direct predictors of pro-environmental intentions.

In the field of plastic handling, the question of loss of biodiversity through marine littering and its consequences is a global challenge. Therefore, the question that arises is whether the behaviour of a single person can *in fact* make a significant difference or whether the problem can be solved only through collective action. Since individual behaviour sometimes appears to be only a 'drop in the ocean', the perception of collective efficacy is important. It captures the belief that a group that a person belongs to or identifies with can influence a person to move towards a certain goal (e.g., reducing waste by using re-usable coffee cups as the person's peers do; Hamann & Reese 2020). In line with this reasoning, collective efficacy in terms of the expectation of attaining a goal through collective action was found to have additional power to predict pro-environmental behaviour (Chen, 2015; Homburg & Stolberg, 2006; Jugert et al., 2016) and thus influence plastic reduction (Reese & Junge, 2017).

Besides the constructs in the TPB, personal norms, and collective efficacy, sufficiency orientation is an additional construct that has recently been introduced into the pro-environmental debate. It captures people's general tendency to refrain from resource-intensive consumption in order to protect nature and to live a good life within planetary boundaries (Verfuërth et al., 2019). It is correlated with significantly lower individual CO<sub>2</sub> emissions in private behavioural domains, such as food consumption and everyday mobility (Loy et al., 2021; Verfuërth et al., 2019). The broader term sufficiency (lat. *sufficere*, enoughness) denotes a sustainability strategy that counteracts several effects of overconsumption, such as environmental degradation through fossil-fuel-based plastics by strictly reducing overall consumption (Samadi et al., 2017; Toulouse et al., 2019). In contrast to the efficiency sustainability strategy, which optimises input-output resource ratios on the level of technology and production (i.e. an example in the field of plastics is outlined by Milad et al., 2020), sufficiency goes beyond technical solutions by addressing the roots of (Western) consumerist lifestyles. It involves an understanding of how both the values that people hold and societal infrastructure constantly push fossil-fuel-based behaviours forwards. Sufficiency involves striving to implement ways of consumption that meet humans' basic needs without overburdening earth's natural resources and thus maintaining a good life within planetary boundaries (Spengler, 2016; Tröger et al., 2021). However, not solely individual behaviour but also technologies and infrastructure (e.g. the materials used to provide to-go alternatives) can be judged on the basis of sufficiency criteria and thus incorporate socio-ecological standards in its foreground (Vargas-Elizondo, 2020). Such an infrastructure would require collective action and progressive policies, which probably might be a consequence from people's motivation to downsize consumption more broadly (Schierup & Alund, 2020; Tröger & Reese, 2021).

## 1.2. Theoretical model and hypotheses

According to Stern (2000), individuals can adopt a sustainable lifestyle, or they can support others (e.g. policy or business) to act accordingly. In his taxonomy, he distinguished between private sphere behaviour (e.g. buying organic food or recycling household waste) and public sphere activities, such as environmental activism (e.g. active involvement in demonstrations), civic engagement (e.g. joining an organisation, signing a petition), and policy support (e.g. willingness to pay taxes for environmental goals). The current study adopted this differentiation and sought to identify shared and unique predictors in the field of anti-plastic use and activities. Using the integrative approach by Klöckner (2013), TPB variables and personal norms were combined as predictors of intentions. Taking the rational choice approach into account, the following hypotheses were tested:

H1a: Each of the *TPB* variables (attitude, perceived behavioural control, social norms) has a unique direct effect on (a) private sphere and (b) public sphere behavioural intentions.

H1b: Private and public sphere intentions as well as perceived behavioural control have a unique direct effect on behaviour.

Behaviour is not driven only by self-interest. In several studies, effects of the TPB were complemented by personal norms (the feeling that one has a moral obligation to act; Schwartz 1977). According to Stern (2000), personal norms shape pro-environmental behaviour in both the private and public spheres (Stern, 2000). Following the original norm activation model (*NAM*, Schwartz, 1977), personal norms directly influence behaviour. Therefore, the following hypotheses were tested:

H2a: Personal norms have a unique direct effect on (a) private sphere and (b) public sphere behavioural intentions.

H2b: Personal norms have a unique direct effect on behaviour.

Two additional predictors were also added to Klöckner's model. First, the impact of engaging in anti-plastic behaviour can primarily be detected on a collective level. Collective efficacy has

been found to predict pro-environmental behaviour and intentions in the private and public spheres (see Hamann & Reese, 2020). Therefore, collective efficacy was included as an additional predictor in the integrated model. Thus, the following hypotheses were tested:

H3a: Collective efficacy has a unique direct effect on behavioural intentions in (a) the private sphere and (b) the public sphere.

H3b: Collective efficacy has a unique direct effect on behaviour.

Second, current models are missing an anti-overconsumption attitude and have thus failed to present an alternative to the emphasis on efficiency that exists in the field of pro-environmental behaviour. To include such a predictor, the current study proposes that sufficiency orientation can be used to represent people's attitudinal stance towards reducing consumption, leading to private-sphere intentions of anti-plastic-activities. Furthermore, living in a sufficiency-oriented manner is often very hard for one individual within an infrastructure that generally causes (over-)consumption (e.g. the fossil-fuel based energy infrastructure in many European countries). Therefore, it is probable that an individual's sufficiency orientation goes hand in hand with a vote for stricter political measures that make sufficiency-oriented decisions easier. People who express a high sufficiency orientation are also likely to support public sphere behaviour that is aimed at bringing about structural changes. Thus, the following hypotheses were tested:

H4a: Sufficiency orientation has a unique direct effect on behaviour intentions in the (a) private sphere and (b) public sphere.

H4b: Sufficiency orientation has a unique direct effect on behaviour.

Thus, the model proposes that anti-plastic activity intentions in the private and public spheres can be predicted by people's perceived behavioural control, attitude, social and personal norms, collective efficacy, and sufficiency orientation. Behaviour is further expected to be directly predicted by intentions, perceived behavioural control, personal norms, collective efficacy, and sufficiency orientation.

### **1.3. The goals of the study**

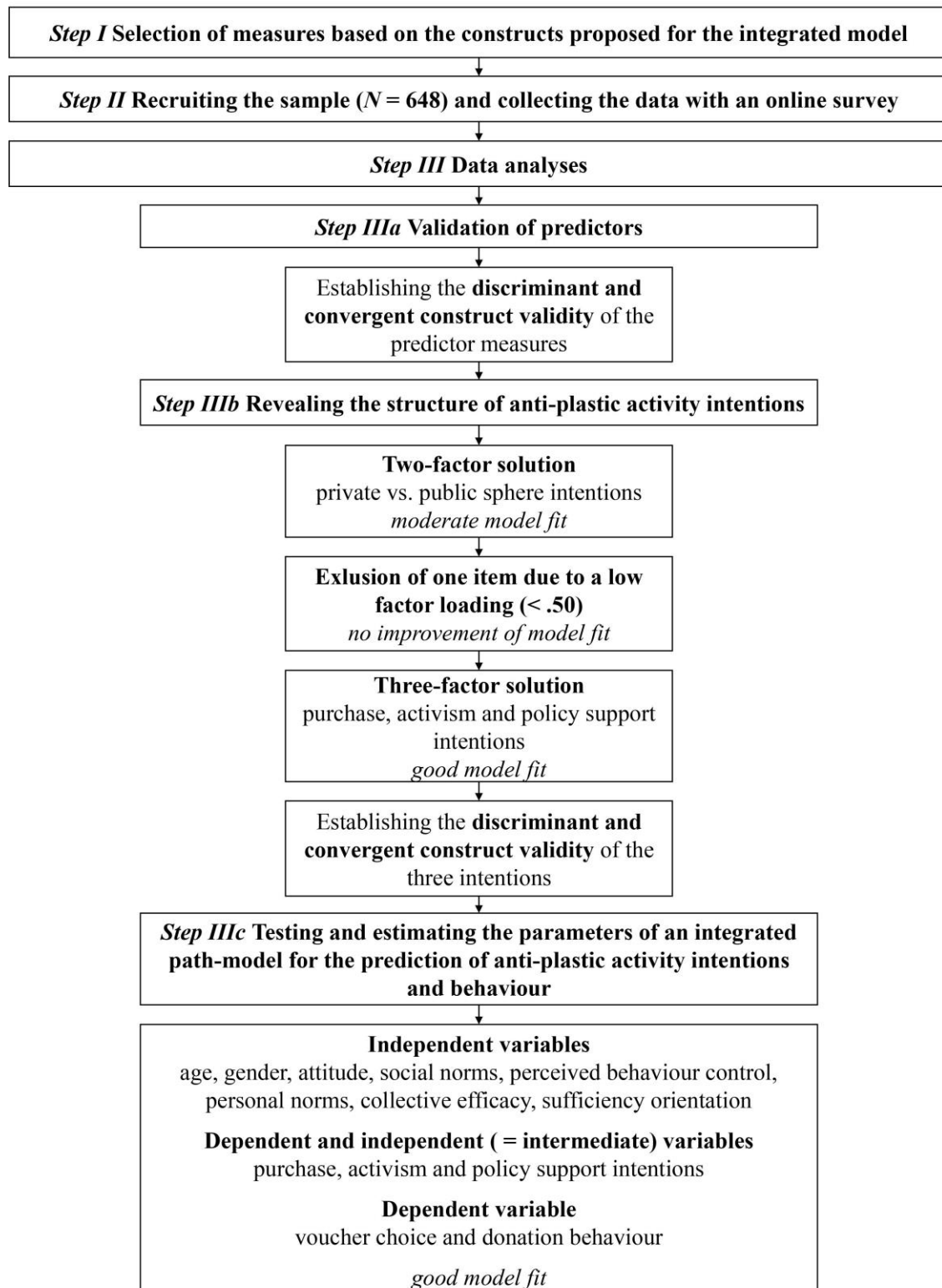
This study pursued four goals: First, it was aimed at increasing knowledge in the field of consumption-related plastic reduction by testing an integrated model of several anti-plastic activities. The focus was on plastic packaging because the majority of plastic use in Europe can be traced back to packaging (PlasticsEurope, 2019). Second, environmental impact cannot be limited to individual consumption decisions only. In line with Stern's approach, several dimensions of anti-plastic activities were considered as outcome variables. By testing the integrated model in both the private and public spheres, unique and shared predictors of various anti-plastic activities can be identified and can reveal spillover effects as reflected by correlations between activities originating from shared sources of variance. Third, and following the interdisciplinary debate on transformation and sustainability, sufficiency orientation was integrated into the model, and its potential in one particular field of reduction-oriented behaviour was explored. Psychological research on sufficiency orientation is still in its infancy, but a deeper understanding is necessary to make sufficiency policies more attractive and feasible (Gosse, et al., 2019; Spangenberg & Lorek, 2019). Fourth, by combining several theories (*TPB*, *NAM*) and including constructs that have not yet been investigated in the context of these theories (sufficiency orientation), the current study aimed to explore whether the proposed integrated model has surplus value in predicting plastic behaviour over and above each theory and construct alone.

## **2. Methods**

The flowchart in Figure 3 depicts the methodological steps that were taken to move towards the four goals of the current research. The steps are numbered and match the order of the gullwing paragraphs.



Figure 3 *Flowchart of research methodology and data analysis; the authors' own design and production*



## 2.1. Measures

Several psychological variables that, according to the integrated model, should be important predictors of plastic-related activities were included in the questionnaire<sup>5</sup> (cf. *Step 1* in Figure 3). If not otherwise stated, answers were recorded on Likert-type scales ranging from 0 (do not agree at all) to 4 (agree completely). The questionnaire can be found in the Appendix I.

*Attitude.* To measure people's attitude towards plastic packaging and its usage, participants answered the question "In my opinion, using plastic packaging is...", and indicated their personal opinion on four statements in completion of this sentence, such as, "practical" or "cheap". Higher numbers recorded a positive attitude towards plastic packaging use.

*Perceived behaviour control.* Participants indicated their beliefs in their ability to avoid using plastic packaging by responding to four items (e.g. 'For me, it is easy to avoid using plastic packaging').

*Social norms.* Four items captured descriptive norms (e.g. 'Most people whose opinion I value try to use less plastic packaging') as well as injunctive norms (e.g. 'Most people who are important to me expect me to avoid using plastic packaging'). Confirmatory factor analysis revealed that the items had one factor in common; hence, descriptive and injunctive norms were combined into one social norm variable.

*Personal norms.* To measure personal norms, three items were adopted from previous work (e.g. Bamberg et al., 2007; Harland et al., 1999), for instance, 'I feel morally obliged to use less plastic packaging'.

*Collective efficacy.* Four items measured collective efficacy (Homburg & Stolberg 2006; Jugert et al., 2016), for instance, 'I think that we as consumers can solve the plastic packaging problem together'.

*Sufficiency orientation.* To measure people's readiness to downshift from high-impact consumption to low-impact consumption, a sufficiency orientation scale was implemented

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<sup>5</sup> The questionnaire was part of a broader survey, but only constructs that fit the theoretical framework of this study are reported here.

(Verfuerth et al., 2019). People answered six statements, for instance, ‘It’s unnecessary to have such a large range of products in supermarkets’ and ‘Usually, high consumption increases environmental pollution’.

*Intentions.* Nine items measured intentions to engage in anti-plastic activities in both the private and public spheres. A confirmatory factor analysis revealed a three-factor solution (see section 3.2), with three items capturing purchasing intentions, two items measuring activism intentions, and three items assessing policy support intentions. One item indicating the willingness to pay for plastic-free products was excluded due to a low factor loading (see Results).

*Behaviour.* As a reward for their participation, participants selected between two types of vouchers: a conventional online shopping voucher versus one for an online shop selling only plastic-free products. As a third option, participants could donate the monetary value of the voucher to an NGO that was lobbying to raise awareness of the plastic waste problem. People’s choices served as a behavioural measurement in the form of a binary variable that aggregated the last two options into an ecological category (conventional vs. plastic-free option).

## **2.2. Procedure and participants**

$N = 648$  German participants completed an online survey during summer 2017. Participants were recruited via mailing lists from German universities and social media (cf. *Step II* in Figure 3). Shopping vouchers were offered as incentives for participation. The survey was implemented on SosciSurvey (Leiner, 2016). The mean time to complete the survey was 15 minutes ( $M = 14.42$ ,  $SD = 5.14$ ; median = 13.87). Participants’ ages ranged from 18 to 76 years ( $M = 30.34$ ,  $SD = 10.56$ ). The sample was predominantly women (77% women, 22% men, and 2% who did not indicate their gender). Educational level was above the German national average (Destatis, 2018): 35% indicated that they had a high school diploma (national average = 32%), and 56% had a university degree (national average = 18%).

### **3. Results**

All analyses were conducted with R (version 3.5.2). The *psych* package (Revelle, 2018) was used for descriptive analyses and correlations, and *lavaan* (Rosseel, 2012) and *sem* (Fox et al., 2017) were used for structural equation modelling. Statistical analyses were based on the general linear model (Rencher & Schaalje, 2008). Except for gender and behaviour, manifest and latent variables were considered interval scales. Gender was considered a binary categorical variable. Behaviour was considered an ordinal scale. Only linear correlations and regression effects were estimated. Nonlinear and interaction effects were not estimated because such effects were not predicted by the hypotheses. Model tests and parameter estimation for all structural equation models, including confirmatory factor analysis models (linking manifest and latent variables) and structural models (linking latent variables), were performed according to current statistical standards (Bagozzi & Yi, 2012; Kline, 2016). The models were fit to covariance matrices. Latent means were not estimated. ML (Maximum Likelihood) estimators were used if the variables in question were considered interval scales and if their distributions did not deviate significantly from a normal distribution. Otherwise, robust WLSMV (Weighted Least Squares Mean and Variance Adjusted) estimators were used.

#### **3.1. Validation of predictors**

Table 1 presents results on convergent and discriminant validity as well as on the reliabilities of the six predictors in the model that was based on confirmatory factor analysis (cf. Step IIIa in Figure 3). The Maximum Shared Variance (MSV) and the Average Shared Variance (ASV) were found to be lower than the Average Variance Extracted (AVE) for all the predictors, indicating discriminant validity for the predictors. The Average Variance Extracted (AVE) of each construct was higher than its correlation with other constructs, indicating convergent validity (see Alumran et al., 2014).

Table 1 *Assessment of the convergent and discriminant validity and reliability of the predictors of anti-plastic activity intentions*

Scales	AVE	MSV	ASV	REL
Perceived behaviour control	0.487	0.228	0.156	0.783
Attitudes	0.489	0.198	0.104	0.781
Social norms	0.448	0.062	0.041	0.755
Personal norms	0.707	0.362	0.187	0.874
Collective efficacy	0.554	0.249	0.134	0.831
Sufficiency orientation	0.516	0.362	0.160	0.832

*Note.* AVE Average Variance Extracted; MSV Maximum Shared Variance; ASV Average Shared Variance; REL Reliability.

### 3.2. Revealing the structure of anti-plastic activity intentions

According to Stern’s basic classification, a confirmatory analysis (cf. *Step IIIb* in Figure 3) of two factors that differentiated between private sphere intentions (three items) and public sphere intentions (six items) was conducted. The model did not demonstrate a good fit:  $X^2(26) = 152.35$  ( $p < .001$ ), CFI = .931, RMSEA = .087 [.074; .100], SRMR = .051. One item (willingness to pay more for plastic-free products) was excluded due to a low factor loading ( $< .50$ ). However, the fit showed only minimal improvement:  $X^2(19) = 115.04$  ( $p < .001$ ), CFI = .942, RMSEA = .088 [.073; .104], SRMR = .046. Therefore, Stern’s model was modified by differentiating between activism and non-activist behaviour within the public sphere (see Table 2). The fit of the resulting three-factor model was good:  $X^2(17) = 38.24$  ( $p = .002$ ), CFI = .987, RMSEA = .044 [.025; .063], SRMR = .028. Importantly, the three-factor model fit the data significantly better than the two-factor model did,  $X^2(2) = 76.8$ ,  $p < .001$ . The results indicated a strong correlation between the factors, particularly between the two public sphere factors. This is plausible due to the content-related proximity of the two constructs. As the confidence interval around the value,  $.67 \leq \phi_{23} \leq .89$ , did not include 1.00, the constructs were concluded to be distinct. Table 3 contains the results on convergent and discriminant validity and reliability based on the confirmatory factor analysis of the three anti-plastic activity intentions. The small difference between AVE and ASE reflects the strong correlations between the three factors. On the basis of the content and the better fit, the three-factor solution was retained.

The first factor reflected ‘purchasing intentions’ and was measured with three items that indicated a willingness to buy food without packaging. The second factor reflected ‘activism intentions’ and was measured with two items that captured the willingness to actively engage in organisational structures against plastic use or to participate in a demonstration. The third factor reflected ‘policy support intentions’ and was measured with three items that expressed support for policy regulations, such as voting and signing a petition.

Table 2 *Parameter estimates and fit indices for the two- and three-factor models of anti-plastic activities*

	Two-factor		Three-factor
$\lambda_{11}$	.66	$\lambda_{11}$	.65
$\lambda_{21}$	.75(.11)	$\lambda_{21}$	.74(.11)
$\lambda_{31}$	.69(.11)	$\lambda_{31}$	.70(.11)
$\lambda_{42}$	.68	$\lambda_{42}$	.77
$\lambda_{52}$	.69(.08)	$\lambda_{52}$	.75(.07)
$\lambda_{62}$	.65(.05)	$\lambda_{63}$	.80
$\lambda_{72}$	.73(.06)	$\lambda_{73}$	.70(.05)
$\lambda_{82}$	.69(.06)	$\lambda_{83}$	.67(.05)
$\lambda_{92}$	.50(.06)		
$\theta_{\delta 11}$	.58(.04)	$\theta_{\delta 11}$	.58(.04)
$\theta_{\delta 22}$	.44(.07)	$\theta_{\delta 22}$	.45(.07)
$\theta_{\delta 33}$	.53(.08)	$\theta_{\delta 33}$	.51(.08)
$\theta_{\delta 44}$	.54(.05)	$\theta_{\delta 44}$	.40(.06)
$\theta_{\delta 55}$	.53(.06)	$\theta_{\delta 55}$	.45(.07)
$\theta_{\delta 66}$	.58(.03)	$\theta_{\delta 66}$	.36(.04)
$\theta_{\delta 77}$	.47(.04)	$\theta_{\delta 77}$	.51(.04)
$\theta_{\delta 88}$	.53(.03)	$\theta_{\delta 88}$	.55(.03)
$\theta_{\delta 99}$	.76(.05)		
$\phi_{21}$	.62(.04)	$\phi_{21}$	.64(.04)
		$\phi_{31}$	.50(.04)
		$\phi_{23}$	.78(.06)
$\chi^2(df)$	152.35(26), $p < .001$	$\chi^2(df)$	38.24(17), $p = .002$
RMSEA	.09	RMSEA	.04
TLI	0.90	TLI	.98
CFI	0.93	CFI	.99
SRMR	.051	SRMR	.028

*Note.* Standard errors of parameters in parentheses; error variances, covariances and factor loadings are standardized;  $N = 648$ .

Table 3 *Assessments of the convergent and discriminant validity and reliability of anti-plastic activity intentions*

Scales	AVE	MSV	ASV	REL
Purchase intention	0.487	0.407	0.330	0.732
Activism intention	0.575	0.601	0.504	0.728
Policy support intention	0.527	0.601	0.427	0.764

*Note.* AVE Average Variance Extracted; MSV Maximum Shared Variance; ASV Average Shared Variance; REL Reliability.

### 3.3. Descriptive analyses

Table 4 presents the bivariate correlations between the latent variables, behaviour, and socio-demographic variables from the CFA model. When aggregating the intention items into manifest scales, policy support intentions ( $M = 3.18, SD = 0.83$ ) reached higher approval rates than purchasing intentions ( $M = 2.55, SD = 0.99$ ) and activism intentions ( $M = 2.14, SD = 1.14$ ). Considering socio-demographics, age was not significantly correlated with policy support or activism intentions, but it was weakly correlated with purchasing intentions, indicating that elderly people were more willing to purchase products with less plastic packaging ( $r = .16$ ). Women were also more likely to purchase products with less packaging ( $r = .33$ ), to show more activism ( $r = .19$ ), and to show more policy support ( $r = .23$ ).

Table 4 *Correlations between the latent variables, behaviour, and socio-demographic variables from the CFA model*

	1 - BEH	2 - PU	3 - ACT	4 - PS	5 - Age	6 - GD	7 - ATT	8 - SN	9 - PBC	10 - PN	11 - CE	12 - SO
1	-	[.32;.49]	[.44;.59]	[.41;.57]	[.08;.25]	[.12;.28]	[-.36;-.18]	[.05;.24]	[.16;.34]	[.36;.51]	[.14;.32]	[.37;.52]
2	.41***	-	[.56;.72]	[.43;.60]	[.08;.25]	[.25;.41]	[-.67;-.52]	[.12;.32]	[.68;.81]	[.63;.75]	[.33;.50]	[.43;.58]
3	.51***	.64***	-	[.72;.85]	[-.07;.11]	[.11;.28]	[-.49;-.31]	[.23;.42]	[.31;.49]	[.51;.66]	[.37;.54]	[.41;.57]
4	.49***	.51***	.79***	-	[-.02;.15]	[.15;.32]	[-.41;-.23]	[.13;.32]	[.17;.36]	[.60;.72]	[.38;.45]	[.56;.69]
5	.17***	.16***	.02	.07	-	[-.18;-.03]	[-.25;-.08]	[.04;.21]	[.04;.21]	[.07;.23]	[-.14;.03]	[.08;.25]
6	.20***	.33***	.19***	.23***	-.10**	-	[-.30;-.14]	[-.10;.08]	[.08;.25]	[.23;.38]	[.08;.25]	[.07;.23]
7	-.27***	-.60***	-.40***	-.32***	-.17***	-.22***	-	[-.22;-.03]	[-.53;-.37]	[-.48;-.32]	[-.31;-.13]	[-.40;-.23]
8	.15**	.22***	.33***	.23***	.12**	-.01	-.12*	-	[.13;.32]	[.16;.34]	[.12;.30]	[.09;.27]
9	.25***	.74***	.40***	.27***	.12**	.17***	-.45***	.23***	-	[.40;.55]	[.32;.48]	[.29;.45]
10	.43***	.69***	.58***	.66***	.15***	.31***	-.40***	.25***	.48***	-	[.43;.57]	[.55;.67]
11	.23***	.41***	.45***	.46***	-.06	.17***	-.22***	.21***	.40***	.50***	-	[.32;.48]
12	.45***	.51***	.49***	.62***	.17***	.15***	-.31***	.18***	.37***	.61***	.40***	-

Note. Below diagonal: correlations, above diagonal: confidence intervals of the correlations; BEH = behaviour; PU = Purchase intention; ACT = Activism intention; PS = Policy support intention; GD = Gender; ATT = Attitude; SN = Social norms; PBC = Perceived behavioural control; PN = Personal norms; CO = Collective efficacy; SO = Sufficiency orientation; \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ ;  $N = 648$ ;  $N_{GD} = 638$ .



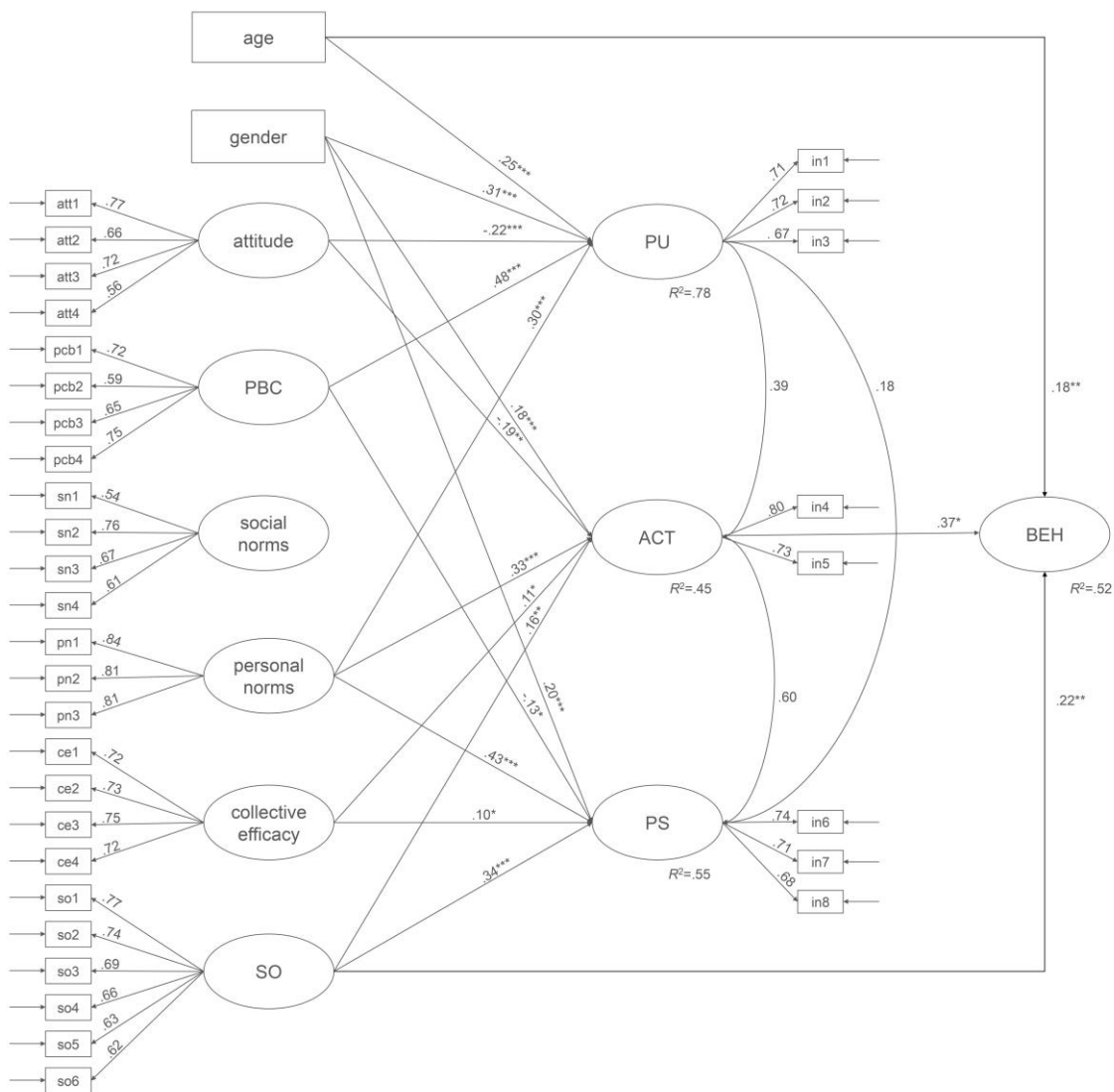
### **3.4. Establishing a path model to predict anti-plastic activity intentions and behaviour**

To test the integrated model, a structural equation model (SEM) that reflected the hypotheses was specified, the model was tested, and its parameters were estimated (see Bagozzi & Yi, 2012); see *Step IIIc* in Figure 3. Because the variables did not reflect multivariate normality and the dependent variables were measured on an ordinal scale, the robust WLSMV estimator was used. The three intentions were included as latent endogenous (dependent) variables in the model and as latent exogenous (independent) variables that predicted behaviour. *TPB* variables (attitude, social norms, perceived behavioural control), personal norms, collective efficacy, and sufficiency orientation were included as latent exogenous (independent) variables in the model, and age and gender were included as control variables. The choice of voucher at the end of the survey was used as a behavioural measurement. People could decide to receive a conventional shopping voucher (n = 155) or a shopping voucher for a plastic-free shop (n = 204) or to donate the money to an NGO addressing plastic pollution (n = 168). The last two choices were combined into one category representing a plastic-free option, and the binary variable representing a conventional versus a plastic-free choice was entered into the model as an ordered endogenous (dependent) variable (see Figure 4). As 121 participants did not choose any of these options, the SEM was calculated with n = 527 participants.

Testing the SEM revealed a good fit of the model,  $\chi^2(545) = 912.20$  ( $p < .001$ ), CFI = .978, RMSEA = .036 [.032; .040], SRMR = .036. The predictors explained 78% of the variance in purchasing intentions, 45% of the variance of activism intentions, and 55% of the variance of policy support intentions. 52% of the variance in behaviour was explained. Personal norms strongly predicted all three intentions. Attitude towards plastic use had a negative influence on purchasing intentions and activism intentions. Perceived behavioural control had a strong positive influence on purchasing intentions and a negative influence on policy support intentions. Social norms were not significant predictors at all, whereas collective efficacy and suffi-

ciency orientation were predictors of activism intentions and policy support intentions. Gender predicted all three intentions, and age had a positive impact on purchasing intentions. Activism intentions, age, and sufficiency orientation predicted behaviour.

Figure 4 *Structural equation model of anti-plastic activities (N = 527)*



Note. Abbreviations: SO = sufficiency orientation, PU = purchasing intentions, ACT = activism intentions, PS = policy support intentions, BEH = behaviour. \*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ .

## **4. Discussion**

This paper addressed different anti-plastic activities people can engage in to reduce plastic waste. This paper sheds light on purchasing decisions, political engagement, and policy support. As hypothesised, psychological variables from TPB and NAM predicted people's willingness to engage in anti-plastic activities (see Figure 4). Sufficiency orientation was also a significant predictor of the plastic-free choice of reward.

### **4.1. Three dimensions of anti-plastic activity intentions**

Using confirmatory factor analyses, three intentions of anti-plastic activities were identified: purchasing intentions, activism intentions, and policy support intentions. Purchasing intentions referred to the willingness to buy products without plastic packaging and corresponded with Stern's factor of private sphere behaviour. Activism intentions and policy support intentions corresponded with public sphere behaviour and were substantially correlated with each other. These results are in line with results from Dono and colleagues (2010), who also showed that private sphere pro-environmental behaviour and activism were distinct constructs.

A confirmatory factor analysis identified policy support intentions and activism intentions as two distinct public-sphere intentions which is in line with Stern (2000). However, in contrast to Stern's findings, signing a petition was part of policy support instead of civic engagement. Due to digitisation and commercialised activism, it is nowadays much easier to sign an online petition than was the case when Stern established his typology (see a comment on the commercialisation and digitisation of social movements by Yang, 2016). Notwithstanding these differences, the necessity of taking a closer look at a specific target behaviour and its antecedents, a practice that Stern (2000) had already highlighted, was confirmed by the present study in the field of anti-plastic behaviour.

#### **4.2. Spillover effects among anti-plastic activity intentions**

In the present study, private and public sphere intentions were positively correlated, pointing out potential spillover effects in the domain of anti-plastic activities. Residuals of purchasing intentions and activism intentions were moderately correlated in the model ( $r = .39$ ); thus, they shared variance that was not explained by the predictors. As spillover refers to the activation of an intention by another intention (Maki et al., 2019), a willingness to buy less plastic might lead to a willingness to engage in this field (and the other way around), independent of other predictors. As activism intentions and policy support intentions shared a strong common source of variance over and above the predictors ( $r = .60$ ), a spillover effect of these two intentions was also likely. Spillover was smaller for purchasing intentions and policy support intentions because the variance they shared that was independent of the predictors was lower ( $r = .18$ ).

Previous studies revealed inconsistent results with respect to spillover effects from private- to public-sphere behaviour (Truelove et al., 2016). On the one hand, people with pro-environmental lifestyles were more willing to sign a petition (Joost De Moor and Verhaegen 2020), and sustainable consumption in the private sphere predicted support for policies that pertained to wind power and political activism (Thøgersen & Noblet 2012; Willis & Schor 2012). On the other hand, negative spillover effects were found between recycling behaviour and policy support (i.e. the support of a green fund; Truelove et al., 2016). No spillover from public- to private-sphere behaviour was found with respect to the introduction of a fee for plastic bags (Poortinga et al., 2013).

In the present study, the negative impact of perceived behavioural control over plastic-free purchasing on policy support intentions led to the conclusion that, for people who fail to purchase less plastic (e.g. because of a lack of infrastructure to support plastic-free shopping), policy support constitutes an opportunity to request structural change. Thus, a negative spillover effect from “failed” private sphere behaviour to public sphere behaviour is also feasible. Policy support for regulations might therefore be strengthened by including people who show

a high level of awareness for the topic but who do not feel capable of taking corrective action through their private purchasing decisions.

### **4.3. Predicting anti-plastic activity intentions**

*(a) Purchasing intentions.* The predictors in the model explained 78% of the variance in purchasing intentions. Compared with other models that have targeted pro-environmental behaviour, the current result represents a comparatively precise prediction (Bamberg & Möser, 2007). The first hypothesis, which proposed a unique direct effect of each TPB variable, was partly supported (H1a). Perceived behavioural control of anti-plastic purchasing was the strongest predictor, a finding that is in line with previous results on general pro-environmental behaviour (for a meta-analysis, see Bamberg & Möser, 2007). Moreover, people who expressed a positive attitude towards plastic packaging were less willing to refrain from consumption in this domain. In a failure to support the hypothesis, social norms did not predict purchasing intentions in the current study. Although social norms had either a small (Armitage & Conner, 2001) or only an indirect impact through personal norms on intentions in previous research (Bamberg & Möser, 2007), social norms have often demonstrated a positive impact in intervention studies. Communicating social norms was found to be successful in reducing the consumption of bottled water (van der Linden, 2015) or plastic bag use (De Groot et al., 2013). In addition, they strongly influenced recycling and waste minimisation in a cross-cultural study (Mintz et al., 2019). Considering these studies, social norms might become more relevant for behaviour at the point of sale and might be less relevant for the intention to purchase less plastic.

Beyond the TPB variables, personal norms strongly predicted purchasing intentions (H2a). Thus, raising moral consciousness with respect to the problems that come with the use of plastic should facilitate behavioural change. Collective efficacy (H3a) and sufficiency orientation (H4a) did not predict purchasing intentions. These findings underline the rational choice approach that the intention to reduce plastic purchasing is less affected by collective beliefs

and more governed by individual decision-making. The low importance of sufficiency orientation might be surprising at first glance as it has predicted food consumption in previous studies (Verfuert et al., 2019). However, sufficiency orientation is conceptualised as a general attitudinal stance on the relationships between individual consumption, resource use, and the impact of using resources on the climate, whereas the items that measured purchasing intentions described very concrete behavioural options (e.g. to buy fresh products packaged in glass instead of plastic). This difference in specificity levels between sufficiency orientation and purchasing intentions may explain the non-significant effect of sufficiency orientation. When also considering socio-demographics, gender and age were significant predictors. Female and elderly people seem to be more willing to purchase plastic-free products. This finding on females corresponds with research indicating that gender plays a significant role in many ecological behaviours in the private sphere (for a review on gender and sustainable consumption, see Bloodhart & Swim, 2020).

(b) *Activism* intentions. The psychological predictors explained 45% of the variance in activism intentions. This was the lowest percentage of explained variance for all three intentions. This result is probably due to the degree of overlap between the content of the predictors and the content of intentions. Specifically, the content of the TPB variables overlapped more with the content of purchasing intentions than with the content of the other two intentions. Accordingly, not supporting the first hypothesis (H1a), perceived behavioural control and social norms did not have unique impacts on activism intentions. People holding a positive attitude towards plastic packaging were less willing to engage in activism. Personal norms (H2a) were the strongest predictor of activism intentions. People who were morally convinced of the need to reduce plastic packaging showed a greater willingness to participate in demonstrations or join a pro-environmental organisation. Sufficiency orientation (H4a) played a subordinate role in activism intentions.

People with high collective efficacy beliefs (H3a) in the reduction of plastic packaging were more willing to engage in activism. This finding is in line with previous studies that have

highlighted that collective efficacy is an essential predictor of activism against climate change (van Zomeren et al., 2010). The processes of self-identifying as an environmental activist and belonging to an environmental organisation are essential for public-sphere engagement (Brick & Lai, 2018; Fielding et al. 2008; McFarlane & Boxall, 2003). A recent meta-analysis supported the overarching role of social identity processes as a key driver of pro-environmental activism (Schulte et al., 2020). This underlines collectivism as an integral part of activism. To increase impact, people team up with like-minded people who are striving for a collective goal. With regards to socio-demographics, women were more likely to show activism intentions, but age had no impact. The particular role of gender with respect to environmental activism is a question of recent interest. For instance, more women than men consistently participate in Fridays for Future climate protests (De Moor et al., 2020). It is very probable that gender norms play a crucial role in who protests against plastic packaging and who does not.

*(c) Policy support intentions.* Overall, the predictor variables explained 55% of the variance in policy support intentions. The strongest predictor was personal norms (H2a), followed by sufficiency orientation (H4a). Thus, the willingness to support policy regulations was driven by a moral conviction and a belief that reducing resource consumption is important for protecting nature and the climate. The emotional component of this moral conviction might be particularly relevant as concern for the environment has been found to be a good predictor of policy support in previous studies (Wang et al., 2018). Collective efficacy (H3a) was also a significant predictor but had the smallest power to predict policy support intentions. This at least partially fit with the results of a study by Brick and Lai (2018), who found that explicitly self-identifying as an environmentalist also supported equivalent policies. With regard to *TPB* variables (H1a), perceived behavioural control was negatively related to policy support intentions such that people who perceived few opportunities to make plastic-free purchases were more willing to support policies to take appropriate action. Attitude and social norms were not significant predictors, which again might be due to the limited content overlap between perceived behavioural control and policy support intentions. *TPB* variables have usually been explored

with respect to private behaviour in the past, whereas public behaviour, such as protesting, has only recently been studied. For instance, Wang and colleagues (2018) found that emotions play a significant role in public engagement. Furthermore, mechanisms behind group identification (e.g. collective efficacy, trust in the government) play a more important role in public engagement than *TPB* components or moral concerns do (Thaker et al., 2019). Again, gender, but not age, had a unique effect on policy support intentions. As gender had the same effect on the other two intentions, women appear to be more willing to tackle the plastic problem than men – independent of the type of intention.

#### **4.4. Prediction of behaviour**

In this study, activism intentions were an important predictor of behaviour. In a failure to support hypothesis H1b, policy support intentions and purchasing intentions were not significant predictors. Age and sufficiency orientation (H4b) had an additional impact. Overall, 52% of the variance in people's choice of incentive was explained. Even though the choice between a conventional shopping voucher and a plastic-free option does not directly correspond to the measured intentions, this result indicates the content validity of the intentions. As boycotting can be interpreted as a form of activism, it is plausible that activism intentions reduced the probability that participants would accept a conventional shopping voucher instead of an ecological choice. Therefore, it is not surprising that the impacts of purchasing intentions with a focus on concrete packaging choices and policy support intentions addressing policy measures have remained behind the impact of activism intentions on this choice. The strong impact of sufficiency orientation confirmed the inherent motivation as a clear stance against overconsumption.

Contrary to theoretical assumptions (H1b, H2b, H3b), perceived behavioural control, personal norms, and collective efficacy were not direct predictors of behaviour. However, these results are in line with empirical evidence that personal norms and perceived behavioural control have only indirect impacts on behaviour via intentions, rather than predicting behaviour directly when intentions are included in the model (e.g. Bamberg et al., 2007). Furthermore,



the choice of incentive was not directly linked to the content of perceived behavioural control that referred to plastic-free purchases. There was no barrier to choosing one of the incentives. Hence, perceived behavioural control was irrelevant.

#### **4.5. Limitations**

The sample in this study was large but not representative. The majority of participants were women and were highly educated. Thus, conclusions should be considered carefully when transferred to other groups. In particular, when considering research on gender biases in the environmental domain which we also argued upon, a more diverse sample should be investigated (Bloodhart & Swim, 2020; Zelezny et al., 2000).

Participants were recruited in summer 2017 when plastic was at the top of the agenda in the German media. The general willingness to become active against plastic pollution was quite large and socially desirable (European Commission, 2017) which might have also increased effects in our sample. In addition, the results presented here do not allow causal inferences to be drawn because the parameters in the path models were based only on cross-sectional correlations. Moreover, the conceptualisation and measurement of the outcome variables were in line with Stern's behavioural categorisation. However, the factor structure of the items did not fully match Stern's model. We propose that our three-factor structure needs to be replicated by running additional studies with more heterogeneous samples and groups with lower pro-environmental awareness. Future research should also explore directional influences between the factors in longitudinal designs.

Referring to the explained variance in this study, purchasing intentions were predicted best by the measured variables. This finding might be due in part to a lack of symmetry in content between intentions (the criteria) and the predictors. For example, the content of the perceived behavioural control items was more precisely related to the content of purchasing intentions than to the content of activism intentions or policy support intentions. Despite the possible inflation of effects due to content symmetry and the possible deflation of effects due

to a lack of content symmetry, it seems noteworthy that sufficiency orientation, a more broadly defined construct with the smallest amount of overlap in content with intentions, had a rather strong effect on behavioural choice. Thus, similarity in content and specificity alone cannot explain the pattern of effects in the path model. Apart from the specific formulation of the items, we suggest to add important constructs (e.g. self-identity, Fielding et al., 2008; Rees & Bamberg, 2014; positive and negative emotions, Hamann & Reese, 2020; Rees et al., 2015; Rees & Bamberg, 2014) in future studies that seek to model lower plastic consumption.

#### **4.6. Implications and future directions**

##### *Implications for future research.*

First, this study confirmed the relevance of psychological factors grounded in rational choice and normative theories (*TPB, NAM*) in the field of plastic consumption. It raises awareness of various predictors of diverse plastic-free activities in the private and public spheres that can each be addressed in detail by future studies. Likewise, one might follow up by implementing interventions based on these constructs and assessing behaviour change in the field of plastic reduction (e.g. Heidbreder & Schmitt, 2020).

Second, broadening the scope of this kind of research to public-sphere intentions (i.e. activism, policy support) rather than simply focussing on private-sphere intentions (i.e. purchasing) is promising as it may inspire collective action and drive changes in infrastructure (Amel et al., 2017). Furthermore, this study provides initial evidence that different behavioural intentions in the field of plastic consumption were predicted by different variables (see Stern, 2000). Thus, future studies should consider and carefully model the target behaviour. Ways to increase the effectiveness of psychological drivers for less plastic consumption (see Reese & Junge, 2017, on efficacy beliefs) should be researched further.

Third, sufficiency orientation was a relevant predictor of plastic-free purchasing and donation behaviour. These findings indicate that increasing people's beliefs in consuming less as a way to counter environmental degradation has the power to close the gap between good

intentions to protect nature and a lack of actual concrete behaviour (Moser & Kleinhüchelkotten, 2017; Verfuërth et al., 2019). Future studies should better incorporate interdisciplinary approaches and address the interrelations between the topics of sufficiency-oriented production and consumption (Bengtsson et al., 2018; Milad et al., 2020).

Fourth, the integrated model adds value beyond addressing single constructs. People's actions are based not only on rational considerations but also on moral ones (see Joanes, Gwozdz, & Klöckner, 2020). Likewise, for activism intentions and policy support intentions, the role of collective action is important. Thus, future studies should consider an integrated framework to strengthen pro-environmental behaviour within the field of plastic consumption.

#### *Practical implications*

Considering the main predictors of plastic-reduction-oriented intentions, purchasing intentions were primarily predicted by perceived behavioural control, indicating a lack of infrastructure and perceived opportunities to avoid single-use plastic. To tackle this structural barrier to increase perceived behavioural control, more convenient alternatives for single-use plastic, such as suitable shopping concepts coupled with information about these alternatives, need to be offered and could be supported by local trade and business initiatives.

A positive attitude towards plastic packaging was a barrier for purchasing and activism intentions. In general, two different ways to change people's attitudes have been discussed: persuasive information and social influence (Wood, 2000). However, only a few studies have addressed the impact of environmental communication in the context of plastic, such as media communication about microplastic (Schallhorn et al., 2019) or role models in reports about plastic pollution in the media (Arlt et al., 2012). Future studies should build on and evaluate interventions in this area.

Personal norms were an important predictor for all three anti-plastic activity intentions. To activate personal norms, Schwartz (1977) argued that people need to be aware of a problem and to feel responsible to solve it. With regard to plastic, the distance in time and space between individual behaviours and their consequences in the environmental domain (van

Lange et al., 2018) should be considered. To raise awareness and a feeling of responsibility, it is crucial to overcome this distance. Presenting photographs of plastic litter from consumer products might be an approach that can make the link between people's consumption and its consequences more visible (Pahl et al., 2017).

Collective efficacy beliefs had a small but significant influence on fostering activism and policy support in the field of plastic consumption. Putting this knowledge into practice, campaigns could strengthen the collective attitudes and collective efficacy of consumers and communicate the impact of a certain behaviour on a collective level (Fritsche et al., 2018).

As sufficiency orientation was a strong predictor of behaviour in the plastic domain, it could be key with respect to a more comprehensive shift towards resource conservation. Although people may be reluctant to use the term sufficiency in everyday practise (Reese, Drews, & Tröger, 2019), the goal here is to outline its potential as a 'mind-set of enoughness' (Spangenberg & Lorek, 2019, p. 1071).

To solve the anthropogenic plastic crisis, all members of society need to promote the more conscious handling of plastic. This study highlights the potential of the general public as consumers, activists, and policy supporters within a representative democracy. While natural science perspectives work on detecting risks and finding material replacement or recycling strategies for plastics (Milad et al., 2020), the social sciences can explain why and when people use plastic and shape the discourse on how to limit plastic pollution. Motivating action against plastic pollution needs to consider decision-making processes and drivers of reduction behaviour. The current study presented such psychological insights.

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### **Conflicts of interests**

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## 5 MANUSCRIPT 3 – WHEN MORAL ROOTS AND ATTITUDINAL SHIFT DISSOCIATE – THE CASE OF SUFFICIENCY ORIENTATION

Tröger, J., Gaschler, R., Nowarra, C., and Schmitt, M. (2018). *When moral roots and attitudinal shift dissociate – the case of sufficiency orientation* [Unpublished manuscript]. Interdisciplinary research group, University of Koblenz-Landau, Campus Landau.

### **Abstract**

The sufficiency sustainability strategy seeks to decrease CO<sub>2</sub> emissions by cutting off resource intensive behaviour patterns. Based on work relating justice sensitivity to politic engagement we reasoned that sufficiency orientation might be related to justice sensitivity. Furthermore, we hypothesized that sufficiency orientation might be fostered by making explicit that the benefits and burdens of overconsumption of resources are not fairly distributed. In two studies we experimentally varied whether participants read about environmental injustices on a local, global and intergenerational level before reporting their extent of sufficiency orientation or did not receive a justice message. While we found the expected relation of sufficiency orientation and sensitivity to justice issues on the level of interindividual differences as well as a negative relationship between justice sensitivity and system justifying tendencies, the results of the experimental manipulation suggested that making an environmental issue a justice issue is not a recommendable short-term intervention. In Study 1 ( $N=123$ ), the justice message led to a decline in responsibility assignments rather than to fostering justice orientation. In line with this, Study 2 ( $N=330$ ) confirmed that at best a weak effect on sufficiency orientation could be obtained from a justice message. The results are surprising, as justice messages could have been expected to raise sufficiency orientation in form of a demand effect. Instead distancing cognitions might automatically reduce the effect of shifting the focus on moral aspects of environmental issues.

### **Keywords**

Sufficiency orientation, environmental justice, justice sensitivity, sustainability strategies, sustainability communication

## **1. Introduction**

Climate change is one of the largest challenges humanity is faced with today and manifold interventions are required to reduce the average global temperature increase to the level of two degrees (IPCC, 2014). While gravity of the situation is already perceived (see for instance Special Eurobarometer, 2011) individual engagement is carried out on a lower level. For instance, only a fifth of the respondents in the Eurobarometer survey (21%) considered having a personal responsibility for taking action. Most frequent actions that were performed by the participants have a comparatively low carbon reducing impact. For instance, 66% of the respondents separate their waste but only 36 % of the people buy local and seasonal products, 9% avoid flying short distances and 7% already switched to renewable energy providers. Albeit people are aware of the risks from global warming, there is a remaining lack of appropriate individual and collective action taking against it (e.g., Gifford 2011 on environmental attitudes and behaviour; Ittner and Ohl 2012 on international negotiations and binding agreements). Ways to nudge attitudes that increase the performance of less resource intensive lifestyles are targeted and debated in research (Kaiser, 2014; Schultz, 2014; Stern, 2011; Swim et al., 2011; Welzer, Soeffner, & Giesecke, 2010). The present research asks if presenting an environmental justice message serves to encourage people to take up a sufficiency-oriented perspective. Furthermore, moderators that might be keys to the expression of sufficiency orientation after message exploration are addressed in the studies, too (justice sensitivity and upholding a free market ideology).

### **1.1. The Sufficiency Sustainability Perspective**

Recent concepts of sustainability separate efficiency, consistency, and sufficiency as a bundle of strategies to be realized for establishing a sustainable society (Alcott, 2008; Linz, 2012; Princen, 2003; Stengel, 2011). (Eco-)efficiency relates to the increase of resource productivity, which includes less resource and energy input per product or service with less usage of nature. Efficiency, however, implies a high demand for investment in technologies and infrastructure

but less demand for behaviour changes (Linz, 2012, p. 8). To exemplify, replacing an A+ labelled refrigerator with a more eco-efficient A+++ refrigerator does not implicate a change in its usage such as to switch it off during the winter (Fischer & Grieshammer 2013). Furthermore, rebound effects often backfire the efficiency gains. More efficient technology can lead to an increase in consumption (Otto, Kaiser, & Arnold, 2014; Peters, Sonnberger, Dütschke, & Deuschle, 2012; Santarius, 2014). Similarly, to efficiency, (eco-)consistency strengthens technical innovations to decrease emissions. It envisions processes of production and consumption that do not compete against the nature, do not emit harmful substances, and do not produce any waste at all (see e.g., the “cradle to cradle” design concept by McDonough & Braungart, 2010). Similar to efficiency, the consistency strategy does not call for attitudinal or behavioural changes regarding consumption.

In contrast to both efficiency and consistency sustainability strategies, the (eco-) sufficiency strategy pursues the sustainability goal by rethinking and changing consumption practices instead of addressing technical improvements (Linz, 2012). Sufficiency seeks to transform and limit resource intensive behaviours with the aim to strictly cut back emissions and the globally incompatible usage of nature (Alcott, 2008; Calwell 2010; Fischer & Grieshammer 2013; Jackson, 2009; Linz, 2012; Princen, 2003; Stengel, 2011). The sufficiency approach is also embedded into the European Sustainable Degrowth movement which seeks to increase human well-being and enhance ecological conditions by an “equitable downscaling of production and consumption [...] on the short and the long term” (Schneider, Kallis, & Martinez-Alier, 2010, p. 512; see also Freyling et al., 2015). This call for ‘consuming less’ is often considered with scepticism due to feelings of deprivation and loss that could be generated (Matthey, 2010). Its incompatibility with current principles of economic progress and the idealistic view of a frugal global society is criticized by political actors (Fücks, 2013; see also Deutscher Bundestag [German Bundestag], 2013). Advocates of sufficiency counter these arguments, for instance, by referring to the Easterlin paradox comprising the finding that the GDP welfare index empirically does not correlate with happiness (Easterlin, 2013) once a threshold is crossed. Alcott (2008,

p. 781) points out that sufficiency contains “a greater consumer frugality” which liberates from overabundance that, in turn, fosters social welfare and justice on both local and global scales (Alcott, 2008; see also Paech, 2013; Stengel, 2011). This way the sufficiency approach converges with moral concerns: Sufficiency is argued to overcome injustices caused by resource overconsumption and seeks to prevent from (continuing) socio-ecological crisis by reduced growth (Fischer & Grieshammer, 2013; Jackson, 2009; Jackson & Victor, 2015; Paech, 2013; Schöpke & Rauschmayer, 2014).

Based on these linkages between morality and the sufficiency sustainability approach, it is important to uncover which daily situations can raise people’s openness towards sufficiency and trigger pro-sufficiency attitude shifts. Media and informational messages play a significant role in our daily lives and are almost omnipresent in our information society. They create situations of informal learning and have the potential to shape judgement, attitudes and behaviour tendencies. Climate change is one important issue actually addressed by journalists and portrayed in the mass media (Schäfer & Schlichting, 2014). Exposure to scientifically based news about climate change through media can foster peoples’ scientific literacy and raise problem awareness (Maier, Rothmund, Retzbach, Otto, & Besley, 2014; Taddicken, 2013). In our studies we want to test the potential influence of reporting about environmental injustices due to man-made climate change regarding peoples’ readiness for adopting a sufficiency orientation.

Before presenting the design of the study, the following section specifies why the influence of an environmental justice message was supposed to work in favour of a sufficiency orientation shift. Afterwards we portray system justification tendencies and justice sensitivity as personality characteristics that were hypothesized to moderate attitudinal changes towards sufficiency orientation.

## **1.2. Fostering Peoples' Readiness towards Sufficiency Orientation and shifting Responsibility Attributions by Environmental Justice Messages?**

There is an on-going interest in how to support pro-environmental attitude and behaviour change in order to limit climate change through effective communication (Moser, 2010). For instance, threat-oriented communication and reporting about ecological disasters due to global warming can grab peoples' attention but potentially generates rejections by the audience (Moser, 2007; Moser & Dilling, 2011). Positive effects are to be expected from linking climate change issues to "more salient (local) issues people consistently care about", such as the local community, one's own children or the relationship between personal behaviour and its impact on other communities (Moser & Dilling, 2011, p. 165).

Personal and societal relevance of climate change can be brought together by communicating not only about technical solutions that may decrease CO<sub>2</sub> Emissions (i.e. efficiency sustainability approach) but also about fundamental justice issues that are closely related to climate change and have to be addressed in order to tackle climate change. Such linkages can be established by explicating relationships on a very local levels, for instance: The lower the individual income, the lower the pollutants and waste products – but, the more people are affected by the consequences of the pollution from others. For example, in Germany people with a lower income (less than 1500€ per month) own only a half of the cars than people with an equivalent higher income (infas & DLR, 2010, p. 57). In average people with a lower income annually drive 8 600 kilometres whereas people with the highest economic status annually drive 28 000 kilometres (ibid). However, people with lower income are affected stronger by noise and harmful exhaust fumes because they more often live in urban areas with a higher average traffic volume (see e.g., Laußmann, Haftenberger, Lampert, & Scheidt-Nave, 2013).

This environmental justice perspective increases the salience of moral issues people fundamentally care about. Core relationships of environmental pollution and resource exploitation to social inequalities on different levels are presented explicitly. This, in turn, has the

power to activate justice as a moral principle (Baumert, Rothmund, Thomas, Gollwitzer, & Schmitt 2013; Lerner & Clayton, 2011; Lerner, 1980) and can encourage pro-environmental attitude and behaviour modification (Clayton, 2000; Clayton, Kals, & Feygina, 2016; Kals & Russell, 2001; Reese & Jacob, 2015; Syme, 2012). In line with these arguments, we suspected a shift towards sufficiency orientation after the presentation of a message focusing various levels environmental justice issues.

This hypothesized effect of an environmental justice message is deduced from the theory of relative privileges and existential guilt (Hoffmann, 1976; Montada, Schmitt, & Dalbert, 1986). Privileged people who (a) perceive large discrepancies between their privileges and others' deprivation and/or who (b) cannot justify that they are privileged whilst others are deprived define the situation as being more unjust than individuals who either deny or justify the discrepancies. Perceiving to be privileged was found to generate pro-social behavioural intentions (Massi, 2005; Montada & Schneider, 1989; Renner, Lindenmeier, Tscheulin, & Drevs, 2013; Schmitt, Behner, Montada, Müller, & Müller-Fohrbrodt 2000; Thomas, McGarty, & Mavor, 2009) and motivated charitable giving in economic game settings (Baumert, Schlösser, & Schmitt, 2014; Rousu & Baublitz, 2011).

Based on these findings, we supposed portraying examples of environmental injustice could activate moral feelings in favour of the disadvantaged who suffer from man-made climate change. Living in an industrialized country combines (a) a high contribution to climate change with (b) a greater potential not to be affected by climate change due to less vulnerability and more economic power to protect against it. Not to be harmed and living in a region of high prosperity can be perceived as unjust and, in turn, provokes the need to solve this discrepancy. Work on sufficiency points out that pro-social orientations play a fundamental role in developing sufficiency oriented behaviour (Kleinhüchelkotten, 2005; Linz, 2012; Schneider et al., 2010). Based on these approaches, we hypothesized an increase of the adherence to sufficiency after processing information on socio-ecological injustices triggered by the salience of feeling

privileged (Schmitt, et al., 2000) and the upcoming moral need to restore justice after processing environmental justice issues.

Additionally, we suppose an influence of the justice message on responsibility attributions for future climate protection. Feeling responsible for an injustice, in terms of moral cognition (Kals & Russell, 2001) or moral obligation (Schwartz, 1977), serves as a significant precondition for pro-environmental behaviour shifts (e.g. Bamberg & Möser, 2007; Montada & Kals, 2000). For instance, responsibility perceptions increase after priming the feeling of being guilty and foster people's intent to reduce the injustices (Berndsen & Manstead, 2007). Kouchaki and colleagues (2014) showed that guilt feelings promote a sense of control and positively influences risk-taking behaviour. According to Thomas et al. (2009) people tend to assuage their negative feelings by symbolic and strategic actions, for instance by assigning responsibility for the disadvantage to the advantaged in-group. Feeling guilty is likely to foster normative and strategic forms of prosocial action that acknowledge the responsibility of the in-group (Thomas et al., 2009). In line with this, we supposed a shift of responsibility attributions increasingly to actors in the industrial countries and the industrial citizenship after being confronted with the socio-ecological injustices in the message.

### **1.3. Dispositions as Moderators for a Sufficiency Orientation Shift**

Justice information processing depends upon pre-conditions, which are likely to moderate the proposed shift towards sufficiency orientation. First, we assumed *justice sensitivity* (Baumert & Schmitt, 2016) as potential moderator and, second, we considered system justifying tendencies in terms of *belief in a just world* (Hafer & Sutton, 2016; Lerner, 1980) as also adherence to a *free market ideology* (Lewandowsky, Oberauer, & Gignac, 2013) as potential moderators. Whereas high justice sensitivity was expected to amplify the effect of justice related messages on pro-sufficiency attitude shifts, system justifying tendencies were assumed to have the opposite effects due to their defensive motivational nature and the reduced impact of moral appeals (Montada & Schneider, 1989; Schmitt et al., 2000).



### **1.3.1. Justice Sensitivity**

Justice sensitivity involves stable and consistent individual justice concerns and, hence, is described as a justice-related disposition (Schmitt, Baumert, Gollwitzer, & Maes, 2010; Schmitt, Gollwitzer, Maes, & Arbach, 2005). It captures the readiness to perceive injustice and the strength of cognitive, emotional, and behavioural reactions to injustice. Four different perspectives are described: victim, observer, perpetrator, and beneficiary sensitivity. People scoring high in justice sensitivity perceive situations as potentially more unjust or adverse and are found to spend more time on thinking about justice matters compared to those who score low in justice sensitivity (Baumert & Schmitt, 2016). Justice sensitivity has been linked to variability in attention, interpretive processes and memory (Baumert, Gollwitzer, Staubach, & Schmitt, 2011). Observer, perpetrator, and beneficiary sensitive people are characterized by pro-social orientations. They were found to be genuinely concerned about others who are affected by an injustice and predominantly. Victim sensitivity, on the contrary, reflects a heightened perception for injustices from a self-oriented perspective and feeling as a victim in an unjust situation (Schmitt et al., 2010). All four dimensions substantially contribute to explanations of social phenomena, for instance, on political protest behaviour (Rothmund, Baumert, & Zinkernagel, 2014). In a study on “Stuttgart 21” (a German transportation project), people who score high on observer sensitivity were found to protest more frequently than those who score high on victim sensitivity. Rothmund and colleagues (2014) argue that highly observer sensitive people sympathise with the disadvantaged others and are more willing to defend the norm or the moral standard. In contrast, victim sensitive people fear the exploitation of their engagement which is argued to result in less willingness to engage in favour of others or the general public. Similar pro-social effects of justice sensitivity were found in economic game settings: Scoring high on pro-social dimensions of justice sensitivity resulted in a heightened adherence to their justice principles even in tempting situations in order to equalize resource allocation (Baumert et al., 2014; Fetchenhauer & Huang, 2004; Lotz, Baumert, Schlösser, Gresser, & Fetchenhauer, 2011).

Due to these findings, we assumed that pre-existing levels of justice sensitivity influence the attitudinal shift towards sufficiency orientation after justice message exploration and hypothesized victim sensitive people to be less responsive towards the environmental justice message than the observer, perpetrator and beneficiary sensitive people. In other words, we supposed that presenting information on environmental justice activates justice concepts more strongly among persons with pro-social oriented justice sensitivity than among those who score less on these dimensions but more on the victim sensitivity dimension. Also the correlational structure should disclose these relationships, i.e. sufficiency orientation was supposed to correlate with the prosocial dimensions of justice sensitivity, while victim justice sensitivity was not.

### **1.3.2. System Justification in terms of Belief in a Just World and holding a Free Market Ideology**

According to Lerner (1980) people have a need to believe that the world is a just place and accordingly struggle for maintaining it (Furnham, 2003; Hafer & Sutton, 2016). Belief in a just world conceptually overlaps with system justification in regard to its comprising motivation to judge the status quo as just and legitimate (as cited in Beierlein, Werner, Preiser, & Wermuth 2011, p. 279). Furthermore, people who hold a high belief in a just world seek to protect oneself against dissatisfaction and exercise certain system justifying strategies (Hafer & Choma, 2009). Challenging peoples' belief in a just world by instances of injustice such as coming across innocent victims either can result in the active promotion of justice, for instance, through helping. Another possible reaction could be that people re-interpret the fate as deserved in terms of blaming the victim for suffering injustice or denying the injustice. People who generally perceive the world as a just place are likely to reinterpret injustices as deserved inequality and feel less motivated to take action particularly in case of high costs for an active restoration of the justice (Beierlein et al., 2011). Concerning pro-environmental behaviour, a strong belief in

a just world has an indirect negative effect because it is linked to scepticism about global warming and less readiness for environmental protection (Feinberg & Willer 2011; Feygina, Jost, & Goldsmith 2010). In line with this knowledge, belief in a just world cannot serve as a proxy for holding justice as a moral standard and acting against injustice. In contrast, it seems to incorporate a conservative, system-justifying tendency (Baumert & Schmitt, 2016).

Holding a free market ideology (Heath & Gifford, 2006; Lewandowsky, Oberauer, & Gignac, 2013) is another system justification tendency related to man-made climate change. Former studies showed that maintaining a free market ideology is associated with the rejecting that climate change is human-made and with doubting consequences of climate change (Heath & Gifford, 2006; Lewandowsky et al. 2013). The endorsement of free market economies is associated to the belief that environmental friendly innovations can solve future problems by technical innovations – a view which is widely accepted (Fücks, 2013, Meijers & Rutjens, 2014). The belief in free market based economies, however, can build an ideological barrier towards pro-environmental behaviour (Gifford, 2011; Welzer, 2011). Therefore, we assumed that holding a free market ideology is negatively correlated with sufficiency orientation and ecological behaviour, but is accompanied by the view that technologies and innovations can manage climate change in the future. For people with such a focus on efficiency, the justice message was supposed to be less effective in supporting a sufficiency orientation. Rather, we hypothesized that holding a free market ideology is associated with the efficiency orientation scale and also with attributing responsibility for future climate protection to more distant others such as stakeholders, governments and citizens in the countries of the global south and thus, might indicate a certain degree of responsibility denial (Schmitt, Montada, & Dalbert, 1991). We hypothesized that holding a free market ideology correlates negatively with the pro-social dimensions of justice sensitivity based on the motivation of upholding the status quo and resistance to personal or collective responsibility regarding the improvement of sustainability and justice.

## **2. Study 1**

The first study tested if an environmental justice message suited into a science-based news format can support peoples' affirmation towards the sufficiency strategy. In the message the relationships between resource wastage and man-made climate change was coupled with the portrayal of consequences on increasing social inequalities on a local, global and intergenerational scale. Besides the effect of the justice message on a pro sufficiency attitude shift we explored the moderating role of system justification and justice sensitivity. Furthermore, we explored whether a justice message affects to whom people assign responsibility in future climate protection (i.e., civil society vs. governmental stakeholders in industrial countries).

### **2.1. Method Study 1**

#### **2.1.1. Participants**

A total of 123 participants were recruited at university or their workplace with the help of student research assistants. Participants took part either for course credit or €5 financial compensation. Age ranged from 18 to 76 years ( $M = 26.20$ ,  $SD = 10.82$ ). All participants spoke German fluently. Seventy-five per cent of the participants of the sample were female. Gender was equally distributed over both groups of the experiment;  $\chi^2(1, N = 122) = 1.08, p = .405$ . Ninety-two participants (75.4%) were undergraduate students, 27 (22.1%) were graduated and, 3 (2.5%) did not indicate their status.

Prior to data collection information according to the German Psychological Society's (Deutsche Gesellschaft für Psychologie) guidelines for conducting psychological studies (which correspond to those of the American Psychological Association) was given. Participants were informed about the study in written form before they decided to take part or not to take part. It was declared, that they voluntarily take part and can drop out the study at any time without any consequences.

### **2.1.2. Design, Procedure and Stimulus Material**

The study contained a one factorial design setting up a justice message versus no justice message condition. All participants were randomly assigned to one of the two conditions.

Participants were asked to complete a paper and pencil questionnaire containing both the experimental manipulation and the dependent variables. The introductory page informed about the proposed processing time of approximately 20 minutes and guaranteed anonymity. At the end of the questionnaire demographic data including age, gender, academic degree and mother tongue was assessed.

All participants processed the material in exact sequence without being allowed to page backward. Participants in the justice message condition were prompted to read through a one-page text based on the essay by (Klostermeyer & Inden-Heinrich, 2014). The text exemplified linkages between individual environmental behaviour and social injustices originating from such behaviours, i.e. overconsumption and resource wastage. The imbalance between benefits and costs from both the utilization of environmental resources and taking responsibility for its many-sided damaging outcomes was outlined. Three justice levels were exemplified, namely the *local justice*, *global justice*, and *intergenerational justice* level. On each level the divide was stressed between people who use the most resources but suffer the least from environmental damages and climate change compared to people who do not contribute to resource exploitation and climate change but suffer the most. These distributive justice concerns were demonstrated with pointing out that social inequalities are source and outcome of environmental problems and climate change.

All dependent variables were assessed after presenting the justice message in the justice message condition. In the no justice message condition, the justice message was administered only at the very end of the questionnaire. By this we ensured obtaining manipulation check data on whether the justice message was read from a large sample. For administering the questionnaire, it was in addition useful that processing time of the two variants of the questionnaire did not differ.

### 2.1.3. Dependent Variables

Data was collected through self-report. *Sufficiency orientation* was measured with an eight-item scale (e.g., “I strive for wasting as few resources as possible throughout my daily life, e.g. mineral oil, scarce minerals and rare earth”),  $\alpha = .73$  (see Appendix II: Supplementary Material Manuscript 1 — A). Four items were adapted from the sufficiency attitude scale from Henn (2013). Response options ranged from 1 (*totally disagree*) to 6 (*totally agree*). *Efficiency orientation* was measured with three items (e.g., “Modern technologies manage to reduce global warming”,  $\alpha = .65$ ). Response options ranged from 1 (*totally disagree*) to 6 (*totally agree*).

The secondary dependent variable *responsibility taking* for future climate change mitigation was measured with seven items (“To my opinion, responsibility for future climate protection is up to...” (a) “Citizens the industrial countries”, (b) “Decision makers from economy and trade in the industrial countries”, (c) “Governments from the industrial countries”, (d) “Citizens from the global south”, (e) “Stakeholders from the global south”, (f) “Governments from the global south”, (g) “NGOs and environmental organizations”, (h) “Educational institutions”). Response options ranged from 1 (*totally disagree*) to 6 (*totally agree*).

### 2.1.4. Moderators

*Justice sensitivity* was measured by a short form with two items per subscale comprising good psychometric characteristics (Beierlein et al., 2012). To exemplify, victim sensitivity was measured by “I ruminate a long time when other people are being treated better than me” ( $\alpha = .75$ ), observer sensitivity was measured by “It bothers me when someone gets something they don’t deserve” ( $\alpha = .61$ ), beneficiary sensitivity by “I ruminate for a long time about being treated nicer than others for no reason” ( $\alpha = .85$ ) and perpetrator sensitivity by “I ruminate for a long time when I treat someone in a less friendly manner than others without reason” ( $\alpha = .61$ ). Response options ranged from 1 (*totally disagree*) to 6 (*totally agree*).

*Free market ideology* items were taken from Heath and Gifford (2006) and translated into German (e.g., “An economic system based on free markets unrestrained by government

interference automatically works best to meet human needs”). Response options ranged from 1 (*totally disagree*) to 6 (*totally agree*). We omitted one item (“The free-market system may be efficient for resource allocation, but it is limited in its capacity to promote social justice”) due to increasing scale consistency from a low  $\alpha$ -value of .57 up to an acceptable level of .67.

*General belief in a just world* was measured with a six-item scale (e.g., “Basically the world is a just place”, Dalbert, Montada, & Schmitt, 1987) ranging from 1 (*totally disagree*) to 6 (*totally agree*,  $\alpha = .79$ ).

### **2.1.5. Additional Measures**

To link the sufficiency orientation measure to established measures, we assessed general ecological behaviour with an adapted and shortened 31-item scale version (Kaiser & Wilson, 2004; Roczen et al., 2013). General ecological behaviour counts as a general performance measure capturing a broad variance of pro-environmental behaviour. A five-point frequency scale ranging from one “never” to five “always” was applied for 15 items. Nine items represented un-ecological activities, which were reversely coded for further analysis. In line with Kaiser et al. (2013) responses were recoded from a five-point to a two-point format by collapsing “never”, “seldom”, and “occasionally” into “rather un-ecological propensity”. “Often” and “always” were combined into “rather ecological propensity”. Another 16 items were formatted dichotomously (yes/no). There was the option to mark “I don’t know” in each question, which were coded as missing values ( $N$  items missing = 168; 4.44%,  $\alpha = .68$ ).

## **2.2. Results Study 1**

### **2.2.1. Manipulation Check**

After presenting the environmental justice message, participants answered three knowledge items to check if people read the text attentively (see Appendix II: Supplementary Material Manuscript 2 — B). They indicated their knowledge about the imbalance of costs and benefits from environmental damage on the local, global and intergenerational level. Questions were

obtained in a free answer format and people were invited to write short sentences or keywords. Answers were analysed and coded as ‘correct’ if any of the keywords from the text were mentioned for each answer. All participants within the justice message group were able to answer the knowledge questions and were included into data analysis.

### **2.2.2. Sufficiency Orientation**

Different from our hypothesis, justice messaging (justice message vs. no justice message) did not affect sufficiency orientation in terms of a main effect ( $M = 4.69$ ,  $SD = .59$  for the justice message;  $M = 4.82$ ,  $SD = .59$ , for the baseline,  $t(120) = -1.25$ ,  $p = .215$ ,  $r = .113$ ).

### **2.2.3. Moderators**

First we tested if justice sensitivity moderated the impact of justice information on the sufficiency score. Variables were standardized before calculating the interaction terms in order to reduce potential multicollinearity (Aiken & West, 1991). Levene’s tests for the justice sensitivity scales were not significant,  $F < 1$ , all  $ps. > .60$ , indicating that error variances were similar across groups.

In the *moderated* regression analysis, we first included *condition* (0 = no justice message; 1 = justice message) and the justice sensitivity scores respectively. Second, the *condition*  $\times$  *justice sensitivity interaction term* was entered. Results for calculating observer sensitivity as a moderator are listed in Table 5. The model including the interaction term was not significant. Table 6 gives an overview of the results from all moderator analyses. None of the calculated interaction terms with sufficiency orientation as dependent variable was significant ( $\Delta R^2 \leq .03$ ,  $F < 1.10$ , all  $ps. > .30$ ).



Table 5 *Summary of moderated regression analysis for variables predicting sufficiency orientation (Study 1)*

<b>Variable</b>	<b>B</b>	<b>SE B</b>	<b>t</b>	<b>p</b>
Constant	.11	.13	.91	.365
Condition Dummy	-.26	.18	.17	.166
Z-Score Observer JS	.06	.12	.60	.600
Condition × Observer JS	.08	.19	.40	.689

Note.  $N = 122$ . JS = Justice sensitivity. Variables were entered z-standardized.

Table 6 *Interactions between the justice sensitivity scales and the experimental condition (Study 1)*

<b>Interaction terms</b>	<b>F</b>	<b>p</b>	<b><math>\beta</math></b>	<b>t</b>	<b><math>\Delta R^2</math></b>
Condition × VS	.58	.449	.19	-.76	.01
Condition × OS	.16	.689	.08	.40	.02
Condition × BS	.52	.471	-.13	-.72	.01
Condition × PS	1.07	.304	.19	1.03	.01

Note.  $N = 122$ . Moderated regression analysis including all potential moderators were run with calculating the respective interaction term condition × VS = victim sensitivity, OS = observer sensitivity, BS = beneficiary sensitivity, or PS = perpetrator sensitivity.

Second we tested both, free market ideology adherence, as well as general belief in a just world as potential moderators. Against our hypothesis, there was no significant moderation term *justice message condition × free market ideology* ( $\beta = -.04$ ,  $t = -.24$ ,  $p = .811$ ,  $\Delta R^2 = .00$ ). The regression model including all three steps (condition, free market ideology and interaction term) explained 23.9% of the total variance,  $F(3, 118) = 12.32$ ,  $p < .001$ . There was a significant main effect of free market ideology ( $\beta = -.46$ ,  $t = -4.16$ ,  $p < .01$ ) on sufficiency orientation and a marginally significant effect of the justice message condition ( $\beta = -.31$ ,  $t = -1.95$ ,  $p = .054$ ).

In the same manner, we ran a regression analysis including the moderation term *condition × general belief in a just world*. The model including justice message condition, general belief in a just world and the interaction terms explained only 7.6% of the total variance,  $F(3, 118) = 3.25, p = .024$ . However, there was neither a main effect of condition ( $\beta = -.25, t = -1.41, p = .160$ ) nor belief in a just world ( $\beta = -.18, t = -1.58, p = .116$ ) on sufficiency. No significant interaction effect was obtained ( $\beta = -.14, t = -.78, p = .435, \Delta R^2 = .01$ ).

#### **2.2.4. Responsibility Assignments**

We had expected that the justice message should increase the level of responsibility attributed to close actors, namely governments and stakeholders in the industrial countries and the civil society. However, people receiving the justice message were in tendency more *reluctant* to attribute responsibility for climate change to the civil society (justice message condition  $M = 4.75, SD = .90$ ; no justice message condition  $M = 5.02, SD = .70, t(119) = -1.83, p = .070$ , Cohen's  $d = .341$ ). Nevertheless, mean scores significantly differed on “responsibility is up to citizens from the developmental countries” in the hypothesized direction, i.e. attributing less responsibility for future climate protection to the citizens from the global south (justice message condition  $M = 2.82, SD = 1.44$ ; no justice message condition  $M = 3.40, SD = 1.36, t(120) = -2.27, p = .025$ , Cohen's  $d = .415$ ).

#### **2.2.5. Correlational Structure**

As expected, correlations between sufficiency and pro-social dimensions of justice sensitivity, i.e. observer, beneficiary and perpetrator justice sensitivity, were positive (e.g. beneficiary sensitivity  $r(122) = .20, p < .01$ , see Table 7).

Table 7 *Correlations and descriptives of the variables for Study 1 and Study 2*

	<i>SO</i>	<i>EO</i>	<i>VS</i>	<i>OS</i>	<i>BS</i>	<i>PS</i>	<i>FM</i>	<i>BJW</i>	<i>GEB</i>
SO	-/	.03/-.07	-.12/-.03	.18/.30**	.20*/.23**	20*/.32**	-.44**/-	-.24** /-.19**	.43** /-
EO	.03/-.07	-/	.09/-.07	.05/-.08	.09/.01	.02/.01	.02/-	.13/.21**	-.04/-
VS	-.12/-.03	.09/-.07	-/	.24**/.37**	.31**/.27**	.00/.01	.12/-	.11/.02	-.05/-
OS	.18/.30**	.05/-.08	.24**/.37**	-/	.57**/.48**	.22**/.46**	-.18/-	-.11/-.10	.12/-
BS	.20*/.23**	.09/.01	.31**/.27**	.57**/.48**	-/	.38**/.40**	-.10/-	-.08/.08	.13/-
PS	20*/.32**	.02/.01	.00/.01	.22**/.46**	.38**/.40**	-/	-.03/-	-.01/-.10	.28*/-
FM	-.44**/-	.02/-	.12/-	-.18/-	-.10/-	-.03/-	-/	.24**/-	-.27**/-
BJW	-.24** /-.19**	.13/.21**	.13/.08	-.11/-.10	-.08/.08	-.01/-.10	.24**/-	-/	-.10/-
GEB	.43** /-	-.04/-	-.05/-	.12/-	.13/-	.28*/-	-.27**/-	-.10/-	-/
$\alpha$	.73/.79	.62/.68	.75/.84	.61/.76	.85/.90	.61/.81	.67/-	.79/.80	.68/-
<i>M</i>	3.06/4.73	4.35/4.15	3.90/3.45	4.23/4.17	3.30/3.02	4.93/4.71	3.06/-	2.63/3.20	15.37/-
<i>SD</i>	.74/.69	.74/.84	1.17/1.30	.92/1.10	1.12/1.38	.85/1.20	.74/-	.81/.85	3.95/-

*Note.* Table presenting results from study one ( $N = 122$ ) and study two ( $N = 284$ ) simultaneously; \* $p \leq 0.05$  (two-tailed), \*\*  $p \leq 0.01$  (two-tailed). SO = Sufficiency Orientation, EO = Efficiency Orientation, OS = Observer Sensitivity, BS = Beneficiary Sensitivity, PS = Perpetrator Sensitivity, FM = Free Market Ideology, BJW = General Belief in a Just World, GEB = General Ecological Behavior. Answers were assessed scales ranging from 1 (*I totally reject*) to 6 (*I totally confirm*)

In line with our hypothesis, sufficiency orientation correlated strongly negatively with free market ideology ( $r(122) = -.44, p < .01$ ) and general belief in a just world ( $r(122) = -.24, p < .01$ ) whereas efficiency orientation in tendency correlated positively with both scales (not significant). Free market ideology and belief in a just world inter-correlated on a medium level ( $r(122) = .24, p < .01$ ), supporting our assumption of both capturing system justification tendencies. They also correlated negatively with general ecological behaviour (see Table 7). general ecological behaviour correlated significantly positively with sufficiency orientation ( $r(122) = .43, p < .01$ ) but did not correlate with efficiency orientation.

We further explored associations between responsibility attributions for future climate protection with efficiency and sufficiency orientation, as well as system-justifying tendencies. Sufficiency orientation was positively correlated with assigning responsibility to the citizens, stakeholders and governments of the industrial countries as well as educational institutions ( $r$ 's  $\geq .28, p$ 's  $\leq 0.01$ ). In contrast efficiency orientation correlated positively ( $r = .29, p \leq 0.01$ ) with attributing climate protection to countries of the global south. In Study 1, endorsement of free market ideology and general belief in a just world correlated negatively with responsibility assigned to the industrial countries (e.g.,  $r = -.34, p \leq 0.01$ , for attributing climate protection to decision makers from economy and trade in the industrial countries; see Table 8 for all correlations). In contrast and in line with our hypothesis, holding a free market ideology correlated positively with the idea of responsibility should be up to citizen from the global south ( $r = .24, p \leq 0.01$ ).

Table 8 *Correlations on responsibility for climate protection with sufficiency orientation (SO), efficiency orientation (EO), free market ideology (FM) and belief in a just world (BJW) in both Study 1 and Study 2*

	<i>SO</i>	<i>EO</i>	<i>FM</i>	<i>BJW</i>
Responsibility for future climate protection is up to: [...]				
[a] Citizens from the industrial countries.	.28**/.44**	.03/-.06	-.14/-	-.14/-.07
[b] Decision makers from economy and trade in the industrial countries.	.37**/.45**	.18/.06	-.25**/ -	-.34**/- .03
[c] Governments from the industrial countries.	.39**/.48**	.17/.08	-.25**/-	-.32**/-0.08
[d] Citizens from the global south.	-.03/.21**	.14/.00	.24*/-	-.03/-.03
[e] Stakeholders from the global south.	.02/.28**	.29**/.07	-.03/-	-.11/-.05
[f] Governments from the global south. <sup>1</sup>	-.27**	-.03	- /-	- /-.08
[g] NGOs and environmental organizations.	.04/.28**	.04/.00	.07/-	.04/.06
[h] Educational institutions	.22*/.36**	.09/-.05	-.09/-	-.10/-.12**

*Note.* Results from correlations from Study 1 ( $N = 122$ ) and Study 2 ( $N = 284$ ) are presented simultaneously in the table; \* $p \leq .05$  (two-tailed), \*\*  $p \leq .01$  (two-tailed). SO = Sufficiency Orientation. EO = Efficiency Orientation, BJW = General Belief in a Just World Item, FM = Free Market Ideology. <sup>1</sup>“governments from the global south” was not assessed in Study 1 due to a technical defect. Answers were assessed with scales ranging from 1 (*I totally reject*) to 6 (*I totally confirm*).

### 2.3. Summary and Discussion Study 1

Contrary to our hypothesis, the environmental justice message containing examples for social inequalities in the context of environmental degradation and climate change did not support an attitudinal shift towards sufficiency orientation. Instead, the justice message in tendency decreased the responsibilities attributed to the civil society in the industrial countries: In the justice message group, less responsibility for future climate protection was attributed to citizens from the industrial countries.

These results possibly indicate a reactance effect triggered by the justice message. According to Miron and Brehm (2006) reactance can emerge from perceived threats to oneself or others. This might have been an unwanted side effect of the justice message we used. The message potentially strengthened participants' feelings of helplessness with respect to mitigating climate change and/or threatened their self-concept instead of appealing to their justice needs. Although portraying closer relationships to moral issues people care about, we did only indirectly offer a concrete solution of the problem. This might have increased feelings of uncontrollability and, thus, evoked feeling less responsible for acting against climate change. Such threats, in turn, are aversive and can promote defensive reasoning aimed at the self-assertion of autonomy (Miron & Brehm, 2006). Fritsche, Cohrs, Kessler, and Bauer (2012) reported that thinking about climate change threats could even elicit authoritarian responses unrelated to the source of threat. In their experiment, people showed higher scores in authoritarian aggression after witnessing a climate change threat. Presenting brief information on environmental justice concerns might, in line with these authors, provoke a "conservative opinion shift" rejecting towards responsibility for climate change mitigation. Equally, Feygina and colleagues (2010) show that environmental threat may lead to global system justification and defence strategies. However, our results cannot not replicate such a massive shift former studies would have predicted.

Recent studies highlight moral emotions to release pro-environmental protection motivation (Carrus, Passafaro, & Bonnes, 2008; Rees, Klug, & Bamberg, 2014; Reese & Jacob, 2015; Reese, Proch, & Cohrs, 2014). Therefore, Study 2 varied time and guidance for emotional processing in an online-setting. Study 2, on the one hand, provided a second trial on the potential beneficial effects of an environmental justice message on sufficiency orientation. On the other hand, it tested potential factors that might have blocked such an impact in Study 1. We tested whether the presumable reactance effect from Study 1 could be buffered by adding a subsequent manipulation after message reading that should help to deal with reactance. Potentially, immediate reactance provoked by the justice message is short-lasting so that positive effects

on attitudes towards sufficiency might prevail only on the long run and after downsizing threat feelings. Thus measuring outcomes either immediately after the message or with considerable delay also targeted temporal dynamics of effects of environmental justice messages.

### **3. Study 2**

Study 2 tested if a 15-20 minutes break between the justice message and the measurement of the dependent variables could counteract the reactance potentially responsible for the mixed outcome of Study 1. In everyday contexts people might be granted some time to think about justice related information (e.g., when consuming a food product), before there is an occasion to implement conclusions (e.g., next time grocery shopping). Justice messages might trigger defence and denial in people in order to reduce negative feelings caused by seeing oneself partially responsible for injustice. Potentially, these negative side effects of the justice message might be actively reduced or decay if there is an occasion to think things through, leaving way for the positive effects. Breaks might positively affect memory due to information consolidation and integration. This, in turn, is supposed to support the influence of the justice message towards a pro-sufficiency oriented attitudinal shift. We tested two variations of an everyday interruption, namely a non-directional music listening phase versus doing a yoga meditation.

A recent meta-analysis suggests that even brief sessions of mindfulness-based stress reductions are equally effective as standard 8-week versions originally developed for clinical settings in organizational settings (Virgili, 2015). Furthermore, yoga helps to cope better with stress (Phang, Chiang, Ng, Keng, & Oei, 2016), elicits positive emotions (Geschwind, Peeters, Drukker, Van Os, & Wichers, 2011), positively influences psychological well-being (Sharma, 2014; Yadav, Magan, Mehta, Sharma, & Mahapatra, 2012) and supports work-related skills and performance (Bennett & Dorjee, 2016; Jacobs, 2002).

Based on these findings we hypothesized the yoga intervention to have a superior effect above listening to music due to its potential to elicit positive emotions and buffer potential negative emotions after being confronted with the environmental justice issues. We expected

positive influences on peoples' attitude shift towards sufficiency orientation due to better cognitive coping with the experienced stressor from the justice message (Reser & Swim, 2011, p. 14) and, thus, an ordinal effect on sufficiency orientation (mere justice message < music listening after reading the text < doing a meditation after reading the text).

With a larger sample we again tested whether observer justice sensitivity and belief in a just world would moderate the impact of the manipulation on sufficiency orientation. Furthermore, we assumed a progressive shift in the responsibility assignments after running through music and meditation interventions due to increased time for ruminating about injustices whereas in the mere justice message condition we expected a replication of the results from Study 1. Furthermore, we expected positive correlations of sufficiency orientation with pro-social justice sensitivity dimensions (and a negative correlation with victim justice sensitivity), but negative correlations of sufficiency orientation with belief in a just world.

### **3.1. Method Study 2**

#### **3.1.1. Participants**

In total, 722 participants clicked on the entry link of the questionnaire with 330 (45.71%) completing it. Presumably, answer duration (20-35 minutes – depending on the condition the participant was assigned to) was one reason for the high dropout rate. Recruitment was realized through a website of the FernUniversität in Hagen where all studies from the department were listed.

Two third of the participants were female (229, 74.35%; 74 males, four participants not declaring their gender). Age ranged from 18 to 61, with a mean age of 29.55 years ( $SD = 9.18$ ;  $MD = 27.00$ ). The sample contained of 184 students, 86 employees, 28 participants indicating to run a vocational training, 7 indicating not to be employed, and 3 participants indicating "other status". Most of the participants were German native speakers, 22 indicated a different mother tongue (9 missing answers). The majority were Germans (279), 13 were Austrians (two were Turkish and two were Romanian; 33 did not specify). The participants were highly



educated as 208 (67.5%) held a student status at the time of data admission. Besides, 170 indicated to have a German certificate of having passed the Abitur, or vocational Abitur, 109 participants already had a university degree, 6 had passed a traineeship and 7 had a lower school degree.

### **3.1.2. Design and Procedure**

The experiment was run online via SoSci-Survey during 1st of November 2015 and 16th of December 2015. It contained three different experimental conditions and one control condition. Participants of the control condition neither received the justice information nor music or yoga before responding to the items on sufficiency orientation. The three experimental conditions all received the justice information before answering the questionnaires. For one group there was no pause in between, while the others received yoga instruction or listened to music (15 minutes of music listening or doing yoga).

On the initial page of the study all participants were informed about the content, the length of the study in written form (see Study 1 for compliance with ethical standards) and requirements for participation such as working loudspeakers or a place to realize the meditation were given. Participants could take part for course credits or alternatively could take part in a lottery (6x25€ shopping vouchers). Anonymity and data security were assured. People were randomly assigned to one of the conditions by the online survey programme. Equal distribution over the conditions regarding gender was checked (Chi-Square-Test,  $\chi^2(7) = 7.26, ns$ ).

As in Study 1, knowledge about socio-ecological justice was manipulated through presenting a text which incorporated the justice messages (Klostermeyer & Inden-Heinrich, 2014). The control text was about the effects of mental training on sports performance and aching muscles (Genschow, 2014).

Two different yoga exercises of similar length were randomly presented to the participants in the message plus yoga condition (Version A was from Kündig, 2014, Version B from Ramm-Bonwitt, 2008). For the music intervention we selected two songs of similar length

and similar mood and presented them randomly in the justice message plus music condition. Both songs were relatively unpopular in order to prevent preference effects (“DAM” by “Lazy Salon” and “Just Plain Ant” by “The new black sampler”, downloaded from <http://freemusicarchive.org>).

### **3.1.3. Dependent Variables**

As in Study 1, self-reported sufficiency orientation ( $\alpha = .79$ ), efficiency orientation ( $\alpha = .68$ ), and responsibility assignments were measured. We additionally assessed responsibility feelings with a scale adapted from Kaiser and Shimoda (1999). Item wording was, for instance, “Because my personal contribution is very small, I do not feel responsible for climate change” with answers ranging from 1 (*I totally reject*) to 6 (*I totally confirm*,  $\alpha = .79$ .)

### **3.1.4. Moderators**

As in Study 1 we assessed *general belief in a just world* (6 Items,  $\alpha = .80$ ) and *justice sensitivity* (short form, victim justice sensitivity,  $\alpha = .84$ , observer justice sensitivity,  $\alpha = .76$ , perpetrator justice sensitivity,  $\alpha = .81$ , beneficiary justice sensitivity,  $\alpha = .90$ ). Answer options ranged from 1 (*I totally reject*) to 6 (*I totally confirm*).

### **3.1.5. Control Variables**

We controlled for *familiarity with meditation* by asking “How often do you practise yoga?”, with answer options ranging from 1 (*several times a week*) to 5 (*I have never done a yoga meditation before*). We wanted to control for responsiveness to the yoga meditation in the experimental condition (cp. Sharma, 2014; Yadav et al., 2012). Furthermore, we wanted to explore whether people who regularly practise yoga score higher on sufficiency orientation (see Rosa, Paech, Wittmann, & Kirschenmann, 2014; Satish & Kumar, 2013).

### **3.1.6. Manipulation Checks**

To check, if the people really meditated we used a shortened version of the *meditation depth* questionnaire (e.g., “I was attentive to the sensations running through my body”; Piron, 2001). We selected 9 items that were suitable for the current study and excluded two further items after scale analysis ( $M = 3.95$ ,  $SD = 1.09$ ,  $\alpha = .86$ ).

Furthermore, the Self-Assessment-Manikin (SAM) captured valence, arousal and dominance on three bipolar dimensions on three points of time within the experiment (Bradley & Lang, 1994; Lang 1980) to compare *affective reactions* after reading the manipulation text versus the control text, as also for comparing a within-emotional change before and after the secondary interventions. This was useful to evaluate if the justice message had an influence on peoples’ affective states (which might have caused a reactance effect in Study 1).

## **3.2. Results Study 2**

### **3.2.1. Manipulation Checks**

First, we checked if all participants who were confronted with the justice message were able to correctly fill out the open-format questions on socio-ecological problems from man-made climate change (cp. Study 1). Based on this indicator, nobody had to be excluded from further analysis.

Plausibility checks of whether a person indeed had meditated or listened to the music were done by analysing the dwelling times on the corresponding pages. We defined a minimum and a maximum border for both conditions. Participants who stayed less than 8 minutes or more than 25 minutes on the manipulation pages were excluded from further analysis (24 people, 7.6%). After exclusion, the mean duration time participants meditated was 14.26 minutes ( $SD = 5.32$ ). Participants listened to music for an average of 9.84 minutes ( $SD = 2.43$ ). Furthermore, we checked if people reported technical problems during listening to the music or the meditation instruction, which was assessed by one item. This was not the case.

We found significant differences in meditation depth scores between the mediation condition ( $M = 4.25$ ,  $SD = .96$ ) and the music condition ( $M = 3.61$ ;  $SD = 1.14$ ) indicating a successful meditation manipulation,  $F(1, 125) = 11.767$ ,  $p < .001$ . This was supported by changes in affective states after running through the meditation and the music intervention (mediation intervention group means:  $M_{valence} = 6.61$ ,  $SD_{valence} = 1.14$ ,  $M_{arousal} = 2.93$ ,  $SD_{arousal} = 1.85$ , music intervention group means:  $M_{valence} = 5.48$ ,  $SD_{valence} = 1.69$ ,  $M_{arousal} = 3.85$ ,  $SD_{arousal} = 2.00$ ). Group means of valence ( $F(1,126) = 19.77$ ,  $p < .001$ ,  $\eta^2 = .14$ ) and arousal ( $F(1,126) = 7.29$ ,  $p = .008$ ,  $\eta^2 = .06$ ) differed significantly suggesting that the yoga manipulation was successful.

To check for a potential reactance effect after message exploration we compared the SAM-ratings at different stages of the experiment. Mean ratings of affect scores were neither different amongst the conditions before the manipulation (valence mean scores,  $F(3,283) = 2.01$ , *ns*; arousal mean scores,  $F(3,283) = 0.73$ , *ns*; dominance mean scores,  $F(3,283) = .142$ , *ns*), nor did they differ immediately after reading the justice message (valence,  $F(3,283) = 1.13$ , *ns*; arousal,  $F(3,283) = 1.00$ , *ns*; dominance,  $F(3,283) = 1.90$ , *ns*). Thus, while we (post hoc) attributed the responsibility shifts found in Study 1 to reactance processes, we did not find support for such an effect based on the people's affective reactions in the online-based Study 2.

### 3.2.2. Sufficiency Orientation

The ANOVA on the mean sufficiency orientation scores showed an effect of condition,  $F(3, 280) = 2.70$ ,  $p = .046$ ,  $\eta^2 = .03$  (see Table 9). Based on a non-significant Levene's Test ( $F(3, 280) = 2.00$ , *ns*) we ran the *post hoc* Tukey test which indicated that the justice message only condition differed marginally from the no justice message control group ( $p = .056$ ). A marginal difference was also observed between the no justice message control group and the experimental justice message plus music intervention group ( $p = .089$ ). There was no significant difference between the no justice message control group and the experimental justice message plus meditation intervention group ( $p = .512$ ). We did not find a superior effect of the meditation intervention in contrast to the music intervention as previously assumed. In a second step

we compared mean sufficiency orientation in the control condition ( $M = 4.56, SD = .81$ ) to the collapsed experimental conditions (as all contained the justice message,  $M = 4.80, SD = .63$ ). The two groups differed significantly (Levene's Test was significant,  $F(1, 280) = 5.20, p = .021$ ; Mann-Whitey Test  $U(284) = 6819.00, Z = -2.07, p = .044$ ).

Table 9 Descriptives for dependent variable mean sufficiency scores per condition (Study 2)

<i>Condition</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>95% CI</i>
Control	79	4.56	.81	[4.38 – 4.74]
Text Message only	78	4.83	.62	[4.69 – 4.97]
Text + Music	60	4.84	.60	[4.68 – 4.99]
Text + Meditation	67	4.72	.67	[4.55 – 4.88]
Total	284	4.73	.60	[4.65 – 4.81]

### 3.2.3. Moderators

As in Study 1, *observer justice sensitivity* was tested as potential moderator. We ran a regression analysis and included condition, observer justice sensitivity and the interaction term *justice message condition*  $\times$  *observer justice sensitivity* into the model (all experimental conditions were collapsed for the first moderation analysis). The model was significant,  $F(3, 284) = 12.89, p < .001, R^2 = .124$ . However, the moderation term *justice message condition (no/yes)*  $\times$  *observer justice sensitivity* was not significant ( $\beta = .14, 95\% CI [-.106; .388], t = 1.23, p = .262$ ). Analysis of the slopes yielded results in direction of our hypothesis. When observer sensitivity levels are at average, there is a significant positive relationship between the condition (justice message no/yes) and sufficiency orientation ( $\beta = .356, 95\% CI [.111, .601], t = 2.85, p = .005$ ) with an increasing influence when observer justice sensitivity is also increasing (+ 1SD,  $\beta = .497, t = 2.846, p = .005 [.153; .841]$ ). When observer justice sensitivity scores are low, there is no significant relationship between condition and sufficiency orientation (- 1SD,  $\beta = .215, t = 1.20, p = .231 [-.138, .568]$ ).

We ran separate moderation analyses to see if a moderator effect of justice sensitivity could be detected in one of the experimental groups. This was the case for the subgroup that meditated after reading the justice message. Data yielded an increasing influence of observer justice sensitivity in the hypothesized direction in the justice message plus meditation group compared to the control group,  $F(1, 146) = 6.84, p < .001, R^2 = .126$ ; significant moderation term,  $b = .403, t = 2.094, p = .038, \Delta R^2 = .017, \text{post hoc power} = 0.64$ .

*Belief in a just world* was also tested as potential moderator for ratings on sufficiency orientation. Although belief in a just world significantly predicted sufficiency orientation scores in the model ( $\beta = -.23, t = -2.13, p = .034$ ), the interaction was not significant (*justice message condition no / yes*  $\times$  *belief in a just world*;  $\beta = .06, t = .52, p = .604$ ).

### 3.2.4. Responsibility Assignments

We ran a one-way ANOVA comparing the group means for all responsibility items. Statistically significant differences were found between the means of “governments in the industrial countries”,  $F(3, 280) = 3.393, p = .018$ , and “educational institutions”,  $F(3, 280) = 4.20, p = .006$ . A marginal significant difference was found for “responsibility is up to decision makers from economy and trade in the industrial countries”,  $F(3, 280) = 2.53, p = .057$ . In all three cases, means were higher after message presentation compared to the control condition, which was in line with our hypothesis (see Table 10 for complete results). *Post hoc* Tukey tests further determined statistically significant differences between the no justice message control group and the justice message only experimental group for responsibility assignment to “governments from the industrial countries” with a mean difference value of .337, ( $p = .016$ ), for “educational institutions” with a mean difference value of .621, ( $p = .012$ ), and “decision makers from economy and trade” in the industrial countries with a mean difference value of .336 ( $p = .043$ ). Additionally, a *post hoc* Tukey test detected a significant difference between the justice message plus meditation experimental group and the no justice message control group of .629 ( $p = .015$ ) regarding the responsibility attribution to educational institutions. The overall

influence of the justice message on the three responsibility items was determined by comparing the collapsed means from all experimental conditions with the no justice message control condition ( $t_{(a)}(282) = -2.70, p_{(a)} = .008, t_{(b)}(282) = -2.12, p_{(b)} = .036, t_{(c)}(282) = -2.82, p_{(c)} = .006$ ; indices refer to the item number in Table 10).

Table 10 *Condition-wise means and standard deviations for dependent variable responsibility for future climate protection (Study 2)*

<i>Responsibility for future climate protection is up to: [...]</i>	<i>Control</i>	<i>Text Message only</i>	<i>Text + Music</i>	<i>Text + Meditation</i>
[a] Governments in the industrial countries.	5.27 [.87]	5.60 [.61]	5.53 [.72]	5.52 [.56]
[b] Decision makers from economy and trade in the industrial countries.	5.20 [.93]	5.54 [.62]	5.45 [.70]	5.34 [.90]
[c] Educational institutions.	4.43 [1.63]	5.05 [1.07]	4.83 [1.14]	5.06 [1.04]

*Note.*  $N_{total} = 284, N_{control} = 79, N_{text\ message\ only} = 78, N_{text+music} = 60, N_{text+meditation} = 67$ . Standard deviations are listed in brackets. The table presents results for the responsibility items, which indicated significant differences, only.

### 3.2.5. Correlational Structures

We replicated some basic findings from Study 1. Significant positive correlations were found between sufficiency orientation and pro-social justice sensitivity orientation (see Table 7). However, there were no significant correlations between victim sensitivity and sufficiency orientation. Belief in a just world correlated negatively with sufficiency ( $r(284) = -.19, p < .01$ ). Efficiency orientation correlated positively with belief in a just world ( $r(284) = .21, p < .01$ ), which was in line with our hypotheses.

Table 8 lists correlations of responsibility attributions and sufficiency orientation, efficiency orientation, free market ideology and belief in a just world from Study 2. Sufficiency orientation more strongly correlated with the industrial country perspectives, i.e. citizens, decision makers from economy and trade, governments; all  $r$ 's between .44 and .48,  $p < .01$ ). In

contrast to Study 1, significant positive medium-level correlations were found between sufficiency orientation and responsibility attributions to citizens, stakeholders and governments from the Global South (all  $r$ 's between .21 and .28,  $p < .01$ ). Neither efficiency orientation nor belief in a just world correlated significantly with responsibility attributions, except people's responsibility attribution to educational institutions ( $r(284) = -.12$ ,  $p < .01$ ).

### **3.3. Summary and Discussion Study 2**

In the second study, the mere presentation of a justice message was able to shift attitudes – albeit slightly – towards sufficiency orientation. However, the combination with yoga and music did not add to the effect of the justice message. Furthermore, observer justice sensitivity in tendency moderated the effect. People who were more observer justice sensitive were also more likely to shift their attitudes towards pro-sufficiency orientation after reading about ecological injustices than less observer justice sensitive did.

A negative or 'conservative' shift in responsibility assignments such as in Study 1 was not found in Study 2. Nevertheless, people in the experimental conditions were equally reluctant to attribute more responsibility to the citizens in the industrial countries – the group of people they are a part of – and thus contrary to our hypothesis, were not nudged to indicate that climate protection is increasingly up to citizens in the industrial countries which is parallel to results from Study 1.

The justice message positively influenced people's responsibility attributions to governments in the industrial countries, educational institutions and decision makers from economy and trade in the industrial countries, which can be judged as positive outcome from the intervention.

Casting doubt upon the reactance explanation we derived from the responsibility shift in Study 1, we could not find any indication for this effect in Study 2 because valence and arousal did not differ before and after message application. On the level of the immediate affective states there was no threat reaction detectable. A significant change in affective states



only appeared between mean levels before and after running through the yoga intervention. This adds a replication regarding positive emotional effects due to short yoga meditations, even if people are instructed in an online setting (Virgili, 2015; Yadav et al., 2012).

#### **4. General Discussion**

Climate change is a recent high risk on a global scale. There is an on-going societal, political and economic interest to support sustainable development – primarily, however, by focusing on efficiency strategies rather than sufficiency strategies. This study addressed the sufficiency orientation as one key factor to promote sustainable development.

We investigated whether stressing the environmental justice perspective by focusing on social inequalities both as source and effect of ecologically problematic action on three different social levels (local, global, and intergenerational) can support an attitudinal shift towards sufficiency orientation. In addition, we asked if responsibility attributions for climate protection could be shifted increasingly towards the civic society and close actors, i.e. governments and stakeholders from the industrial countries after receiving the justice message. This we addressed because of the moral roots of the sufficiency sustainability strategy. Given that one could argue that demand effects alone might suffice to induce a positive effect of raising such moral issues on sufficiency orientation, it is the more surprising that we found justice messaging to be ineffective to raise sufficiency orientation. While sufficiency orientation was related to justice sensitivity on the level of interindividual differences, results of the experimental manipulations in our studies were less promising. While the justice message had no positive effect on sufficiency orientation in Study 1 (paper & pencil), a small significant effect in line with the hypothesis was obtained in Study 2 (online sample). The extra activity, music listening or yoga meditation, after reading the justice message did not additionally increase the impact of the justice message on our dependent variable sufficiency orientation.

In Study 1, the justice message led in tendency towards denial of responsibility for climate change to the civil society (and hence, oneself as a part of it). We thus found evidence for

a conservative responsibility shift and argued in favour of a potential threat reaction that was a plausible explanation (Fritsche et al., 2012; Fritsche, Jonas, & Kessler, 2011; Miron & Brehm, 2006). Yet, in Study 2 this effect of the justice message was not found. Rather, in Study 2 positive shifts in assigning responsibility to governments and decision makers from economy and trade in the industrial countries as also to educational organisations were found after message exploration. Yet, in both studies there was no shift towards more civic engagement, i.e. attributing responsibility to the citizens in the industrial countries, which is conflicting with our hypothesis. Thus, presenting environmental justice issues the way we did in this study was not effective. Presumably, the information needs to be enhanced with ways how to individually and collectively cope with the injustices that were portrayed (Clayton, Koehn, & Grover, 2013; Moser, 2010). In this endeavour dealing with reactance might not be a major concern. Affective reactions measures did not substantiate the reactance effect we had suspected to operate in Study 1. We argue that the responsibility decline we found in Study 1 resulted from the less private and more supervised experimental setting in Study 1 – in contrast to the online setting in Study 2. Against our hypothesis, none of the additional interventions were effective in shifting responsibility attributions increasingly towards civil society in Study 2. In Study 2, however, participants addressed governments and stakeholders in the industrial countries as well as educational institutions increasingly after reading about environmental justice perspectives, which was in line with our assumptions.

We analysed if observer justice sensitivity served as a supportive moderator. While results from Study 1 yielded no significant influences, the slope analysis in Study 2 was in line with the hypothesized moderation: A high observer justice sensitivity slightly increased the effect of the environmental justice message on sufficiency orientation. For participants who were confronted with the justice message and meditated before reporting sufficiency orientation we found a significant moderation term.

Correlational analyses from both studies were in line with our hypotheses. Pro-social justice sensitivity facets were positively related to sufficiency orientation whereas victim justice sensitivity was negatively correlated with sufficiency orientation. These results correspond to findings stating that pro-social justice sensitivity facets act together with “other-oriented” cognitive and behavioural tendencies (Baumert & Schmitt, 2016; Gollwitzer, Schmitt, Schalke, Maes, & Baer, 2005; Rothmund et al., 2014; Schmitt et al., 2010). The results support the notion that justice sensitivity is relevant for pro-environmental motivation and ecological behaviour. Additionally, in Study 2 we found observer justice sensitivity to have an influence on processing environmental justice related information (cf. Baumert et al., 2011). Future studies should focus on these aspects of the environmental justice message. Furthermore, our results support the assumption that free market ideology and system justification may function as an ideological barrier towards sufficiency orientation. The negative correlations of sufficiency orientation with belief in a just world and free market ideology are in line with former findings (see Feinberg & Willer, 2011; Feygina et al., 2010; Jost et al., 2012) and may hamper willingness to counteract climate change.

#### **4.1. Limitations and Conclusion for Future Research**

The present studies suggest that the applied justice message approach is not a suitable strategy to increase openness for sufficiency orientation. Also, the role of pro-social justice sensitivity facets in terms of a moderation effect was not clearly identified throughout our studies. Before turning to other potentially more effective interventions, one should consider factors that could limit the validity of this conclusion. Our outcome variables were assessed through self-report and influenced by social desirability effects. We also did not ask for actual sufficiency oriented behaviour and cannot derive conclusions regarding people’s pro-environmental behaviour performance and possible long-term effects. Our findings do not preclude that a justice message can help to increase openness for sufficiency with respect to a specific target domain, especially, if the justice message relates to a domain that leaves large room for improvement

as sufficiency-oriented and climate-friendly behaviour is not common practice (e.g., flights for vacations, German Aerospace Center Study, 2015; Infratest Dimap, 2007). Future studies should more directly and explicitly focus on behaviour with high impact on the environment that leave large room for improving sufficiency and tailor justice messages for the specific behaviour. Presumably, our assessment of the dependent variable did not sufficiently capture people's intentions to relinquish from resource intensive consumption practises. Also note, that a variation of the justice messages would be necessary to disentangle which parts of the message are effective or not. We obtained the influence of the complete message incorporating several levels of injustice, i.e. intergenerational, global and local. Composing the three levels together in one message as we did may have strained the reader too much. Potentially, characterizing only one of these levels and adding exemplified options to oppose these injustices by changing consumption practise, for instance, would have been more effective. Presumably, the justice message was too complex for the audience in the way we presented it, i.e. pure text based only with rational arguments, not appealing to imagination. Adding visual material or narrative elements could be more effective to nudge sufficiency orientation (cf. Appel & Richter, 2007; Felser, 2015).

Against our hypothesis we could not find conclusive results regarding the classification of efficiency orientation. The scale we used was not reliable enough and should be improved. This limits the interpretability of correlations involving efficiency orientation in the current work. The differentiation between people who more strongly prefer sufficiency approaches and reject a free market based economy in contrast to people who more strongly prefer efficiency approaches and support a free market economy should be within the scope of future research. Developing an innovative and ecological economy, which is able to mitigate climate change and increase global justice, will be only feasible by counting on both sustainability approaches with its supporters.

Justice-related dispositions influence the way people deal with environmental injustices (e.g. Baier, Kals, & Müller, 2013). Correlational analyses from both studies suggest that

also pro-social justice sensitivity could assist in pro-environmental and sufficiency orientated attitude formation (see Reese & Jacob, 2015, who proposed a similar relationship). However, if and how justice sensitivity leads to sufficiency-oriented behaviours on a longer term and how justice related perceptions could be triggered in real life situations to influence environmental decision taking (e.g., to relinquish from wrapping vegetables and fruits in an extra plastic bag during shopping) should be in the scope of future studies. In line with former findings on system-justifying tendencies, both free market ideology and belief in a just world play impeding roles towards pro-sufficiency orientation (Feygina, 2013; Feygina, Jost, & Goldsmith, 2010). Hence, suitable ways to address “system-justifiers” to mobilize their particular moral motivations increasingly in favour of pro-environmental behaviour should be detected.

Sufficiency represents a key towards realizing a sustainable society but lacks of interest in the public debate and in recent politics (Alcott, 2008; Grunwald & Kopfmüller, 2012; Hopwood, Mellor, & O’Brien, 2005; Schöpke & Rauschmeyer, 2014). This partly results from the fact that there are different variants of environmental protection behaviour, only some of which are in line with sufficiency orientation, which seems to be an especially far-reaching variant: “It touches the border between our needs and wants as also to our inborn desire of justice” (Alcott, 2008, p. 782). In Western societies there is a common believe in free market based systems and its immediate functionality regarding affluence. However, according to our studies this is correlated with less endorsement of a sufficiency approach.

In sum, an information-message approach portraying environmental issues as justice issues does not seem to be effective in supporting pro-sufficiency orientation shifts. Given the correlational link between justice perception and sufficiency orientation we need to better understand how and when the justice perspective on ecological challenges can be useful to mitigate change in attitudes and behaviour.

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## 6 MANUSCRIPT 4 – GLOBAL CITIZENS – GLOBAL JET SETTERS? THE RELATION BETWEEN GLOBAL IDENTITY, SUFFICIENCY ORIENTATION, TRAVELLING, AND SOCIO-ECOLOGICAL TRANSFORMATION OF THE MOBILITY SYSTEM

Loy, L.S.\*, Tröger, J.\*, Prior, P., & Reese, G. (2021). Global citizens – global jet setters? The relation between global identity, sufficiency orientation, travelling, and socio-ecological transformation of the mobility system. *Frontiers in Psychology*. 12, 733.

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### **Abstract**

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 CO<sub>2</sub>-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 CO<sub>2</sub> 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 CO<sub>2</sub> 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

## **1. Introduction**

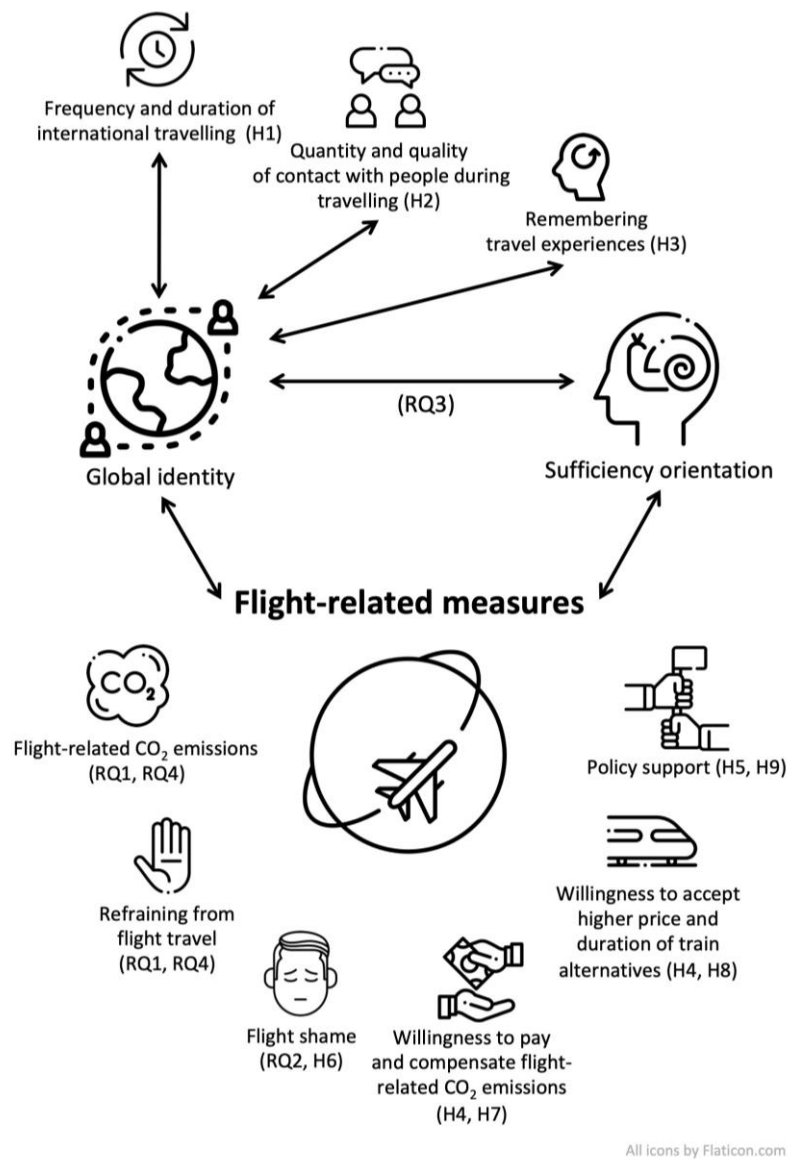
Global crises such as climate change are challenging humanity as a whole and collective efforts from people all over the world are required to build a sustainable future. A sustainable future, however, seems at odds with the current status of the planet. Global environmental change has reached levels that surpass a safe operating space for humanity (O'Neill et al., 2018; Rockström et al., 2009; Steffen et al., 2015). It is evident that together with technological developments, a socio-structural transformation is necessary (Abson et al., 2017; Fischer & 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 in-group (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., Brieger, 2019; Joanes, 2019; Loy & Reese, 2019; Renger & Reese, 2017), 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 (Römpke et al., 2019; Sparkman & Eidelman, 2018). However, air travelling allowing such contact is amongst the most CO<sub>2</sub>-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; Verfuërth 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 5 provides a graphical overview of our research.

Figure 5 Graphical overview of research questions and hypotheses



Note. RQ, research question; H, hypothesis. This graphical illustration has been designed using resources from Flaticon.com. Icons are by Freepik ([www.freepik.com](http://www.freepik.com)), Dan Darius ([www.flaticon.com/authors/darius-dan](http://www.flaticon.com/authors/darius-dan)), Pixel perfect ([www.flaticon.com/authors/pixel-perfect](http://www.flaticon.com/authors/pixel-perfect)), and Pixelmeetup ([www.flaticon.com/authors/pixelmeetup](http://www.flaticon.com/authors/pixelmeetup)).

## 2. Theoretical Background

### 2.1. 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 (European Commission, 2011; Urry, 2008; Zipori & Cohen, 2015). Given the current technological infrastructure, people can deliberately reduce their mobility-related CO<sub>2</sub> footprint by simply travelling less and/or by choosing less CO<sub>2</sub>-intensive means of transport such as trains. Moreover, they can support policy measures that make CO<sub>2</sub>-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 (European Commission, 2020; UBA, 2019). 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 (Alcock et al., 2017; Geiger et al., 2018; Lassen, 2010). 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 & 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 multi-level 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, 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 & 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 towards a socio-ecological transformation of the mobility system. Specifically, we investigate the role of global identity and sufficiency orientation as drivers for transition processes.

## **2.2. Global Identity and Travel Experiences**

Different conceptualisations of a *global identity* exist (see Carmona et al., 2020; McFarland et al., 2019, 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 Hamer et al., 2020; Reysen & Hackett, 2016). 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 & 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; McFarland et al., 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 (Loy & Spence, 2020; McFarland et al., 2019; Reese et al., 2015; Sparkman & Hamer, 2020; Turner et al., 1987).

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 et al., 2011; Pettigrew & Tropp, 2006) was that personal contact with people all over the world might strengthen global identification (see e.g., Römpke et al., 2019; Sparkman & Eidelman, 2018). 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 six 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 US 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.

### **2.3. 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 CO<sub>2</sub>-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, Röpke 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 CO<sub>2</sub> emissions and how often people refrained from flying:

RQ1: Is global identity related to past flight-related CO<sub>2</sub> 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 CO<sub>2</sub>-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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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.

#### **2.4. 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 evi-

dence 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 (Verfuerth 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 CO<sub>2</sub> 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 air-planes 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 CO<sub>2</sub> 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.

### 3. Materials and Methods

#### 3.1. 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.

#### 3.2. Participants

We conducted an *a priori* power analysis (see Appendix III, Supplementary Section "Power Analysis") and recruited a convenience sample of  $N = 322$  participants (see Appendix III, 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 Appendix III, 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.



### **3.3. Measures**

In the following, we provide an overview on the self- report measures used to answer our research questions (see Appendix III, Supplementary Section “Measures” for detailed descriptions and Appendix III, Table 18, Table 19 for psychometric properties)<sup>6</sup>. It took participants on average 18.5 min to fill out the questionnaire. All variables are provided on the OSF Forum<sup>7</sup>, the key scales in Appendix III, Supplementary Section “Measures.”

#### **3.3.1. Global Identity**

We used an adapted version (see Loy and Reese, 2019 and Appendix III, 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.

#### **3.3.2. 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 (Appendix III, 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 (Appendix III, Supplementary Section “Travel Experiences,” see also Sparkman and Eidelman, 2018).

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<sup>6</sup> 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 CO<sub>2</sub> 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.

<sup>7</sup> OSF Forum: <https://bit.ly/3vbEGvh>

### 3.3.3. Flight-related measures

*Flight-related CO<sub>2</sub> 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 CO<sub>2</sub> emissions (in tons per person) using an online footprint calculator (see Appendix III, Supplementary Section “Calculation of Flight-Related CO<sub>2</sub> Emissions”). The values of  $n = 15$  cases were incomplete and we excluded them from further analyses (see Appendix III, 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 Appendix III, 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 Appendix III, 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 CO<sub>2</sub> emissions.* We asked participants to imagine that they travel by plane and pay 100€. They indicated whether they would pay a CO<sub>2</sub> 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).

*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 Appendix III, Supplementary Section “Exclusion of Outliers and Implausible Values”).

### **3.3.4. Policy Support**

We refined and extended a policy support scale used by Loy and Reese (2019, see also Tobler et al., 2012, Appendix III, 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.

### **3.3.5. 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 Appendix III, Supplementary Section “Sufficiency Orientation”).

## **4. Results**

The results regarding our research questions (RQ) and hypotheses (H) in terms of bivariate correlations are summarised in Table 11 (see Appendix III, Table 19 for all bivariate correlations).

#### **4.1. 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 12).

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 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.

#### **4.2. Global Identity and Decarbonised Travelling**

Global self-investment but not self-definition was negatively related to past CO<sub>2</sub> 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 CO<sub>2</sub> 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).

### **4.3. 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 CO<sub>2</sub> 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 CO<sub>2</sub> emissions at higher costs.

We additionally ran regression models with global identity and sufficiency orientation as parallel predictors of past flight-related CO<sub>2</sub> emissions, willingness to reduce flying, and policy support favouring a transformed mobility system to examine their relative explanatory value (see Table 13). 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 CO<sub>2</sub> emissions and the willingness to refrain from flying. Both global identity and sufficiency orientation predicted policy support<sup>8</sup>.

## **5. Discussion**

### **5.1. 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.

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<sup>8</sup> As a robustness check for the results on flight-related CO<sub>2</sub> 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.

Global self-investment but not self-definition was negatively related to flight-related CO<sub>2</sub> 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 CO<sub>2</sub> 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; Römpke et al., 2019).

## **5.2. 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 (Römpke 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 CO<sub>2</sub> 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 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.

### **5.3. Practical Implications**

#### **5.3.1. 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”<sup>9</sup>. 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 (Kooß 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.

### **5.3.2. 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

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<sup>9</sup> [www.terran.eco](http://www.terran.eco)

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”)<sup>10</sup>.

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 sys-

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<sup>10</sup> [www.back-on-track.eu](http://www.back-on-track.eu)

tem 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.

#### **5.4. 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, CO<sub>2</sub> 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.

Table 11 *Bivariate correlations addressed in our research questions and hypotheses*

Variable	H/RQ global identity	1	2	H/RQ sufficiency ori- entation	3	4
<b>Global identity</b>						
1. Global self-definition <sup>a</sup>						
2. Global self-investment <sup>a</sup>		.94*				
<b>Sufficiency orientation</b>						
3. Low-carbon lifestyle <sup>a</sup>	RQ3	.44*	.47*			
4. Consumption impact <sup>a</sup>	RQ3	.42*	.49*		.80*	
<b>Travel experiences</b>						
5. Frequency of travelling Europe <sup>b</sup>	H1	.03	.03			
6. Duration of travelling Europe	H1	-.05	-.05			
7. Frequency of travelling beyond Europe <sup>b</sup>	H1	.08	.07			
8. Duration of travelling beyond Europe	H1	.10	.10			
9. Quantity of contact with locals <sup>a</sup>	H2a	.24*	.21*			
10. Quality of contact with locals <sup>a</sup>	H2b	.27*	.27*			
<b>Decarbonised mobility practices and appraisals</b>						
11. Flight-related CO <sub>2</sub> emissions	RQ1a	-.08	-.12*	RQ4a	-.14*	-.15*
12. Refraining from flight travel	RQ1b	.22*	.25*	RQ4b	.39*	.31*
13. Flight shame	RQ2	.35*	.40*	H6	.46*	.45*
14. Willingness CO <sub>2</sub> compensation	H4a	.34*	.39*	H7	.39*	.36*
15. Amount CO <sub>2</sub> compensation	H4b	.21*	.22*	H7	.20*	.17*
16. Accepted train price	H4c	.15*	.16*	H8a	.22*	.19*
17. Accepted train travel duration	H4d	.13*	.12*	H8b	.13*	.11*
18. Policy support <sup>a</sup>	H5	.43*	.48*	H9	.65*	.65*

Note. \*  $p < .05$ . We used pairwise exclusion of missing cases. <sup>a</sup> Factor scores resulting from CFA were used. <sup>b</sup> Spearman correlations were calculated for these ordinal variables; all others are Pearson correlations.

Table 12 Results of regressing global identity (mean score) on travel experiences

	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI	$\beta$	<i>R</i> <sup>2</sup>
						0.135
Constant	4.45	0.55	<.001	[3.23, 5.60]		
Gender	-0.41	0.18	.020	[-0.79, -0.04]	-.13*	
Age	-0.01	0.01	.198	[-0.02, 0.00]	-.07	
Subjective financial situation	-0.11	0.08	.170	[-0.28, 0.05]	-.07	
Frequency of travelling Europe	0.00	0.04	.911	[-0.07, 0.08]	.01	
Duration of travelling Europe	-0.01	0.00	.134	[-0.00, 0.00]	-.09	
Frequency of travelling beyond Europe	-0.01	0.03	.782	[-0.07, 0.06]	-.02	
Duration of travelling beyond Europe	0.00	0.00	.206	[-0.00, 0.01]	.08	
Quantity of contact with locals <sup>a</sup>	0.11	0.05	.030	[0.01, 0.24]	.14*	
Quality of contact with locals <sup>a</sup>	0.28	0.08	<.001	[0.09, 0.46]	.21*	

Note. \*  $p < .05$ . 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. <sup>a</sup> Mean scores were used.

Table 13 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	$\beta$	<i>R</i> <sup>2</sup>
						0.032
Flight-related CO <sub>2</sub> emissions						
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	2.88	0.777	[-18.31, 5.89]	-0.02	
Sufficiency orientation	-8.34	3.81	0.032	[-19.53, 0.39]	-0.15*	
						0.164
Refraining from flight travel						
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*	
						0.475
Policy support						
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*	

Note. \*  $p < .05$ . 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.

### **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 focused on global identity. JT specifically focused on sufficiency orientation. PP and GR revised and edited the manuscript. All authors contributed to the article and approved the submitted version.

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### **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> and in the **Appendix III**.

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## 7 MANUSCRIPT 5 – CAN REFLECTIVE DIARY-WRITING INCREASE SUFFICIENCY-ORIENTED CONSUMPTION? A LONGITUDINAL INTERVENTION ADDRESSING THE ROLE OF BASIC PSYCHOLOGICAL NEEDS, SUBJECTIVE WELL-BEING, AND TIME AFFLUENCE

Tröger, J.\*, Wullenkord, M.C.\*, Barthels, C., & Steller, R. (2021). Can reflective diary-writing increase sufficiency-oriented consumption? A longitudinal intervention addressing the role of basic psychological needs, subjective well-being, and time affluence. *Sustainability*, 13(9), 4885. <https://doi.org/10.3390/su13094885>

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### **Abstract**

Sufficiency is a sustainability strategy aiming for (1) a decrease in absolute resource consumption on individual and societal levels and (2) for socio-ecological justice and the fair distribution of costs and benefits of resource use to meet every human's basic needs. This study examined a longitudinal intervention to foster individual sufficiency *orientation* (i.e., a multidimensional construct including both attitudes towards the sufficiency sustainability strategy and corresponding behavioral intentions). We recruited  $N=252$  participants who participated in a one-week reflective diary-intervention to increase sufficiency orientation in every-day life and assessed sufficiency orientation, basic psychological need satisfaction, self-reflection, subjective well-being, and time affluence before (T1), directly after (T2), and four weeks after the intervention (T3). Contrary to our predictions, there was no significant difference between the experimental and the control group. Sufficiency orientation increased across groups. Basic psychological need satisfaction was the strongest predictor of sufficiency orientation. There were positive relations with subjective well-being. Targeting basic psychological need satisfaction as a potential underlying driver of sufficiency orientation seems to be a promising avenue for designing interventions. Employing a need-based, humanistic approach to design psychological interventions is in line with the aims of sufficiency to meet every human's basic needs, in a socio-ecologically just world.

## **Keywords**

Consumer behavior, diary method, intervention, psychological needs, behavioral intention, pro-environmental behavior, environmental psychology, self-reflection, reflective writing, sufficiency orientation

## **1. Introduction**

How can we minimize ecological footprints and support lifestyles that are compatible with ecological limits? In face of the climate crisis [1,2]<sup>11</sup> and the high consumption levels of industrialized nations [3], investigating ways to change non-ecological consumption patterns is critical. Although risk awareness about the climate crisis is generally high [4], individuals and societies still fail to perform behaviors that substantially lower CO<sub>2</sub>-emissions [5,6]. Current Western societal norms are embedded in growth imperatives [7], promoting materialistic goals as a means to a meaningful life, whilst perpetuating environmentally destructive consumption and human ill-being (i.e., lack of well-being and happiness) [8,9]. Given these growth imperatives, the societal and political debate on climate change mitigation has widely focused on efficiency improvements (i.e., more effective use of resources) over the past decade. However, a one-sided focus on efficiency can lead to rebound effects, as it makes consumption more profitable (compare Jevons' paradox, [10–12]). Instead, the sufficiency sustainability strategy needs to be increasingly considered. According to the Oxford dictionary, sufficiency is “an amount of something that is enough for a particular purpose” [13]. The term entered the sustainability debate as a strategy that, in contrast to efficiency and consistency, aims at reducing absolute consumption of resources with the goal of meeting every human's basic needs [14–17]. It can be approached looking at both minimum and maximum thresholds for consumption (see [17,18]). However, most people refer to upper limits for consumption in Western consumerist cultures, such as Germany, that significantly contribute to environmental degradation and global socio-ecological injustice. What does a sufficiency orientation look like concretely?

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<sup>11</sup> Due to the journal guidelines all references were listed in a sequential order and can be found at the end of the chapter 7.

### **1.1. Sufficiency Orientation as Multidimensional Construct**

Depending on disciplinary focus, various interpretations of sufficiency in terms of “having enough” exist [19]. For instance, sufficiency is discussed as a transformational political project and an organizing principle of society. On such a macro-economic level, sufficiency questions the economic growth paradigm as a major reason for ongoing resource exploitation and growing emissions. In line, the discourse around sufficiency can be seen as one within the more global and socio-political discourse on degrowth (Degrowth “signals a radical political and economic reorganization leading to reduced resource and energy use”, which includes turning away from the (economic) growth paradigm [20] (p. 291.) [20,21]. Nevertheless, there will be no socio-ecological transformation without a deep societal shift in psychological dimensions, such as values shared by individuals and society as a whole [9,22]. A reorganization of society in line with the sufficiency principle requires individuals who are open to rethink values and aspirations and develop a sufficiency orientation themselves. In line, sufficiency at the individual level represents a voluntary strategy to reduce consumption (e.g., [23]) in high-impact fields of action (e.g., see Loy et al. [24] on flying and sufficiency orientation, see also Verfuert et al. [25]). In the German debate on adequate sustainability strategies, sufficiency is often criticized, partly out of fear that it might trigger feelings of loss and aversion (see Gossen et al. [26] on how to communicate sufficiency in marketing strategies). However, that is a fallacy. Rather, O’Neill [27] defines sufficiency to result in having enough for a good life, whilst not consuming so much that it is ecologically excessive. Sufficiency is argued to increase well-being and life satisfaction based on voluntarily restricting consumption ([26,28,29] discuss affluent consumption and life fulfilment). Thus, sufficiency is not about simply giving up beloved habits or material things. Rather, it is based on the realization that excessive consumption in Western cultures is neither socially nor ecologically feasible, or beneficial in the long term for societal well-being.

In our study, we use sufficiency *orientation* as a construct that captures (a) an attitude in line with the sufficiency strategy that reflects the necessity to transform consumption so that



it is compatible with ecological limits, and (b) behavioral intentions in line with sufficiency. According to the general nature of attitudes [30], sufficiency orientation can be interpreted as a cognitive scheme, which contains evaluative knowledge (e.g., about consumption and production of goods and services), and which influences how people perceive information, feel, and act in situations and towards certain objects (e.g., when shopping). Furthermore, we argue sufficiency orientation to be an attitude that is modifiable over time and activated in dependence of situational contexts. Accordingly, a person with high sufficiency orientation will decide not to buy a particular product in certain consumption situations.

Balderjahn et al. [31] developed the *General Consciousness for Sustainable Consumption Scale* to measure an “intention to consume in a way that enhances the environmental, social, and economic aspects of quality of life” [31] (p. 182). In particular, three sub-dimensions correspond to the sufficiency sustainability strategy: (1) “voluntary simplicity”, defined as the voluntary reduction in resource use in peoples’ everyday life (see also [32,33]); (2) “collaborative consumption”, defined as the shared use of items for the purpose of saving resources (and money, see also [32,34]); and (3) “environmentally friendly consumption”, defined as consumer consciousness for environmentally friendly consumption regarding packaging, recycling, local production, and climate impact. Nevertheless, we argue that Balderjahn et al.’s [31] work does not capture the sufficiency construct in its entirety (it was not designed to do so in the first place). In our opinion, when measuring individual sufficiency orientation, one needs to incorporate attitudes in line with the sufficiency sustainability strategy. Thus, we build on recent work by Verfuether et al. who measure sufficiency orientation as an attitude reflecting a “person’s evaluation of a sufficiency-oriented lifestyle” [25] (p. 375). Former research showed that people who score high on sufficiency orientation actually consume less resources and have lower ecological footprints in several fields of action [25,35,36], such as clothing consumption [37], or in online shopping environments [38].

## 1.2. Sufficiency Orientation and Subjective Well-Being

As O’Neill et al. [27] argue, sufficiency is a strategy that aims to ensure sufficient means for all people to realize a *good life*. In their research, a “good life” is associated with meeting peoples’ basic needs. They argue that sufficiency in resource consumption on national levels as a political strategy is possible without negatively impacting social standards and still maintaining a good life. In line, the Easterlin Paradox [39,40] indicates that subjective well-being (SWB) across nations no longer increases or even decreases with a growing GDP and material well-being after a certain threshold. The same is true at the individual level [41,42]. The degrowth movement argues that less resource consumption, and an economy without growth, would result in human well-being and life satisfaction [43]. As such, sufficiency should be positively associated with SWB. Even though there are no psychological studies to our knowledge that investigate this explicitly, research on individual materialism and perceived well-being may be indicative. Sufficiency orientation, in most cases, means intending less material consumption and an opposition to materialistic values. We, thus, argue that sufficiency orientation can be understood as relatively contrary to materialism. Former studies investigating the relationship between materialism and well-being found materialism to be negatively associated with SWB (see overview [44]), across cultures [45], and over time [46]. Based on these findings and theoretical considerations, we argue that increased sufficiency orientation would similarly be related to SWB. We hypothesized that:

**Hypothesis 1 (H1):** SWB is positively associated with sufficiency orientation.

Please note that we preregistered our hypotheses (<https://aspredicted.org/ye5hs.pdf>, accessed 15 December 2020). However, due to missing power, we combined and simplified some of the former hypotheses. Pre-registered analyses did not reveal any significantly different results. See Supplementary Material S1 for originally planned analyses.

### **1.3. Sufficiency Orientation and Time Affluence**

Recent research argues that time affluence could play a role for sufficiency orientation [16,47]. Time-affluence is the perception that one has enough time to perform the activities one desires to perform [48]. There is mixed evidence regarding the relation of sufficiency orientation and time affluence. Some research argues that the reduction in time spent in traditional work-time-infrastructures causes subjective time affluence, which might have an effect on increased intentions to reduce one's own consumption, resulting in decreased actual resource consumption [49,50]. Given that some sufficiency-oriented activities (e.g., do-it-yourself projects or forms of collaborative consumption, such as sharing and repairing items) become only possible if people take their (free-)time to perform them [51], time affluence should be an important correlate to consider and could change depending on changes in sufficiency orientation. However, the direction of the relation is unclear: Once people do perform such behaviors, they may also perceive a lack of time affluence [52]. Sufficiency-oriented practices (e.g., abstaining from buying unneeded products), however, save time and could contribute to a sense of time affluence [51,53]. Based on these findings, the direction of the relation between time affluence and sufficiency orientation remains unclear. We explored if:

**Hypothesis 2 (H2):** Time affluence is associated with sufficiency orientation.

### **1.4. Sufficiency Orientation and Basic Psychological Need Satisfaction**

Basic psychological need satisfaction may be an important concept to consider when investigating the psychology of sufficiency orientation. While need satisfaction is often considered a consequence of sufficiency, it is also understood to be a source of it [54]. People whose basic psychological needs are satisfied have more psychological resources to cope with challenges, such as climate change, may develop a sufficiency orientation, and in turn create contexts that further satisfy needs [55]. Such a process would be consistent with Self-Determination Theory [55,56], a dialectical, humanistic theory of basic psychological needs and human motivation. It

proposes three innate basic psychological needs as prerequisites for psychological functioning, well-being, and the experience of intrinsic motivation when performing specific actions. First, competence need satisfaction involves experiencing personal mastery in goal attainment and the ability to reach desired outcomes. Second, the basic need for autonomy is satisfied when people feel a sense of choice and volition and are able to act in absence of restrictions and coercion (e.g., hierarchies, time restrictions). Third, relatedness needs are satisfied when people feel meaningfully connected with important others. It is important to note that Deci and Ryan define needs as “innate psychological nutrients that are essential for ongoing psychological growth, integrity, and well-being” [55] (p.3). Basic psychological needs are thus not the same as physiological needs (e.g., for nourishment, such as food or water) or drives. Basic psychological need satisfaction is always a function of the social context: Social contexts can be more or less need-satisfying. At the same time, people shape social contexts depending on their need satisfaction. Thus, need satisfaction and social contexts shape each other reciprocally.

There is evidence for basic psychological need satisfaction to be positively related to pro-environmental behaviors reflective of sufficiency orientation (see [57] for an overview). For example, basic psychological need satisfaction is associated with lower individual environmental impact [58] and increased persistence in difficult ecological behaviors [59,60] in different contexts (e.g., in schools [61–63] or in the family home [64]). Furthermore, need satisfaction predicted intentions for voluntary simplistic sustainable clothing consumption [65] and mediated SWB in voluntary simplifiers [66]. In turn, people who prioritize materialistic values experienced lower levels of need satisfaction and showed less pro-environmental behavior [44]. Furthermore, materialism as a counterpart to sufficiency orientation is associated with basic psychological need frustration [44]. In line with these empirical findings and our theoretical considerations, we expected basic psychological need satisfaction to be associated with increased sufficiency orientation. Therefore, we hypothesized that:

**Hypothesis 3 (H3):** Basic psychological need satisfaction is positively associated with sufficiency orientation.

### **1.5. Sufficiency Orientation and Self-Reflection**

Another factor influencing sufficiency orientation may be self-reflection. Reflection, in general, is a meta-cognitive strategy defined as the profound thought about something. It is relevant for goal-striving and accomplishing goals [67,68]. In self-reflection, the self is an essential, concrete object of thinking; it aims to broaden its own perspectives through new insights, analyses of the self in relation to others and the environment, and often pursues the goal of changing certain behaviors [69]. Self-reflection is key for successful learning [70,71] and is applied in therapy [72] or team work processes [73]. A series of studies has shown that reflection interventions lead to a reduction in materialism: For example, when participants were asked to write short essays about their favorite intrinsic values over a prolonged period of time, they reported reduced materialism and benefits for well-being (i.e., increased positive affect and vitality) [74]. In another study, deep reflection about one's own mortality reduced materialism [75] and people who reflected on what they are grateful for reported less materialistic goals [76]. Kasser [44] concludes that self-reflection may redirect people's focus toward intrinsic values and goals. We argue that critical reflection about one's own consumption goes in line with a reflection about values and ways to live one's life, reducing materialism, as in other studies. Based on these empirical results and theoretical considerations, we expected reflection on one's own consumption to increase sufficiency orientation. Therefore, we hypothesized that:

**Hypothesis 4 (H4):** Self-reflection is positively associated with sufficiency orientation.

### **1.6. Strengthening Self-Reflection and Basic Psychological Need Satisfaction through a Reflective Diary Intervention**

Reflective diaries can induce reflective processes [77,78]. A diary is “a frequently kept, often daily, record of personal experiences and observations in which ongoing thoughts, feelings, and ideas can be expressed” without being observed or judged by someone else [79] (p.204). They are commonly used to investigate psychological processes in everyday situations. They are

common in work and organizational psychology [80], health psychology [81,82], and in particular in professional education science to support self-regulated learning and academic performance [78,83]. Reflective diaries, in particular, differ from log-like diaries, which are highly structured and list factual accounts only. Reflective diaries increase peoples' self-awareness and have an intimate character [79]. Self-reflection during the writing process aids people in identifying potential mismatches between their attitudes, intentions, and behaviors [79]. This process can be helpful for the modification of subsequent behavior [82]. Reid et al. [84] found that keeping a household diary and reflecting over consumption raised awareness for ecological behavior and influenced actual household consumption.

Furthermore, writing a diary and reflecting meets needs for autonomy as people become more aware of themselves and their attitudes and goals, fostering their integration and pursuit [85]. Both Friedman [86] and Ryan and Deci [87] suggest that self-reflection intensifies feelings of autonomy. Self-reflection involves evaluating goals, desires, and values, and endorsing or rejecting them – prerequisites for satisfied autonomy. When self-reflection leads to endorsement of a goal, desire, attitude, or value it becomes a part of the self and can be autonomously pursued. Nevertheless, it is important to note the dialectical nature of need satisfaction. While endorsing attitudes or values is a *necessary pre-requisite* for the satisfaction of autonomy, it is *not always sufficient* for the need for autonomy to be met completely. This may be the case if the social context is need-thwarting, for instance in the face of dependency on others or infrastructural barriers. People who self-reflect also are more likely to experience more autonomy [88,89]. Weinstein et al. [90] suggest that giving people opportunities to self-reflect should promote their satisfaction of the need for autonomy. Thus, reflecting about sufficiency and daily consumption patterns should satisfy the basic psychological need for autonomy.

We argue that self-reflection could also help satisfy the basic psychological need for competence. For example, gaining new insights in one's own behavior and potentially deriving strategies to reduce one's own consumption may ease efforts to consume more sufficiency-oriented, given supportive structural pre-conditions. In fact, some literature suggests that self-

reflection fosters performance and skills, which satisfies needs for competence [91,92]. In line, self-reflection should also satisfy needs for competence, enabling behavior change in favor of increased sufficiency orientation. We hypothesized that:

**Hypothesis 5 (H5):** Self-reflection is associated with basic psychological need satisfaction.

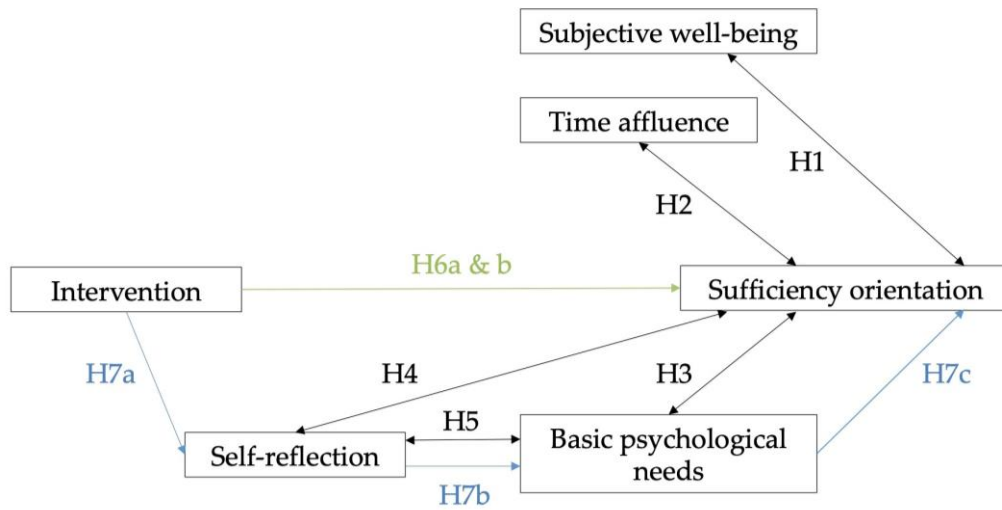
## 1.6. The Present Research

Based on these considerations, we examined whether inducing self-reflection through reflective diary writing meets peoples' needs for autonomy and competence and fosters sufficiency orientation. We assumed that self-reflection meets basic psychological needs, especially for autonomy and competence, and further fosters a sufficiency orientation. To investigate this, we ran a week-long online diary intervention study. We gave people either a reflective or a descriptive task: We asked people either to reflect about their personal experiences about attempting to consume sufficiency-oriented for a week (experimental group, EG) or to merely list what they had consumed each day over the course of a week (control group, CG). We measured short- and medium-term effects of the intervention and investigated the following hypotheses (see Figure 6 for an overview):

**Hypothesis 6 (H6):** Individuals in the one-week reflective diary intervention (EG) show significantly higher sufficiency orientation than individuals in the CG, after one week (H6a) and after four weeks (H6b).

**Hypothesis 7 (H7):** Self-reflection and basic psychological need satisfaction mediate the effect of the intervention: The intervention increases self-reflection in the EG (H7a), which in turn influences basic psychological need satisfaction (H7b) and increases sufficiency orientation (H7c).

Figure 6 Overview of hypotheses



## 2. Materials and Methods

### 2.1. Participants and Procedure

We recruited a convenience sample of  $N = 252$  German individuals to take part in an online diary study using Qualtrics [93]. Participants were invited via social media platforms (pro-environmental mailing lists, e.g., IPU e. V. (Initiative Psychology in Environmental Protection, German: Initiative Psychologie im Umweltschutz); public Facebook groups (e.g., zero waste, Ecosia, Greenpeace; and private social media pages of two of the authors) and offline (posters in public places, e.g., in organic supermarkets). Data collection consisted of five waves, each starting three days apart. This enabled a quick and sequential start of the study for already recruited participants whilst still recruiting new participants. Participation was voluntary and anonymous and in line with ethical guidelines of the Helsinki Declaration. The local ethics committee approved the protocol (LEK-306r). Participants received no monetary compensation for their efforts. We expected that people were attracted by the prospect of receiving support in implementing an ecological lifestyle and by actively contributing to environmental protection. We assumed that only people who were autonomously motivated to change their everyday lives would take part in the study.



After participants gave their informed consent ( $N = 248$ ), we randomly assigned them to either the EG ( $n = 128$ ) or the CG ( $n = 120$ ). Depending on group membership, participants received instructions on what to write in their consumption diaries (see Supplementary Material S3, see Appendix IV). They should either reflect on their daily experiences in consumption situations (EG) or list the goods and resources they consumed during those respective days (CG). Over the course of the six days, both groups received links to their next diary entry, daily at 6 p.m. via e-mail, and asked to write their diary in the evening (see Supplementary Material S3, see Appendix IV). Their written records were exclusively registered online. Sent links only expired after the entry had been made. To keep the dropout rate as low as possible, we sent reminders via e-mail (two days after distribution of respective questionnaires, see Supplementary Material S3, see Appendix IV).

We excluded three people because they did not pass an attention check at T1 and ten outliers (i.e., participants who scored more than 2.5 *SDs* above or below scale mean values, compare pre-registration; for analyses without exclusion of outliers see Supplementary Material S2). Sample size for analysis at T1 was  $N = 223$ . In total, 69 participants did not participate in T2 (27.82% dropout rate). They did not systematically differ from completers on any study variable. We excluded participants that completed less than four diary entries ( $n = 7$ ), did not pass an attention check at T2 ( $n = 2$ ), and were outliers at T2 ( $n = 11$ ). The total sample size at T2 was  $N = 134$  ( $n_{EG} = 65$ ,  $n_{CG} = 69$ ). In total,  $N = 131$  participated in a follow-up assessment (T3) four weeks after T2, answering the same questions as in T1 and T2 (Please note that we decided to conduct the intervention over the course of one week because we wanted people to reflect on both working days and weekends and expected that an effect of the intervention would not be visible after only a few days. Furthermore, we chose a follow-up assessment after four weeks because we judged this as resulting in acceptable attrition rates. A longer time between the end of the intervention and follow-up measurement would have likely resulted in a higher attrition rate. In addition, we were interested if effects would be maintained over longer

periods of time, which is of general interest in intervention studies regarding pro-environmental attitude and behavior changes [95]). There were no differences between completers and non-completers at T3 on any study variables. We excluded one participant who did not pass the attention check and  $n = 6$  outliers. Final sample size at T3 was  $N = 124$  ( $n_{EG} = 65$ ,  $n_{CG} = 59$ , see Supplementary Material S3 for participant flow chart, see Appendix IV, Figure 8). Ages ranged from 16 to 69 ( $M_{T1} = 32.56$ ,  $SD_{T1} = 12.60$ ). Our sample was female-dominated (78%), highly educated (63% had a Bachelor's degree or higher), and indicated left-leaning political orientation ( $M_{T1} = 26.50$ ,  $SD_{T1} = 15.12$ ; see Supplementary Material S1 for demographics at T2 and T3).

## 2.2. Intervention and Material

If not otherwise indicated, participants judged their experiences with reference to the past week. We only phrased items assessing sufficiency orientation as general statements (see Supplementary Materials S3–S5 for complete item list, see also Appendix IV, Table 20).

*Sufficiency orientation* was assessed using 13 items of the belief component of the *Consciousness for Sustainable Consumption Scale* ([31], e.g., “Even if I can financially afford a product, I only buy it if I really need it”). We excluded the social dimension from the complete item list of the original belief component because it did not assess sufficiency orientation as defined in this study (see [31]). For the sake of completeness, we list the respective items in Supplementary Materials S3–S5. Participants answered this part of the sufficiency items on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Furthermore, we used six items by Verfuërth et al. [25] from the *Sufficiency Attitude Scale* (e.g., “All the new things that are sold all the time are a big waste of resources to me”) and seven own items (e.g., “Abstaining from consumption can significantly reduce the extent of global warming”). Participants answered these items on five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree). An exploratory main axis analysis with oblique rotation revealed four dimensions (see Supplementary Material S1 for details) after removing nine items with  $KMO <$

0.65,  $h^2 < 0.2$ , factor loadings  $< 0.3$ , or that were cross-loading: (1) Consumption critique ( $\alpha_{T1-T3} = 0.82 - 0.87$ ); (2) voluntary simplicity ( $\alpha_{T1-T3} = 0.80 - 0.88$ ); (3) collaborative consumption ( $\alpha_{T1-T3} = 0.68 - 0.83$ ); (4) eco-friendly consumption ( $\alpha_{T1-T3} = 0.68 - 0.79$ ).

*SWB* was assessed with the six items of the *Scale of Positive and Negative Experience*, asking participants about various feelings they had experienced over the past week, such as positivity, negativity, or sadness ([96]; German translation: [97]). Participants responded to items on a five-point Likert scale ranging from 1 (very rarely or never) to 5 (very often or always) with good internal consistency ( $\alpha = 0.89 - 0.93$ ).

*Time affluence* was assessed using eight items of the *Material and Time Affluence Scale* ([34], e.g., “My life has been too rushed”) that were partly translated by Neubert and Moser [98] and partly by ourselves. Participants responded to items on a five-point Likert scale ranging from 1 (very rarely or never) to 5 (very often or always). Internal consistency was excellent across all times of measurements ( $\alpha = 0.92 - 0.93$ ).

*Self-reflection* in the context of consumption was assessed with seven items of the *Groningen Reflection Ability Scale* [99] that we adapted and translated for our purpose (e.g., “During the consumption situations of the last week I wanted to know why I do what I do”). Participants responded to items on a seven-point Likert scale, ranging from 1 (very rarely or never) to 5 (very often or always). After exclusion of one item that negatively influenced internal consistency, internal consistency was good at T1 ( $\alpha = 0.80$ ) and acceptable at T3 ( $\alpha = 0.74$ ), but poor at T2 ( $\alpha = 0.51$ , see Supplementary Material S1 for more details).

*Basic psychological need satisfaction* was measured with 15 items of the *Balanced Measure of Psychological Needs Scale* ([100]; German translation: [101]). We adapted the scale to measure satisfaction of the basic psychological needs for autonomy (e.g., “I was free to consume my own way”) and competence (e.g., “When it came to consumption I took on and mastered hard challenges”) in the context of consumption, and used the original scale to measure relatedness need satisfaction (e.g., “I felt a sense of contact with people who care for me, and whom I care for”). We adapted one item by Sheldon et al. [102] to supplement the autonomy

subscale (“My consumption choices were based on my true interests and values”), and adapted one item by Taljaard and Sonnenberg [65] (“I am able to live frugally”) to complement the competence subscale. Participants answered the items on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). An exploratory main axis analysis with oblique rotation revealed the items to cluster slightly differently than expected after removing two items with  $KMO < 0.6$ , and five items with  $h^2 < 0.25$  (see Supplementary Material S1 for details). While the relatedness subscale was retained ( $\alpha_{T1-T3} = 0.83 - 0.85$ ), the other items clustered on need satisfaction ( $\alpha_{T1-T3} = 0.60 - 0.73$ ) and need frustration ( $\alpha_{T1-T3} = 0.72 - 0.78$ ) in the context of consumption, respectively.

*Political Orientation.* As a control variable and for descriptive purposes, we assessed political orientation with one item, using a slider bar ranging from 1 (left-wing) to 101 (right-wing; [103]).

*Intervention.* The aim of the intervention was to encourage participants to reflect about their everyday consumption experiences in order to increase their sufficiency orientation. After all participants completed the first questionnaire, assessing baseline values of the respective study variables, the EG read a short text about sufficiency and its significance. The EG was then encouraged to take a few minutes to remember the situations in which they bought, consumed, or refrained from consuming something over the course of their day. We provided four guiding questions for the purpose of inspiring self-reflection (see [46], e.g., “What did I feel and think today when I consumed something, wanted to consume, or refrained from consuming?”, see Supplementary Material S3 / Appendix IV for complete instructions). Otherwise, we designed the diary in a way that would be as supportive of participant’s autonomy as possible. People in the CG did not receive an information text and got the descriptive task to list everything they had bought, used, and consumed on that respective day. We provided some guiding questions to help respondents to remember consumed items, for example “What material goods have I consumed today? Some examples: Clothing, hygiene products, electronics, etc.?”.

### 3. Results

We analyzed data using the statistical program R, version 4.0.3 [104]. Detailed results, a complete analysis without exclusion of pre-registered outliers, and syntax used to reproduce the analysis can be found in Supplementary Materials S1, S2, and S6 (available online at <https://osf.io/f68nc/>).

#### 3.1. Descriptive Statistics

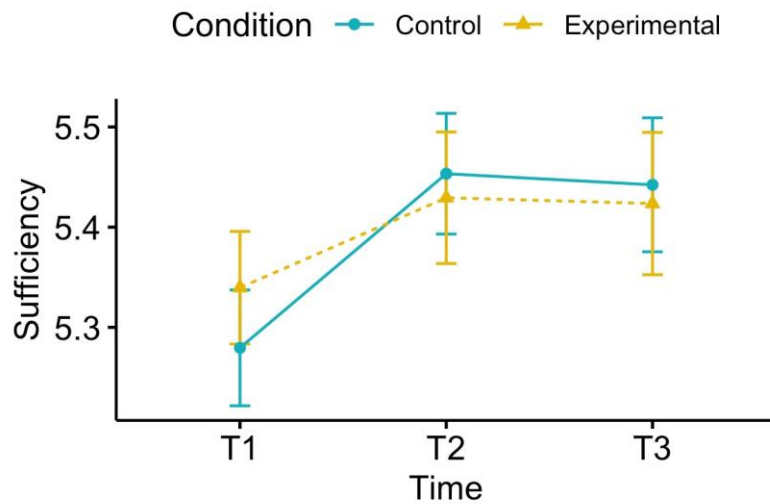
Descriptive statistics of all study variables are displayed in Table 14. Correlations of sufficiency orientation with study variables can be found in Table 15). On average, participants reported high sufficiency orientation, high basic psychological need satisfaction, medium self-reflection, SWB, and time affluence at T1.

#### 3.2. Effect of the Intervention

A series of Welch *t*-Tests revealed that EG and CG did not significantly differ on any study variables at T1 (see Supplementary Material S1). A G\*Power analysis [105] assuming a small to medium effect size of  $f = 0.2$ ,  $1-\beta = 0.80$ , and  $\alpha = 0.05$  suggested that our initial sample was sufficiently large to use mixed ANOVA for testing our assumptions H6a and H6b. Five mixed ANOVAs to test for effects of the intervention (between subject variation), time (within subject variation), and their interaction on sufficiency orientation (overall and subscale mean scores) showed no significant effect of the intervention ( $F[1, 95] = 0.12, p = 0.911$ ) but a significant change in overall mean sufficiency orientation scores over time ( $F[2, 190] = 12.91, p < 0.001, \eta^2 = 0.024$ ). There was no significant interaction between group and time on overall sufficiency orientation ( $F[2, 190] = 0.32, p = 0.725$ ; Figure 7). Pairwise comparisons between time points using *t*-tests with Bonferroni correction, indicated a significant increase for overall sufficiency orientation from T1 ( $M_{CG} = 5.28, SD_{CG} = 0.61; M_{EG} = 5.34, SD_{EG} = 0.59$ ) to T2 ( $M_{CG} = 5.45, SD_{CG} = 0.50; M_{EG} = 5.43, SD_{EG} = 0.53; t[126] = -4.07, p < 0.001, p_{adj} < 0.01, \eta^2 = 0.15$ ) and from T1 to T3 ( $M_{CG} = 5.44, SD_{CG} = 0.51; M_{EG} = 5.44, SD_{EG} = 0.51; t[117] = -3.52, p < 0.001, p_{adj} = 0.002, \eta^2 = 0.09$ ,

see Figure 7). We analyzed subscales with mixed ANOVAs. However, none of the interactions were significant (see Supplementary Material S1). These results do not confirm H6a and H6b.

Figure 7 Mean sufficiency orientation scores (*y*-axis) over three assessment points (*x*-axis) with standard errors for both groups



To test H7a, we ran a mixed ANOVA for effects of the intervention (between subject variation), time (within subject variation), and their interaction on self-reflection scores. This analysis revealed no effect of the intervention ( $F[1, 95] = 0.73, p = 0.394$ ) but a significant change in self-reflection over time ( $F[2, 190] = 117.73, p < 0.001, \eta^2 = 0.356$ ). There was no significant interaction ( $F[2, 190] = 0.16, p = 0.854$ ). Pairwise comparisons, using paired *t*-tests with Bonferroni correction on time points indicated that all comparisons were significant (T1 to T2:  $t[126] = -17.4, p_{\text{adj}} < 0.001, \eta^2 = 0.71$ ; T1 to T3:  $t[117] = -2.73, p_{\text{adj}} = 0.007, \eta^2 = 0.06$ ; and T2 to T3:  $t[100] = 13.4, p_{\text{adj}} < 0.001, \eta^2 = 0.64$ ). Self-reflection mean scores in both groups increased from T1 ( $M_{\text{CG}} = 3.04, SD_{\text{CG}} = 0.71; M_{\text{EG}} = 3.14, SD_{\text{EG}} = 0.74$ ) to T2 ( $M_{\text{CG}} = 4.04, SD_{\text{CG}} = 0.55; M_{\text{EG}} = 4.16, SD_{\text{EG}} = 0.35$ ) and decreased again at T3 ( $M_{\text{CG}} = 3.17, SD_{\text{CG}} = 0.67; M_{\text{EG}} = 3.27, SD_{\text{EG}} = 0.62$ ). This indicates that self-reflection increased across groups and indicates that our manipulation was not specifically successful, contrary to H7a. Furthermore, self-reflection and basic psychological need satisfaction were unrelated at T2, contrary to H5.

Given that the intervention did not influence self-reflection but we assumed it to indirectly influence basic psychological need satisfaction, we also ran three mixed ANOVAs for effects of the intervention (between subject variation), time (within subject variation), and their interaction on basic need satisfaction subscales. Those analyses revealed no effects.

Please note that due to dropout after T1 and T2, we did not have sufficient power to perform mediation analyses. Given that the intervention did not have an effect on sufficiency orientation, we refrained from performing them.

### **3.3. Relations between Sufficiency Orientation, SWB, Time Affluence, Basic Psychological Need Satisfaction, and Self-Reflection**

SWB correlated slightly positively with overall sufficiency orientation, collaborative consumption, and eco-friendly consumption at T2 (see Table 15). Furthermore, SWB correlated with voluntary simplicity across time points (T1:  $r[221] = 0.17$ , 95%CI[-0.01, 0.24],  $p < 0.05$ ; T3:  $r[116] = 0.21$ , 95%CI[0.02, 0.34],  $p < 0.01$ ). Further, SWB at T2 correlated with overall sufficiency orientation at T3 ( $r[99] = 0.27$ , 95%CI[0.07, 0.43],  $p < 0.01$ ) and collaborative consumption at T3 ( $r[99] = 0.28$ , 95%CI[0.04, 0.42],  $p < 0.01$ ), and with voluntary simplicity at T3 ( $r[99] = 0.20$ , 95%CI[0.04, 0.42],  $p < 0.10$ ). These results indicate a trend for positive associations of SWB and sufficiency orientation but only partially confirm H1.

Time affluence and sufficiency orientation did not significantly correlate at T1 and T2 (see Table 15 and Supplementary Material S1). At T3, time affluence correlated with voluntary simplicity ( $r[122] = 0.19$ , 95%CI[-0.02, 0.31],  $p < 0.05$ ), and in tendency with consumption critique ( $r[122] = 0.16$ , 95%CI[0.03, 0.35],  $p < 0.10$ ) and overall sufficiency orientation ( $r[122] = 0.16$ , 95%CI[0.01, 0.34],  $p < 0.10$ ). These findings are in contrast to H2.

Sufficiency orientation and basic psychological need satisfaction in the consumption context showed medium positive correlations across groups. At T1, need satisfaction correlated with overall sufficiency scores ( $r[221] = 0.30$ , 95%CI[0.12, 0.37],  $p < 0.01$ ), consumption critique ( $r[221] = 0.21$ , 95%CI[-0.02, 0.27],  $p < 0.01$ ), voluntary simplicity ( $r[221] = 0.29$ ,

95%CI[.18, 0.41],  $p < 0.01$ ), and collaborative consumption ( $r[221] = 0.14$ , 95%CI[-0.03, 0.22],  $p < 0.05$ ). There was a similar pattern at T2 (see Table 15) and T3 (overall:  $r[122] = 0.28$ , 95%CI[.11, 0.40],  $p < 0.01$ ; consumption critique:  $r[122] = 0.34$ , 95%CI[0.09, 0.41],  $p < 0.01$ ; see Supplementary Material S1). Furthermore, we found a positive correlation between need frustration and eco-friendly consumption at T1 ( $r[221] = 0.14$ , 95%CI[.00, 0.25],  $p < 0.05$ ) and negative correlations between need frustration and overall sufficiency orientation ( $r[122] = -0.12$ , 95%CI[-0.22, 0.11],  $p < 0.10$ ) and consumption critique ( $r[122] = -0.20$ , 95%CI[-0.34, 0.03],  $p < 0.05$ ) at T3. These results are in line with our hypothesis and partially confirm H3.

Self-reflection and sufficiency orientation were unrelated across all time points (see Table 15 and Supplementary Material S1), not confirming H4.

### 3.4. Predicting Sufficiency Orientation

To evaluate the value of potential correlates of sufficiency orientation, we ran exploratory hierarchical regression models, including all study variables as predictors of sufficiency orientation and its subscales on T2 and T3, controlling for gender, age, and political orientation (see Table 16 and Supplementary Material S1). Our sample was sufficiently large for the analysis (required sample size to detect a medium effect of  $f^2 = 0.15$  with  $\alpha = 0.05$  and  $1-\beta = 0.80$  was  $N = 123$ , G\*Power 3, [105]).

After controlling for covariates, basic psychological need satisfaction ( $\beta = 0.32$ ) and SWB ( $\beta = 0.20$ ) were significant predictors of overall sufficiency orientation at T2 ( $F[10, 120] = 4.506$ ,  $p < 0.001$ ). Furthermore, basic psychological need satisfaction significantly predicted consumption critique ( $\beta = 0.22$ ,  $F[10, 120] = 3.246$ ,  $p < 0.001$ ). SWB positively ( $\beta = 0.36$ ,  $p < 0.001$ ) and time affluence negatively ( $\beta = -0.24$ ) predicted collaborative consumption ( $F[10, 120] = 2.343$ ,  $p < 0.05$ ). Analyses predicting voluntary simplicity were not significant ( $\beta = 0.31$ ,  $F[10, 120] = 1.603$ ,  $p = 0.114$ ). These results partially support H1, H2, and H3.



Table 14 *Descriptive statistics of study variables across time points and groups.*

Variable	T1				T2				T3			
	<i>N</i>	<i>M</i> ( <i>SD</i> )	Skewness (Kurtosis)	$\alpha$ [95%CI]	<i>N</i>	<i>M</i> ( <i>SD</i> )	Skewness (Kurtosis)	$\alpha$ [95%CI]	<i>N</i>	<i>M</i> ( <i>SD</i> )	Skewness (Kurtosis)	$\alpha$ [95%CI]
<b>Sufficiency orientation</b>	223	5.31	-0.67	0.79	134	5.44	-0.77	0.75	124	5.43	-0.67	0.78
(overall mean score)		(.60)	(-0.33)	[0.72, 0.81]		(0.51)	(-0.02)	[0.70, 0.79]		(0.54)	(-0.44)	[0.74, 0.82]
Consumption critique	223	4.39	-0.98	0.82	134	4.44	-1.10	0.87	124	4.41	-1.07	0.86
		(0.55)	(0.32)	[0.78, 0.86]		(0.57)	(0.76)	[.84, 0.89]		(0.56)	(0.39)	[0.83, 0.88]
Voluntary simplicity	223	5.90	-1.41	0.83	134	5.99	-2.22	0.88	124	6.15	-2.05	0.80
		(1.17)	(1.09)	[0.89, 0.86]		(1.16)	(5.18)	[0.85, 0.90]		(0.92)	(4.36)	[0.77, 0.84]
Collaborative consumption	223	5.31	-0.92	0.70	134	5.79	-1.42	0.72	124	5.58	-1.25	0.83
		(1.49)	(-0.06)	[0.63, 0.76]		(1.22)	(1.64)	[0.66, 0.78]		(1.53)	(0.87)	[0.79, 0.87]
Eco-friendly consumption	223	6.36	-2.15	0.68	134	6.36	-1.94	0.70	124	6.37	-2.72	0.79
		(0.87)	(5.57)	[0.62, 0.75]		(0.75)	(-5.02)	[0.64, 0.77]		(0.77)	(10.23)	[0.75, 0.84]
Subjective well-being	223	3.68	-0.40	0.91	134	3.77	-0.24	0.89	124	3.72	-0.53	0.93
		(0.63)	(-0.43)	[0.89, 0.93]		(0.56)	(-0.50)	[0.87, 0.91]		(0.66)	(-0.31)	[0.91, 0.94]
Time affluence	223	3.20	-0.03	0.93	134	3.19	-0.22	0.91	124	3.02	0.22	0.92
		(1.00)	(-0.91)	[0.92, 0.94]		(0.89)	(-0.62)	[0.90, 0.93]		(0.92)	(-0.84)	[0.91, 0.94]
Self-reflection	223	3.09	-0.41	0.81	134	4.10	-0.40	0.50	124	3.22	-0.23	0.68
		(0.72)	(-0.61)	[0.77, 0.85]		(0.47)	(-0.22)	[0.39, 0.60]		(0.64)	(-0.67)	[0.74, 0.79]
<b>Basic psychological needs</b>												
Relatedness	223	5.51	-0.81	0.85	134	5.65	-0.74	0.85	124	5.54	-0.60	0.83
satisfaction		(1.12)	(0.07)	[0.81, 0.88]		(1.01)	(0.09)	[0.82, 0.88]		(1.03)	(-0.13)	[0.79, 0.87]
Satisfaction in the	223	4.98	-0.46	0.69	134	5.08	-0.22	0.73	124	4.92	-0.29	0.60
consumption context		(1.04)	(0.03)	[0.62, 0.76]		(0.97)	(-0.47)	[0.67, 0.79]		(0.88)	(0.85)	[0.52, 0.69]
Frustration in the	223	2.23	0.90	0.72	134	2.36	0.68	0.78	124	2.29	0.61	0.72
consumption context		(1.12)	(0.15)	[0.66, 0.78]		(1.15)	(-0.37)	[0.72, 0.83]		(1.08)	(-0.41)	[0.66, 0.79]

Note. We display 95% CIs in brackets. SO = sufficiency orientation. †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

Table 15 Spearman correlations of sufficiency orientation and study variables at T2.

	Overall SO at T1	Overall SO at T3	Subjective well-being	Time affluence	Relatedness satisfaction	Consumption need satisfaction	Consumption need frustration	Self-reflection	Age	Political orientation
Overall sufficiency orientation at T2	0.77 ** [0.67, 0.83]	0.73 ** [0.57, 0.80]	0.16 † [-0.04, 0.36]	-0.02 [-0.18, 0.16]	0.10 [-0.10, 0.26]	0.28 ** [0.13, 0.48]	-0.08 [-0.22, 0.09]	0.15 † [0.03, 0.33]	-0.07 [-0.26, 0.07]	-0.26 ** [-0.44, -0.08]
Consumption critique	0.58 ** [0.41, 0.66]	0.42 ** [0.22, 0.55]	0.01 [-0.19, 0.15]	-0.02 [-0.16, 0.16]	0.16 † [-0.10, 0.24]	0.27 ** [0.04, 0.38]	-0.04 [-0.17, 0.14]	0.05 [-0.08, 0.21]	-0.10 [-0.26, 0.11]	-0.30 ** [-0.50, -0.15]
Voluntary simplicity	0.35 * [0.24, 0.55]	0.38 ** [0.19, 0.56]	0.01 [-0.18, 0.25]	0.13 [-0.03, 0.28]	0.11 [-0.13, 0.19]	0.14 [0.05, 0.43]	0.01 [-0.18, 0.12]	0.05 [-0.08, 0.24]	-0.02 [-0.24, 0.10]	-0.16 † [-0.30, 0.12]
Collaborative consumption	0.46 ** [0.35, 0.61]	0.43 ** [0.24, 0.57]	0.15 † [0.06, 0.41]	-0.12 [-0.30, 0.00]	-0.02 [-0.14, 0.23]	0.10 [-0.11, 0.28]	-0.05 [-0.20, 0.12]	0.09 [-0.04, 0.34]	-0.05 [-0.19, 0.07]	-0.04 [-0.14, 0.15]
Eco-friendly consumption	0.32 ** [0.21, 0.48]	0.39 ** [0.24, 0.56]	0.20* [-0.01, 0.31]	-0.04 [-0.21, 0.11]	0.09 [-0.13, 0.21]	0.16 † [-0.05, 0.35]	-0.08 [-0.23, 0.06]	0.16 † [-0.04, 0.30]	0.05 [-0.18, 0.17]	-0.25 ** [-0.44, -0.12]

Note. We display 95% CIs in brackets. SO = sufficiency orientation. †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

Table 16 Hierarchical multiple regression analyses predicting sufficiency orientation at T2 (after the intervention).

	Overall sufficiency orientation		Consumption critique		Voluntary simplicity		Collaborative consumption		Eco-friendly consumption	
	$\beta$	[95%CI]	$\beta$	[95%CI]	$\beta$	[95%CI]	$\beta$	[95%CI]	$\beta$	[95%CI]
Age	-0.11	[-0.11, -0.10]	-0.03	[-0.03, -0.02]	-0.11	[-0.13, -0.10]	-0.09	[-0.11, -0.08]	0.03	[0.02, 0.04]
Gender (1 = female)	0.15 †	[-0.06, 0.36]	0.22 *	[-0.02, 0.46]	-0.02	[-0.53, 0.48]	0.07	[-0.45, 0.60]	0.15 †	[-0.17, 0.47]
Political orientation	-0.27 **	[-0.27, -0.26]	-0.32***	[-0.33, -0.31]	-0.04	[-0.06, -0.03]	-0.04	[-0.05, -0.02]	-0.34 ***	[-0.35, -0.33]
Basic psychological needs										
Relatedness satisfaction	-0.05	[-0.15, 0.04]	0.04	[-0.06, 0.15]	0.04	[-0.19, 0.27]	-0.16	[-0.40, 0.08]	-0.08	[-0.22, 0.06]
Satisfaction in the consumption context	0.32 ***	[.23, 0.41]	0.22*	[0.11, 0.33]	0.31 **	[.08, 0.53]	0.09	[-0.15, 0.33]	0.06	[-0.08, 0.21]
Frustration in the consumption context	0.06	[-0.02, 0.14]	0.04	[-0.05, 0.13]	0.08	[-0.11, 0.28]	0.03	[-0.17, 0.23]	-0.04	[-0.17, 0.08]
Self-reflection	0.16 †	[-0.03, 0.34]	0.08	[-0.13, 0.30]	0.03	[-0.41, 0.48]	0.13	[-0.33, 0.60]	0.15 †	[-0.13, 0.43]
Time affluence	-0.06	[-0.16, 0.03]	0.02	[-0.09, 0.13]	0.11	[-0.12, 0.34]	-0.24 **	[-0.48, -0.00]	-0.08	[-0.23, 0.06]
Subjective well-being	0.20 *	[.02, 0.37]	-0.06	[-0.26, 0.14]	0.03	[-0.40, 0.46]	0.36 ***	[-0.09, 0.80]	0.18 †	[-0.09, 0.45]
Condition (0 = CG)	-0.05	[-0.22, 0.12]	0.03	[-0.16, 0.23]	-0.10	[-0.51, 0.31]	-0.06	[-0.49, 0.36]	0.07	[-0.19, 0.33]
$R^2$	0.27		0.21		0.12		0.16		0.19	
Adjusted $R^2$	0.21		0.15		0.04		0.09		0.12	
$\Delta R^2$	0.17		0.06		0.11		0.15		0.08	
$\Delta$ Adjusted $R^2$	0.14		0.01		0.06		0.10		0.03	

Note. Displayed are final regression analyses including all controls and predictors measured at T2.  $\Delta R^2$  specifies differences between models including all covariates and predictors, compared to models including only covariates (i.e., age, gender, political orientation);  $n_{t2} = 135$ , †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

## **4. Discussion**

Although sufficiency orientation receives increasing attention within psychology (e.g., [25,37,38]), there is little literature on how to strengthen it using interventions. This paper aimed at (1) investigating the relationship of sufficiency orientation and SWB, time affluence, basic psychological need satisfaction, and self-reflection; and (2) investigating the modifiability of sufficiency orientation using a one-week reflective diary intervention. We found no effect of our intervention on sufficiency orientation but observed sufficiency orientation to increase across groups. Furthermore, the intervention had no effect on self-reflection or basic psychological need satisfaction. Taken together, only basic psychological need satisfaction, SWB, and left-wing political orientation were significant to explain variance in sufficiency orientation. Relationships between sufficiency orientation and time affluence remain unclear. Nevertheless, our results contribute empirical insights about correlates of sufficiency orientation.

### **4.1. Increase in Sufficiency Orientation after Study Participation**

Previous studies argue [67,68,75,106] that keeping a diary should serve as a non-invasive strategy assisting self-reflection and driving attitudinal and behavioral change. However, sufficiency orientation increased from T1 to T2 across groups. Merely listing daily consumption may have been enough to spur reflection in the control group. At first glance, this finding does not fit with the literature on reflection and materialism, which suggests reflection to reduce materialism and increase sufficiency orientation (e.g., [74]). However, recent research investigating effects of a mindfulness-based intervention including reflection about needs and desires found no effects on consumption attitudes and behavior [107]. Similar to our study, this was a longer-term intervention including self-reflective elements. Perhaps such reflective processes need to be more assisted by further strategies that overtly target peoples' consumption intentions and conflicting values, habits, goals, or even infrastructure.

There are several potential explanations of why we did not observe an intervention-specific increase in sufficiency orientation. Our participants already reported high levels of sufficiency orientation at the beginning of the study. The intervention may not have matched their particular phase of goal striving. In a research tradition different than the humanistic approach we follow in this paper, Gollwitzer's *Phase Model of Action* [108,109] suggests that people pass through different action phases when setting and striving for goals, namely the *pre-decisional*, *pre-actional*, *actional*, and *post-actional* phase. In each phase, people solve tasks that are important to reach a certain goal and have corresponding, phase-typical mind-sets (cognitive procedures). According to Gollwitzer [108], people have deliberative mind-sets when choosing between goals and balancing arguments. However, when people have chosen a certain goal to pursue, they enter an implemental mind-set and try to determine how, when, and where to act towards the goal, focusing attention on cues and opportunities to act. People in our sample may already have decided to consume more sufficiency-oriented previous to the study and may, thus, have had an implemental mindset. They may have been attracted to the study because they were potentially struggling with goal completion. However, our intervention might have triggered deliberation and a "why-mindset" instead of pro-active implemental action planning and, thus, may have hindered successful planning (see [110]). When people have made a deliberate decision to change their behavior and have an implemental mindset, other techniques such as the formulation of implementation intentions should be added to reflection, in order to increase successful goal-attainment (see [111,112]). A diary intervention focused on reflection and monitoring one's behavior is potentially more effective in participants that score lower on sufficiency orientation and are in pre-decisional action phases. Tailoring an intervention that both measures peoples' mind-sets and action phases may be most effective and sustainable in strengthening sufficiency orientation.

Furthermore, our intervention may not have been specific and timely enough to encourage reflection only in the intervention group. Contrary to our expectations, self-reflection and sufficiency orientation were less positively and clearly related as predicted. Participation in the

study itself increased people's reported self-reflection, suggesting that both groups engaged in a reflective exercise. In a study by Hussein et al. [113], reflective diaries posed more concrete questions that engaged participants in mindful thinking right at the time of consumption (i.e., when eating). For instance, participants were asked about detailed features of the meal (e.g., smell) and prompted to put themselves in relation to the food they consumed and to reflect on what consuming that food meant for them in that moment. In contrast, our diary reflection was temporarily distant from the actual behavior and inspirational prompts were less specific. Accordingly, sufficiency orientation may be supported using more detailed, specific questions that engage people in reflection right at the time of consumption or immediately afterwards. This would be effective to intervene in habitual consumption, as timely reflection may better capture important salient feelings while consuming, inner conflicts, or ambivalences, and may better influence subsequent decision making (e.g., [114,115]).

Nevertheless, research on materialism has shown unspecific reflection to be successful in reducing materialism (see [44]). This research implies that such reflection interventions should in turn increase sufficiency orientation. One explanation for the ambiguity of our findings with the literature may be that sufficiency orientation and materialism may not be related as we assume throughout this paper and as conceptual research suggests [36,116–118]. One reason might be that contemporary consumerism is more focused on services or areas of consumption that are not directly material (e.g., carbonized mobility practices [24,25] or digitalization [38]). Materialism measures do not necessarily capture these carbon-intensive consumption practices.

#### **4.2. Basic Psychological Need Satisfaction Predicts Sufficiency Orientation**

Given that the underlying mechanisms of previous reflection interventions remain unclear, it may not have been the reflective process per se that was effective in other reflection interventions. One such underlying driver may be the satisfaction of basic psychological needs through

the reflective process. However, self-reflection in this study did not influence basic psychological need satisfaction. Several explanations are possible: Perhaps a simple reflection exercise was not sufficient to influence need satisfaction, which is also influenced by other factors, such as the social context (see [87]). Furthermore, the instrument used to assess self-reflection had questionable psychometric properties [99]. Future studies should employ a reliable and valid measure of self-reflection to investigate its effects.

Nevertheless, basic psychological need satisfaction in the consumption context was an important correlate of sufficiency orientation in our study. This is in line with previous studies showing a positive relationship between basic psychological need satisfaction and pro-environmental behaviors, such as reduced clothing consumption [65] and well-being in voluntary simplifiers [66]. We expected this relation based on the literature on materialism and need frustration [44]. This finding is also in line with the sufficiency literature that argues in favor of infrastructures (e.g., possibility of voluntary working time reduction) that might assist in satisfying basic psychological needs and, thus, support sufficiency orientation and behavior [27,47]. Even though there are sporadic findings on basic psychological need satisfaction and sufficiency-oriented practices, our study is the first to systematically investigate sufficiency orientation as a multifaceted construct in relation to basic psychological need satisfaction. We carefully argue that our study aids in integrating previous findings on individual behaviors into a more encompassing generalizable whole. Based on the relations we found in our study, we believe that it is possible to draw inferences on the relationship of basic psychological need satisfaction with other sufficiency-oriented practices

#### **4.3. Relations between Sufficiency Orientation, SWB, and Time Affluence**

Our study has several strengths compared to previous studies in this field of research but could further be amended methodologically. By using a longitudinal experimental approach, our study contributes knowledge on sufficiency orientation, its psychological correlates, and (potential) modifiability over time. Even if we found small to medium correlations (i.e., the role of

basic psychological need satisfaction) we were not able to detect causal relationships between self-reflection, basic psychological need satisfaction, and sufficiency orientation. As our intervention was not specific enough to detect why sufficiency orientation scores increased independently of group membership, future studies should explore if more elaborated and specific reflections can nevertheless increase sufficiency orientation, and investigate how basic psychological need satisfaction could foster this process. Furthermore, increasing the duration of the intervention and also elaborating longer-term effects should be of interest for future research [79,95,119,120].

We relied on convenience sampling for this study and recruited a highly educated, female sample with high sufficiency orientation at baseline assessment. Due to self-selection, we assume that the sample was relatively autonomously motivated and committed to the study, as reflected in a low attrition rate. To increase external validity, future studies should recruit more varied and larger samples that are more representative of the general population. This would increase power for more advanced statistical analyses, for instance to detect robust mediation effects [121]. Even though participants wrote a diary every day, we analyzed only their self-reported, retrospective perception of the intervention period. Future studies complementing this approach with a qualitative in-depth analysis of diaries as a prospective account of sufficiency orientation, experience sampling, or online shopping histories would offer further methodological improvement.

## **5. Conclusions**

In conclusion, this study shows that sufficiency orientation is a promising concept for a socio-ecologically just future. Sufficiency orientation is positively related to satisfied basic psychological needs, SWB, and left-wing political orientation. However, reflecting about sufficiency and listing consumption were enough to increase sufficiency orientation slightly. However, it is a question for future research to develop more effective interventions taking self-reflective processes into account and testing specific influences. The underlying workings of sufficiency



orientation and different interventions in this field of re-search remain unclear and need to be the subject of future research. Given the positive relation of basic psychological need satisfaction and sufficiency orientation, exploring causal relationships between both seems important to develop effective and practice-relevant interventions. Employing a need-based, humanistic approach to design psychological interventions is in line with the aim of sufficiency to meet every human's basic needs, in a both socially and ecologically just world. Perhaps most importantly, however, is that structural barriers that are hindering sufficiency at the societal level (e.g., lack of time affluence in Western cultures, growth-oriented infrastructures, resource intensive and eco-hostile processing flows) need to be addressed using bold policies and far-reaching societal change to enable individuals to transform their sufficiency orientation in their every-day practices.

**Supplementary Materials:** The following are available online at <https://osf.io/f68nc/>, html-file S1: Complete data analysis; html-file S2: Complete data analysis without exclusion of outliers; Word document S3: Instructions, participant flow chart, and variables – **see Appendix IV**; Excel file S4: Variables (German and English version); Excel file S5: Values (German and English version); Markdown-file S6: Syntax to reproduce analysis; Markdown-file S7: Syntax to reproduce analysis without exclusion of outliers.

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## PART III

### 8 DISCUSSION

Western lifestyles cause overconsumption and socio-ecological crises such as climate change. To limit climate change, strong emission reductions are necessary. Sufficiency orientation pursues the overarching goal to consume less and to reduce resource intensive consumption wherever possible. Five manuscripts targeted the overall research question; can sufficiency orientation contribute to both understanding and driving socio-ecological transformation from a psychological viewpoint and constitute a key for socio-ecological transformation? To answer this, both individual (Manuscripts 2-5) and societal sufficiency orientation (Manuscript 1) were addressed in the studies. The dissertation project integrated qualitative (Manuscript 1) and quantitative (Manuscripts 2-5) approaches, connected sufficiency orientation to important psychological theories from personality research (i.e. justice sensitivity) to pro-environmental and social psychological behaviour research (i.e. Theory of Planned Behaviour, Norm Activation Model, Self-Determination Theory, global identity). Furthermore, the dissertation project investigated important fields of impact-relevant actions, i.e. flying behaviour (Manuscript 4), and plastic consumption as environmental- and risk behaviour for health (Manuscript 2). Moreover, in the dissertation, a justice framing intervention (Manuscript 3) and a reflective diary writing intervention (Manuscript 5) were experimentally tested to increase individual sufficiency orientation. Both were not particularly effective, but each study and manuscript contributed to a wider picture of correlates and potential influences in regard to sufficiency orientation.

In the following, the results of the manuscripts are summarized and their contributions in regard to the research questions (see Chapter 2 and Figure 1 for an overview) of this dissertation project are outlined. Afterwards, theoretical and practical implications as well as overarching limitations of the presented studies are discussed and future research directions are outlined.

## 8.1 Summary of the manuscripts

Table 17 gives an overview of the research questions and findings outlined in the manuscripts. Manuscript 1 took a broader perspective on sufficiency to grasp an overview on keys and barriers for societal change towards a sufficiency orientation whilst embedding it in a system thinking concept (Meadows, 1999). The following manuscripts selected smaller scopes of interest and particular fields of actions but also highlighted the relevance of an interdisciplinary perspective on sufficiency orientation and the linkages to psychological theories such as the Theory of Planned Behaviour, Justice Sensitivity and Self Determination Theory. All studies contributed to the understanding of sufficiency orientation as, (i) psychologically relevant construct to be reliably measured and integrated in behaviour relevant models, and second, (ii) how sufficiency orientation as an attitude towards less consumption could be supported in various forms (i.e. individually, collectively, by specific interventions etc.) in order to lower actual emissions and foster socio-ecological change.

The qualitative interview study (Manuscript 1) analysed experts' opinions on sufficiency orientation and derived a framework of important selected keys and barriers towards societal change. Experts from science, politics and economy ( $N = 21$ ) were interviewed about the definitions of sufficiency versus efficiency and elaborated on several socio-psychological mechanisms that play a role in preventing or supporting change towards sufficiency orientation (see Figure 2, answering RQ<sub>a</sub>). The interviewees further outlined visions of a sufficiency oriented society. We analysed and interpreted the expert interviews in the light of the leverage points approach and developed a framework that can serve as a heuristic for further theoretical considerations, empirical studies as well as practical approaches to foster sufficiency orientations on the micro and the meso level. We also identified three types of discourse patterns that exemplify the ambiguities within the debate on sufficiency as sustainability strategy and opinions that were articulated by the experts in the course of the interviews (i.e. the role of technology, the levels of responsibilities and the perception of societal dynamics towards societal change). Overall, the study highlighted both the potential of sufficiency orientation to be

embedded in a wider systems thinking approach and the connectivity to important psychological concepts, such as values, norms or framing approaches in communication.

The second manuscript ( $N = 648$ ) addressed single usage of plastic usage in terms of plastic packaging in household consumption (i.e. a sufficiency oriented behaviour to refrain from packaged products and decrease plastic usage in general) but also public behaviour (i.e. public behaviour and policy support in regard to plastic production). We analysed the antecedents of behavioural intentions to reduce single-use plastics in the private-sphere (i.e. purchasing of plastic free packaged products) but also in the public-sphere (i.e. participating in activities that encourage industrial production to use less plastics; categorization adopted from Stern, 2000). We investigated the role and predictive power of sufficiency orientation in the field of plastic consumption. Our model of intentions and actions in regard to plastics identified three individual outcome variables: purchase, activism and policy intentions. Each showed different antecedents: perceived behavioural control, personal norms, and attitudes predicted purchase intentions significantly. Thus, rational (i.e. easiness to perform the behaviour, personal evaluation in regard to plastics) and moral cognitive cognitions influenced people's motivation to reduce plastic packaging (the opposite was true in the case of holding a positive attitude towards plastic packaging). Personal norms, attitudes, sufficiency orientation, and collective efficacy significantly predicted activism intentions (such as participating in a demonstration against plastic usage). Similarly, personal norms, sufficiency orientation, and collective efficacy positively predicted policy support intention to restrict plastic usage. Additionally, perceived behavioural control negatively predicted policy support indicating that the lower the perceived behavioural control, the higher the policy support and expressed will for infra-structural change to make less plastic consumption easier for many. In sum, moral obligations are driving people's intentions in both the private and public spheres. By enriching the model (which was combined with well-established variables from Theory of Planned Behaviour and Norm Activation Model), sufficiency orientation contributed to the overall model specification and significantly predicted public sphere behaviour and also actual consumer choice in terms

of a voucher choice. Answering RQ<sub>b</sub>, and partially RQ<sub>d</sub> this indicates an attitude-behaviour consistency by people holding a high sufficiency orientation.

The third manuscript (Study 1:  $N = 123$ , Study 2:  $N = 330$ ) focused on the moral reasoning of sufficiency orientation and explored the potential genesis of the construct and its psychological translation from a justice and personality psychological perspective. In detail, the two studies explored justice sensitivity as personality disposition to potentially drive the development of a sufficiency orientation and whether justice sensitivity could be considered as an important correlate of sufficiency orientation. We analysed each sub-dimension of justice sensitivity in regard to sufficiency orientation. Specifically, we tested if an environmental justice frame can make pro-social justice sensitivity more salient in more justice sensible people and, thus, increase the expression of sufficiency orientation after receiving the respective justice message. Answering RQ<sub>c</sub>, in both studies pro-social dimensions of justice sensitivity (i.e. beneficiary, perpetrator and observer sensitivity) correlated positively with sufficiency orientation whereas victim sensitivity correlated slightly negatively. This indicates that justice sensitivity could be a relevant correlate of an individually held sufficiency orientation. However, we did not find a solid moderator effect of justice sensitivity. The intervention itself was not successful in the hypothesized direction, in contrast, it seemed to activate a tendency of defensive responsibility shift and no increase of sufficiency orientation. We furthermore analysed free market ideology and system justification in terms of ideological barriers towards sufficiency orientation and found negative correlations indicating a contradiction of certain (conservative) political and system-justifying ideologies to sufficiency orientation. This is in line with the identified societal barriers to a socio-ecological change in Manuscript 1, and, thus, partially answering RQ<sub>a</sub>.

In order to focus on the relation between sufficiency orientation and actual high impact behaviour (RQ<sub>a</sub>), Manuscript 4 ( $N = 317$ ) investigated if sufficiency orientation can predict actual CO<sub>2</sub> impact, and may indicate another attitude-behaviour consistency in high impact mobility behaviour (i.e. flying) above concurring indicators of pro-environmental behaviour. In

this study we also addressed global identity and investigated interrelationships between both concepts (RQ<sub>e</sub>). By conducting a survey, we found high sufficiency orientation could actually predict carbon emissions, i.e. the higher the sufficiency orientation the lower the actual flight related carbon emissions (small effect) and the stronger the willingness to refrain from flying (large effect). Furthermore, higher sufficiency orientation is associated with people's approval of policies that decarbonize the mobility system such as banning domestic flights (large effect). This partially answers RQ<sub>a</sub> as this result indicated that participants in our study also agreed to infrastructures that facilitate the easiness to perform sufficiency-oriented actions.

The fifth manuscript ( $N = 252$ ) tested if a reflective diary intervention could increase sufficiency orientation over a short (one-week) or longer term (4 weeks after participation). We found no significant difference between the experimental and the control group but sufficiency orientation increased slightly across both groups. In regard to RQ<sub>f</sub> any kind of reflection on consumption might instigate sufficiency orientation approval on short term but future experimental research is needed to identify concisely which kind of reflection could help to whom and in which situations. We concluded that participation only made people more aware of sufficiency orientation in general and thus slightly increased across groups. Furthermore, basic psychological need satisfaction was the strongest predictor of sufficiency orientation partially answering RQ<sub>f</sub>, i.e. basic psychological need satisfaction could play an essential role in peoples' persistent motivation to consume less. Besides, sufficiency orientation and subjective well-being correlated positively while the role of time affluence remains unclear (also partially answering RQ<sub>a</sub>).

Overall, the experimental studies showed that sufficiency orientation correlates with behavioural intentions that are important for systemic changes such as policy intentions and can predict actual lower consumption. Thus, sufficiency orientation serves as a key towards socio-ecological change. The empirical studies also validated parts of the established framework from the qualitative study, namely the relevance of infrastructural change that make it easier to actually act collectively in a sufficiency oriented manner (again through expressing

political support and public behaviour as found in Manuscript 2 and Manuscript 4). All studies highlight the connectivity of sufficiency orientation to psychological discourses.

Table 17 *Overview of the manuscript contents with key findings*

**Manuscript 1:** Tröger, J. & Reese, G. (2021). Talkin' bout a revolution: an expert interview study exploring barriers and keys to engender change towards societal sufficiency orientation. *Sustainability Science*, 16(3), 827-840.

Scope	Research questions*	Method	Key findings
Sufficiency orientation as a transformative concept, keys and barriers towards change from expert perspectives	RQ1: How does sufficiency and efficiency interrelate? RQ2: Which keys and barriers towards societal sufficiency orientation do experts outline? RQ3: Which further insights can be derived from the interviews that help to understand the concept and its ambiguities?	Qualitative expert interview study ( $N = 21$ )	<ul style="list-style-type: none"> <li>• Sufficiency remains fuzzy in its definitions whilst efficiency has a clearer definition</li> <li>• Barriers: (economic) norms, infrastructures, capacities and path dependencies, strong focus on individuals instead of larger groups and embeddedness in systems</li> <li>• Keys as leverage points: Reward and recognition, narratives, time structures, responsibilities</li> <li>• Framework for transition towards sufficiency orientation is established</li> </ul>

**Manuscript 2:** Heidbreder, L.M., Tröger, J. & Schmitt, M. (in press). Exploring the psychological antecedents of private and public sphere behaviours to reduce household plastic consumption.

Scope	Research questions*	Method	Key findings
Antecedents of private- and public-sphere behaviours regarding plastic packaging, model integration of sufficiency orientation	RQ1: Which types of activities to mitigate plastic pollution can be empirically distinguished? RQ2: Which psychological factors determine public- and private-sphere behavioural intentions and actions? RQ3: Does sufficiency orientation predict intentions and reduction-oriented behaviour?	Online survey, student sample ( $N = 648$ )	<ul style="list-style-type: none"> <li>• Purchasing, activism, and policy support can be distinguished</li> <li>• Personal norms, perceived behavioural control and attitudes predict private-sphere behavioural intentions</li> <li>• Sufficiency orientation significantly predicts activism intentions, policy support and actual behaviour (i.e. voucher choice)</li> </ul>

**Manuscript 3:** Tröger, J., Gaschler, R. & Schmitt, M. (unpublished manuscript). When moral roots and attitudinal shift dissociate – the case of sufficiency orientation.

Scope	Research questions*	Method	Key findings
Interrelations between sufficiency orientation, justice sensitivity, and making environmental injustices salient	RQ1: How does justice sensitivity and sufficiency orientation interrelate? RQ2: Can justice messaging increase sufficiency orientation? RQ3: Can justice sensitivity moderate this effect? RQ4: Which role does system justification and free market ideology play in regard to fostering sufficiency orientation?	Experimental field study, student sample (Study 1: N = 123, Study 2: N = 330)	<ul style="list-style-type: none"> <li>• Pro-social justice sensitivity facets are positively related with sufficiency orientation, victim justice sensitivity is negatively correlated with sufficiency orientation</li> <li>• Justice messaging did not increase sufficiency orientation</li> <li>• Moderating role of justice sensitivity to increase sufficiency orientation remains unclear and needs further empirical testing</li> <li>• Free market ideology and system justification may work as ideological barrier towards sufficiency orientation</li> </ul>

**Manuscript 4:** Loy, L.; Tröger, J., Prior, P. & Reese, G. (2021). Global citizens – global jet setters? The relation between global identity, sufficiency orientation, travelling, and socio-ecological transformation of the mobility system. *Frontiers in Psychology*. 12, 733.

Scope	Research questions*	Method	Key findings
Sufficiency orientation and global identity in regard to flight travel behaviour, refraining from flying and environmental policy support; interrelations between sufficiency orientation and global identity	RQ1: Is sufficiency orientation related to global identity? RQ2: Is sufficiency orientation related to past flight-related CO <sub>2</sub> emissions and refraining from flight travel? RQ3: Is sufficiency orientation related to strong support for policy measures that decarbonise the mobility system?	Online survey, student sample (N = 317)	<ul style="list-style-type: none"> <li>• Global identity and sufficiency orientation are compatible and can contribute to socio-ecological transformation</li> <li>• Stronger sufficiency orientation is associated with less flight-related CO<sub>2</sub> emissions and the willingness to refrain from flying</li> <li>• Stronger sufficiency orientation is associated with support for policies to decarbonize the mobility system</li> </ul>

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**Manuscript 5:** Tröger, J., Wullenkord, M. C., Barthels, C., & Steller, R. (2021). Can reflective diary-writing increase sufficiency-oriented consumption? A longitudinal intervention addressing the role of basic psychological needs, subjective well-being, and time affluence. *Sustainability*, 13(9), 4885.

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Scope	Research questions	Method	Key findings
Testing a diary intervention to increase sufficiency orientation and analysing relationships to psychological need satisfaction, subjective well-being, and time affluence	RQ1: Can reflective diary writing increase sufficiency orientation over short and long term? RQ2: How does basic psychological need satisfaction, subjective well-being and time affluence relate with sufficiency orientation and with regard to the intervention?	Experimental field study, student sample ( $N = 252$ )	<ul style="list-style-type: none"> <li>• Sufficiency orientation increased across groups independently of the intervention</li> <li>• Basic psychological need satisfaction was the strongest predictor of sufficiency orientation</li> <li>• Subjective well-being and sufficiency orientation are positively related</li> <li>• Basic psychological need satisfaction could be an underlying driver of sufficiency orientation</li> </ul>

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*Note.* \*The research questions presented here include further research question that were not overarching research questions as outlined in the introduction section, see chapter 1.3. Furthermore, the numbering does not match the numberings of hypotheses and questions in the respective manuscripts as main questions were selected from the manuscripts in order to give a more comprehensive overview of results from all studies included here.

## 8.2 Theoretical contributions

The following section highlights and discusses a few theoretical contributions that can be derived by the five manuscripts in the light of the overarching research questions (see Chapter 1.3). First, sufficiency orientation can serve as measure to predict behavioural intentions and actual emissions in (impact) relevant fields of action (answering RQ<sub>b</sub>, RQ<sub>d</sub>). Second, the studies show important psychological correlates and potential drivers of sufficiency orientation (answering RQ<sub>a</sub>, RQ<sub>c</sub>, RQ<sub>e</sub>). Third, the presented research provides insights in how and when sufficiency orientation could potentially be promoted (answering RQ<sub>a</sub>, RQ<sub>e</sub>, RQ<sub>f</sub>).

### 8.2.1 Sufficiency orientation as construct and predictor for reduced consumption

Based on the presented studies, sufficiency orientation serves as a reliable and valid measurement that actually predicts lower carbon intensive consumption and behavioural intentions in



regard to plastic consumption and flight travel behaviour. A higher level of sufficiency orientation was associated with higher intentions to protect the environment and to act in accordance to these intentions. It was also related to higher responsibility ascriptions towards important actors in politics (for policy support, see Manuscript 1, 2, 4; for responsibility ascriptions, see Manuscript 3), and actual lower carbon intensive consumption (Manuscript 4). This, in turn, indicates that sufficiency orientation is a measure that is potentially closer to actual behaviour than other pro-environmental attitude or behaviour measures. Therefore, these findings contribute knowledge to the debate on intention-behaviour relations (ElHaffar et al., 2020; Kollmuss & Agyeman, 2002) and the behaviour-impact gap (Csutora, 2012). Furthermore, it is an economic instrument that also contributed to the overall model fit to explain plastic consumption intentions and behaviour (Manuscript 2).

The level of sufficiency orientation was relatively high in all samples investigated throughout the dissertation. On the one hand, this is a common finding in other well-established measures of environmental awareness or identity, where people often show very high levels of agreement but lack corresponding impact-relevant behaviours (e.g. Moser & Kleinhüchelkotten, 2018). On the other hand, we found that sufficiency orientation has a specific explanatory power that other constructs, in turn, such as pro-environmental identity do not bear witness to (ibid.). This was a consistent finding with recent findings on sufficiency orientation (Verfuërth et al., 2019). Consequently, sufficiency orientation may differ in a way from traditional measures: besides measuring a pure pro-environmental attitude it possibly may also measure an implicit control conviction. Specifically, a higher control conviction to actually (want to) perform an appropriate behaviour might be inherent to the present sufficiency orientation measure. Another explanation could be that sufficiency orientation ultimately only targets 'difficult' pro-environmental behaviour (such as refraining from flying or car driving at all). Hence, for people who have a strong underlying intrinsic motivation to protect the environment it is easier to agree to the sufficiency orientation items and more probable to act in accordance to this behaviour (Kaiser et al., 2007, 2010). There is still need for more research

to better understand and further develop the construct of sufficiency orientation also in the light of the criticism towards 'traditionally' constructed measures in environmental psychology (Kaiser et al., 2018). This would also include to better assess and understand possible sub-dimensions of sufficiency orientation and to include this in the instrument. In the presented manuscripts (i.e. Manuscripts 2-4), the sufficiency orientation scale was expanded to investigate a two-dimensional approach while always building on the core items from Verfuërth et al. (2019). The idea was to additionally implement the justice-oriented dimension anchored in the rationale of sufficiency as a broader concept in dealing with the climate crisis (see Manuscript 3). The study presented in Manuscript 4 actually showed that one can distinguish two sub-dimensions, namely low carbon impact and consumption impact, but they were highly intercorrelated and collapsed into a mean score for analysis as also results only slightly differed when analyzed separately. To get a broader picture on facets of sufficiency orientation and to assess it in a more multi-layered manner, we used sufficiency orientation in its traditional version in combination with a formerly developed instrument in Manuscript 5 (i.e. Consciousness for Sustainable Consumption Scale, Balderjahn et al., 2013). Based on exploratory factor analyses, we differentiated four subscales; consumption critique, voluntary simplicity, collaborative consumption, and eco-friendly consumption. Doing this, we found important differences in the correlational structure with regard to the study variables and the regression analyses. For instance, subjective well-being correlated significantly with ecofriendly consumption, but not with all other sub-dimensions highlighting the fact that green consumption might nevertheless contribute to feeling subjectively good – which partially contradicts the debate on sufficiency that proposes feeling good with less and to also refrain from 'compensatory' or symbolic ecological consumption that may cause rebound effects (see for a critical perspective on sufficiency and its potential rebound effects Sorrell et al., 2020). Regression analyses showed that subjective well-being predicted collaborative consumption significantly whilst none of the other three sub dimensions were statistically significant. Of course, this single study with the small sample size cannot serve to derive generalizable interpretations. But due to this multi-

dimensional measurement, fruitful insights were derived to further investigate these facets of sufficiency orientation in detail (see discussion section in Manuscript 5).

Overall, provided that one is not subject to major economic restrictions when doing research on sufficiency orientation, it would be appropriate to investigate a more complex measurement and more facets of sufficiency orientation to develop a valid instrument to complement the classic version by Verfuërth et al. (2019). Within a student project which was connected to this dissertation project, sufficiency orientation was comprehensively conceived with rational (deductive) scale construction and empirically tested (Barthen, 2021). The study revealed strong overlaps with Voluntary Simplicity and Environmental Identity. Discriminant validity of sufficiency orientation was rather unsatisfactory. Therefore, further refinements and investigations are necessary in order to increase specificity and to capture further peculiarities of sufficiency orientation as psychological concept and measurement. In addition, and as already highlighted in the introduction of this dissertation, many related instruments capturing facets of restrained consumption but from different motivation have only recently received an update. Voluntary Simplicity and Minimalism are two famous examples. Therefore, it is important to critically question the contributions of sufficiency orientation and to ask if there are potential lacks in validity (Flake & Fried, 2020). Thus, it would both be necessary to test the instrument itself and ask whether sufficiency orientation in its present measurement can stand up to critical scrutiny by more modern modelling approaches to understand pro-environmental actions: Kaiser and colleagues (2018) emphasize strongly that environmental protection is unidimensionally assessable and specific objectivity can be applied to the measurement of latent attributes. In addition to refine the sufficiency orientation instrument, it would also make sense to expand and update current instruments in this direction (such as the General Ecological Behaviour Scale, Kaiser et al., 2007) and to integrate the idea of sufficiency oriented consumption more strongly (Balderjahn et al., 2013; Ziesemer et al., 2016, 2021) as also to understand the multifaceted motivations of (non)sustainable consumption in a more

complex way (Hüttel et al., 2018). Of course, it is important to be aware of good scientific practices whilst doing so and argue transparently on the findings (Flake & Fried, 2020).

Integrating the results from the presented studies, the empirical findings contribute to further theory building in regard to pro-environmental attitudes and their impact on intentions and behaviour by highlighting a new psychological construct and its connectivity to theoretical and practical questions within the debate on socio-ecological transformation, thus also bridging mere disciplinary discourses. Further, it widens the perspective of classical pro-environmental attitude measurements by integrating a clear stance for less overall consumption and turns away from the efficiency solution.

Additionally, sufficiency orientation seeks to integrate a more recent understanding of human-nature relationships in its measurement by emphasizing a systems-perspective in the field of individual and collective consumption behaviour. At least in theory, sufficiency orientation seeks to integrate a community with nature and the environment and thus to overcome the historically evolved demarcation of boundaries between self and environment. The direct reference to the actor in environmental degradation as the one that has the power to change the system by consuming less is inherent to the concept itself. Things are refused to be bought because one is convinced that one neither needs it nor would it be good for other people or the environment. The interconnectedness between consumption, its effects on people, society and nature alike is intended to be addressed. As outlined above, methodological refinement is needed, however, sufficiency orientation derives from a present discourse in sustainability research, and bridges current multi-disciplinary considerations as a psychological measurement.

### 8.2.2 Sufficiency orientation and important correlates

This chapter particularly discusses three potential correlates of sufficiency in detail as they were identified as systematically related to sufficiency orientation throughout the respective studies, i.e. a) global identity, b) justice sensitivity, and c) political ideologies in terms of policy support and political orientation.

*Global Identity.* Within Manuscript 4 we investigated the compatibility of global identity and sufficiency orientation and their relations with pro-environmental action in the field of travel mobility, i.e. flying and long-distance trips. In our example, we found a positive relationship between sufficiency orientation and global identity – which is good news and partially contradicting to former results on several global identity concepts. Global identity and consumption are intertwined in a complex way. However, there are findings in the literature that argue that global identity is linked to status and luxury consumption (Yang et al., 2018). Flying, for instance, is a luxury for Westernized people (Urry, 2012) and it has symbolic means for many globalized people of the middle and upper class such as academics (Gössling et al., 2019; McDonald et al., 2015; Oswald & Ernst, 2021). In line with Yang et al. (Yang et al., 2018, p. 539), consumption is also a means to strengthen the self and one's own identity (i.e. known as self-verification process) and to portray it. Those who identify themselves as global people will show certain behaviours that maintain this image. “By using luxury products, consumers can emulate lifestyles seen in other cultures and claim their membership of the global community” (Yang et al., 2018, p. 539). It is precisely in the area of such consumption, which strengthens this global identity, that conflicts with genuinely environmentally friendly behaviour. In general, however, the proximity to the global community must be verified with corresponding actions. Mobility around the globe plays a significant role here precisely because changed mobility patterns (bikes instead of cars, refraining from flying) could be a significant environmental protection behaviour. However, for those who want to reaffirm their sense of global identity this, in turn, could be associated with more consumption in mobility and generate severe rebound effects as this behaviour has symbolic significant meaning for them. Such symbolically significant behaviour – for example to strengthen peoples’ global identity – is valued positively and leads people to legitimize other behaviour. This phenomenon has been shown in many other fields of green consumption (Johnson et al., 2018; Sütterlin & Siegrist, 2014). In a further study that examined a very similar concept to global identity, namely “Cosmopolitan Orienta-

tion", Leung et al. (2015) argue both a high significance of this scale in relation to environmental protection but also in regard to travel behaviour as people acquire better knowledge through travel experiences and, thus, realizing impacts of climate change to get an awareness of global interdependence, for instance. Although their findings are in line with ours indicating a uniting core between global identity and sufficiency orientation, there might be two pitfalls in their argumentation: First, they did not measure actual carbon impact of such an cosmopolitan oriented behaviour which might be contradictory to peoples' good intentions (see also Moser & Kleinhüchelkotten, 2018). Second, this line of argumentation can be criticized from a postcolonial perspective as it shifts responsibilities away from those who actually cause climate change through their lifestyles and incorporates climate determinism (Carey, 2012; Mahony & Endfield, 2018). Given these downsides of some global identity and related concepts, future research should analyse in detail different operationalisations of global identity in relation to both sufficiency orientation and actual carbon emission impact.

In the presented study, the positive correlation of global identity with sufficiency orientation may be due to the specific operationalization of the global identity construct (Loy & Reese, 2019; Reese et al., 2015), which captures a strong pro-social and moral component, especially within the global self-investment subscale (i.e. concern for and solidarity with people all over the world). Perhaps this justice considerations act as a common core in both sufficiency orientation and global identity and, in turn, guide to pro-environmental behaviour. Although sufficiency orientation was slightly superior regarding explaining actual behavioural impact and policy support for structural changes towards sustainability. Therefore, it would be necessary to understand roots of both as also compare different concepts of global identity with sufficiency orientation in the future.

*Justice Sensitivity.* Manuscript 3 addressed justice concerns and feelings in regard to sufficiency orientation. Justice sensitivity in terms of a trait was analysed as correlate and potential driver towards sufficiency orientation. Two studies in Manuscript 3 highlight relation-

ships between prosocial dimensions of justice sensitivity (observer, beneficiary and perpetrator sensitivity) and sufficiency orientation, i.e. higher levels of prosocial justice sensitivity are potentially related to increased sufficiency orientation. This fits into research on justice sensitivity (Baumert & Schmitt, 2016) indicating that justice related knowledge is more easily available for people with high pro-social justice sensitivity (Baumert et al., 2011) and increased concerns for others (Thomas et al., 2011) that might yet suffer from climate crises which fits to the concept of sufficiency. This finding is also in line with the many research on justice concerns and fairness perceptions as drivers for sustainability (for an overview see Clayton et al., 2016). The higher correlations (with small to medium effect sizes) with the pro-social dimensions of justice sensitivity found in the present research correspond to numerous research findings that relate pro-environmental behaviour to moral cognitions and emotions anchored in the item wordings of the single dimensions of justice sensitivity: for example, worrying and ruminating about injustices from an observer perspective (see Bouman et al., 2020, on worry and climate protective action) and feeling guilty or ashamed when being a perpetrator or beneficiary of an injustice (see for instance Rees et al., 2015, on guilt and negative emotions and their mobilizing effects for pro-environmental protection). Experienced guilt, in particular, was recently validated to have strong effects on pro environmental behaviour (see for a meta-analysis Shipley & van Riper, 2022) and play a crucial role in each of the pro-social dimensions of justice sensitivity. Also feeling anger und responsibility serves to activate climate protective behaviour (Reese & Jacob, 2015) – which, however, is only explicitly embedded in the item formulation of victim sensitivity, and (in alignment with our hypotheses) was uncorrelated to sufficiency orientation in our study.

Justice sensitivity from an observer perspective can be motivating for political protest (Rothmund et al., 2014) and, thus, it is probable that also justice sensitive people would support pro-environmental policies that incorporate sufficiency principles (e.g. bans, restricted behaviour, carbon limits) – which was shown to be another correlate with sufficiency orienta-

tion throughout the dissertation. However, causality remains unclear, as the framing experiment was ineffective in regard to heightened perceived individual responsibility to act against climate change and to increase sufficiency orientation in the short run. Thus, the role of justice sensitivity to actively engage people in consuming less or protecting the climate remains a question for future research. When investigating this, one may dive deeper in the nuances of emotional reactions in the face of the climate crises and in regard to the single dimensions of justice sensitivity. For instance, it was found that the process of perspective taking and empathic concern was found to be a functional, controlled cognitive process that partially crystallizes in pro-social justice sensitivity facets (Decety & Yoder, 2016). Whereas, feeling personal distress may result in more egoistic motivations and this may be detrimental to empathic concern (ibid.). However, when looking at the item wordings of justice sensitivity facets, e.g. observer sensitivity, one can argue that some facets would potentially imply the danger of cognitive functional impairment if sensitivity feelings are very intensive such as feeling upset or ruminating for a long time about the (observed) injustice, for instance. However, this can potentially have negative effects on action initiation in the context of such a major stressor as climate change. Recent research in the context of 'Climate Anxiety' explores precisely these different nuances of emotional reactions in dealing with climate change (Clayton et al., 2016; Stanley et al., 2021; Wullenkord et al., 2021). Feeling powerless and overwhelmed by the climate crisis, can prevent actions and rather lead to depression or increased climate anxiety (Stanley et al., 2021). This might be also related to shifting of responsibilities to particular actors but a hesitation to act individually. Thus, mere justice information provision and a heightened sensitivity towards injustices as we did test in our study does not immediately lead to an increase of sufficiency orientation or actions but also perhaps to reactance and defence mechanisms (Kapeller & Jäger, 2020). On the one hand, sensitivity to (in-)justices possibly serves for general awareness of injustices in regard to climate change but not immediately to intentional shifts or action initiation as we formerly predicted in our study. In contrast, emotional reactions need to be functional incorporating agentic processes and regulation by conscious concerns (Blasi,



1999) – that might be the case when people feel hope which was found to manage fear and worry in the light of climate crises (Kleres & Wettergren, 2017; Ojala, 2015). Future research, thus, should explore the interrelations between justice sensitivity and sufficiency orientation respecting for different cognitive emotional reactions in the face of socio-ecological injustices in more detail.

*Political Ideologies.* Furthermore, sufficiency was related with left wing political orientation and the support of climate policies in the presented quantitative studies. This corresponds to the findings of the qualitative study in which the role of infrastructures and situations that favour environmentally unfriendly behaviour through defaults was assessed as a major barrier towards transformation. Studies in Manuscripts 2, 4 and 5 showed that sufficiency orientation is related to the support of progressive climate protection measures through policy regulations (see for an overview of social-psychological factors and climate change perception on policy support Drews & van den Bergh, 2016). Pro-environmentalism, climate risk perception, knowledge about man-made climate change are some commonly found correlates for environmental policy support (ibid). In particular, results presented in Manuscript 5 highlight that collaborative consumption and voluntary simplicity are less related to political orientation than both sub dimensions 'consumption critique' and 'environmentally friendly consumption'. Indeed, consumption critique measures people's approval to consumption behaviour itself as being harmful to the environment. In turn, this human-environment related cognitions are related to a political ideology that seek to protect the environment and can be located in the liberal-/left-wing political spectrum (e.g. McCright et al., 2016). Similarly, high consent to environmentally friendly consumption justifies certain consumption of products that are compatible to ecological business standards and which are discussed in the public left-wing pro environmental debate. Legitimising the consumption of these products highlights peoples' pro-environmental identities and values alike that partially overlap with sufficiency orientation. Such a 'green consumption' is particularly anchored in a left-liberal political spectrum (Watkins et al., 2016) and in contrast, regulation of consumption is rejected in the conservative

spectrum (e.g. Irmak et al., 2020, give recent experimental findings that such kind of regulations are aversive for conservatives). However, in concept, sufficiency-oriented people would partially reject mere self- and status-enhancing green consumption (e.g. Griskevicius et al., 2010) being aware of potential rebound effects, for instance. But as recent research shows, sufficiency also come along with potential negative spillover (Sorrell et al., 2020) and perhaps are apparent in a correlations of green consumption with sufficiency orientation. In contrast, collaborative consumption and voluntary simplicity seems to be (still) less politicised dimensions of sufficiency orientation and not related to a strong political ideology – which is good news for communication and practical approaches as people could potentially agree to this part of sufficiency orientation more independently of their political orientation. If so, this would make it much more easier for practical approaches to address sufficiency orientation in ideological diverse target groups. It may also reflect, that sharing certain consumer goods is not so strongly intertwined with the ideological divide on climate change and which might be good news for policy acceptance across the political spectrum and socioeconomic variables on sharing economy, for instance (see Ballew et al., 2020). However, future research needs to investigate this relationship between facets of sufficiency orientation, political support and political ideologies.

*Subjective well-being, psychological need satisfaction, time affluence.* As outlined in Manuscript 5, subjective well-being and basic psychological need satisfaction positively correlated with sufficiency orientation which fits in current streams of research that find positive relationships between reduced acquisition, less materialistic but more simplistic, decluttered way of life and well-being (Chamberlin & Callmer, 2021; Dittmar et al., 2014; Rich et al., 2017; Seegebarth et al., 2016; Taljaard & Sonnenberg, 2019). This finding maps also to a current meta-analysis on well-being and pro-environmental behaviour that they are robustly positively associated (Zawadzki et al., 2020). In contrast, findings on the relationship between sufficiency orientation and time affluence were mixed. This is astonishing since both the experts (i.e. time infrastructures, see Manuscript 1) and the current research propagate time affluence

as very promising for sustainable consumption and changed consumption practices (Geiger et al., 2021; Kasser & Sheldon, 2009; Manolis & Roberts, 2012; Reisch, 2001). Further current debates in politics and society highlight the potential influence of voluntary working hour reductions and changed time infrastructures (e.g. introducing a general basic income) to serve for people and the planet (Bader et al., 2020; Ketterer, 2019; Nässén & Larsson, 2015). However, time affluence is a rather complex phenomenon, which is confounded to well-being and satisfaction of basic psychological needs, which we measured and but perhaps with methodological shortcomings. In a study by Kasser and Sheldon (2009), the influence of time affluence on well-being was mediated by the satisfaction of basic psychological needs. Future studies, thus, need to clarify the role of time affluence as a correlate, cause and/or consequence of sufficiency orientation (Geiger et al., 2021).

There are currently few efforts to develop new indicators that measure societal well-being as important drivers towards sustainability and could substitute traditional measurements of societal affluence such as the GDP (e.g. Burchardt & Ickler, 2021). Therefore, studying time affluence and well-being in regard to individual and collective sufficiency orientation would be very important to further develop such indicators and ground their applicability on consistent scientific findings.

To sum up, global identity, justice sensitivity and political ideologies were important correlates in our studies. Furthermore, subjective well-being, time affluence and basic psychological needs should be further investigated in light of sufficiency orientation. It is important to investigate causal relationships between each of the mentioned correlates and sufficiency orientation in order to explore what drives sufficiency orientation and which are potential negative or positive spill-over effects. This is essential to better understand sufficiency orientation as psychological concept, its measurement and part of a low-impact lifestyle.

### 8.2.3 How to promote sufficiency orientation?

In Manuscript 1 several barriers and keys for transformation towards a sufficiency oriented society were outlined based on expert interviews. The derived framework (see Figure 2) gives also a first idea of potential approaches to promote sufficiency when tackling the particular barriers and uptake the respective keys for change, such creating a new narrative by various forms of communication about sufficiency orientation or recreating more default options that favour sufficiency orientation by rebuilding infrastructures (see also section 8.3.2 on practical implications on the meso-level). As this framework nevertheless remains very abstract and explorative, the presented empirical studies tested two approaches that can be located in the communication-context, which was argued as both a barrier and - if reconfigured in terms of building a positive and gain oriented frame – a key for change by the experts. The first one tested a justice framing intervention (see Manuscript 3); the second one tested reflective processes about consumption (see Manuscript 5) that are also instigated by certain communication tools and interfering with people in their everyday life. This second intervention was tested to further understand underlying mechanisms that could be helpful in later communication approaches to promote sufficiency orientation. However, both were not effective in increasing sufficiency according to the respective hypotheses. In contrast, the justice frame increased reluctance in attributing actions for climate protection to the civic society (oneself included) and did not increase individual sufficiency orientation. Thus, one may conclude that justice frames are not appropriate instruments to promote sufficiency orientation. However, and in line with current research, experts in study 1 argue in favour of several communication approaches such as framing (see, for instance, Nisbet, 2009) and narratives (see, for instance, Fløttum & Gjerstad, 2017) to have a significant impact towards societal change and sufficiency orientation when embedding them in positive and more gain-oriented manner, i.e. highlight positive consequences as a goal when engaging in climate protection, for instance, by consuming less (e.g. Bilandzic et al., 2017; Spence & Pidgeon, 2010, on goal framing in regard to climate

change). In other words, sufficiency orientation should be communicated in a sense of positivity, supportive to intrinsic values and outlining a gain for both the individual and the society if behaving in line with sufficiency principles. In the framing experiment, however, there was not such a particular goal oriented “gain frame” established but only information about social injustices due to climate change and alarming information was given to the participants. These types of frames, which are threatening and anxiety-inducing and less effective in terms of action orientation (e.g. O’Neill & Nicholson-Cole, 2009), but widespread in the public climate change discourse (Jackson, 2015; Schäfer & O’Neill, 2017) and can lead to potential desensitisation of risk perception (Bloodhart et al., 2019; Miles-Novelo & Anderson, 2020). In order to bring about sufficiency and corresponding attitude changes, the justice frame possibly included too few activating and positive gain-oriented elements, which would contribute to its success in messaging (e.g. Spence & Pidgeon, 2010). Indeed, a recent laboratory study found communicating sufficiency orientation in an online setting successfully increased attrition scores to sufficiency and consumption of new products less attractive (Frick et al., 2021). Outside the lab and, similarly to our study in Manuscript 5, Frick et al. (2021) also found a mere exposure effect. However, they identified the activation of self-transcendent values as key mechanism towards increased sufficiency orientation that can be enrolled in course of such an unobtrusive communication intervention (Frick et al., 2021; Geiger & Keller, 2018; Lindenberg & Steg, 2007). A central mechanism that is related to the influence of values in consumption setting is the role of autonomy satisfaction that can be enrolled through these communication elements. In the context of self-determination theory, the experience of autonomy is a basic psychological need (Deci & Ryan, 2000). If this need is satisfied, people can act in a self-determined way and according to their own values (see Manuscript 5 for details). If a frame and communication approach mainly focus the moral imperative to reduce consumption (as is often the case in the sustainability and sufficiency discourse and was mainly addressed in the presented justice intervention, see Manuscript 3), the need for autonomy may be frustrated

and, thus, preventing openness for the message itself and undermining intrinsic self-determined motivation. When communicating need-satisfying aspects of sufficiency-oriented practice, for instance, aspects of individual well-being and time affluence through less material consumption (see for instance Hüppauff et al., 2021; Isham et al., 2019) together with the moral necessity of reducing consumption for socio-ecological justice, it is more probable to induce intention changes and trigger value-congruent behaviours. In the context of the Covid-19 crisis, it was shown that structured, caring and autonomy-enhancing communication could predict compliance in governmental rules and voluntary actions to protect themselves and others (Martela et al., 2021). Frick et al. (2020, 2021) argue, that potentially engaging in consumption at the right place and time point is important to increase awareness and openness towards sufficiency, in particular, in such situations where people are seduced to consume based on their hedonic motives (short term, self-interest motives) but are cleverly instigated to reflect their (perhaps concurring) personal values.

Accordingly, value based approaches and linking intrinsic values such as personal fulfilment or a sense of community in the communication of sufficiency as concept would be important to investigate in order to detect potential long-term and broader societal changes towards sufficiency orientation. This, however, implies a partial contradiction to results from the qualitative study as mere goal frames could also trigger materialism and self-centred motives in the longer term (Burroughs & Rindfleisch, 2002; Lindenberg & Steg, 2007). Thus, when pro-sufficiency frames are intentionally established, actors in the field of communication (e.g. journalists, politicians, press release department of a company) might be cautious. Goals can be manifold for the actor itself and in regard to the target. They could be ego-centred but also good for the community alike - but often they are at odds, in particular when addressing companies that, in the end, need to sell products. Encouraging positive attitudes towards companies who engage in more sufficiency-oriented consumption could potentially increase their reputation and credibility (Frick et al., 2021; Ramirez et al., 2017; Reich & Soule, 2016). Future research should, thus, examine more detailed which kind of goals can be effectively linked to each other

for which target groups in order to prevent negative long-term effects of simple communication approaches (see for a review on the the relationship between various goals and materialism Kasser, 2016).

Within Manuscript 5 we investigated how induced self-reflection can play a role in changing consumption patterns as highlighted by prior research (see for instance Lekes et al., 2012, and Manuscript 5 for details). However, the setup of the intervention was not successful in our sample. Independently of the group assignment, people showed increased levels of sufficiency orientation after the one-week reflective diary intervention – which is not bad news at all. A probable explanation may be due to the fact that any kind of confrontation with one's own consumption that happened apparently in both experimental conditions, intrinsic values were activated and, thus, a short-term effect emerged in both groups. Hence, repeated as also subtle exposure in particular consumption situations that instigate people to reflect on their consumption would be potentially effective. Future research can approach this and analyse different influences of more or less subtly induced reflection tasks and evaluate appropriate behaviour changes.

Even more interesting in regard to a society wide and more systematic promotion of sufficiency orientation is the finding in regard to the satisfaction of basic psychological needs as this was the strongest predictor of sufficiency orientation in the reflective diary study. The more the participants reported that their basic psychological needs were satisfied when trying to consume sufficiency oriented, the more sufficiency orientation (especially consumption critique and voluntary simplicity) they indeed reported. This is in line with recent findings on voluntary simplicity (Rich et al., 2017) and minimalist lifestyles (Hook et al., 2021). Less materialism and simpler lifestyles tend to be associated with an increase in individual happiness and life-satisfaction. On an individual level, causal relationships were already found (Dittmar et al., 2014). Furthermore, this approach is supported by current efforts to develop differentiated measures of societal well-being and progress in the context transformation (Burchardt & Ickler, 2021; Giannetti et al., 2015). In order to provide justification for alternative approaches,

it is highly relevant to further explore these relationships in various fields of consumption and practice. Individual well-being, which is related to time well-being and need satisfaction, are key concepts for understanding and promoting sufficiency orientation at the individual and societal level.

In the light of the findings from the interview study, a wider and narrative oriented perspective of communication would be important in order to stepwise change consumer cultures and tackle mental infrastructures in terms of collective beliefs and positive visions within society (Fløttum & Gjerstad, 2017). However, to improve peoples' well-being and feelings of time affluence - concepts that were also mentioned by the experts - communication would not suffice at all to increase sufficiency orientation and engender a socio-ecological transformation. Material or "materialised" infrastructures of these alternative or changed belief systems are also necessary and identified as driver towards transformation. We were not able to systematically investigate these in the present project as it is also a question of more interdisciplinary perspectives integrating social science, economics and political science to evaluate the effects on a broader sense, for instance, to investigate if building up a new pop-up bike line actually boost sufficiency oriented behaviour and peoples' or communities well-being (e.g. Kraus & Koch, 2021, on the effects of infrastructural changes during Covid-19). Furthermore, research on the potential effects of basic income and working time reduction, that is associated to time- and resource infrastructural changes and argued to have a leveraging effect towards reduced consumption, will be promising (Antal et al., 2020; Bader et al., 2020; Knight et al., 2013; Näsén & Larsson, 2015).

To sum up, we are currently in the middle of a window of opportunity in which infrastructures (at least temporarily) worldwide have changed and still change due to the Covid-19 pandemic. People all over the world adapt their lifestyles due to severe contact restrictions, work in home office, or restricted mobility (Le Quéré et al., 2020). Many researchers already investigated whether these adaptations contribute to quality of life and ecological behaviour



(Botzen et al., 2021; Pileggi, 2021). Sadly, it increases many societal injustices instead of decreasing them (Sultana, 2021) and capacities to transform or adjust one's own lifestyle is bound to socio-economic conditions, e.g. in regard to food consumption practises (Hoolohan et al., 2022). Thus, it is necessary to look at long-term effects of promoting sufficiency orientation on individual and other levels in society. Furthermore, a major theoretical problem is how to establish truly sufficiency-oriented structures in a growth-oriented system and outline long-term perspectives for different actors within the system to establish a just one (e.g. Dengler & Lang, 2022, on care work in a degrowth-oriented economy). As outlined in Manuscript 1, economic norms and profit maximisation within the capitalist growth-oriented paradigm are a central barrier to sufficiency orientation on a societal level (Hickel, 2019; Hickel & Kallis, 2020). What kind of growth is perhaps still needed (at least for a transitional period) and what kind of growth in the economic system needs to be transformed rapidly is still an open question in a diverse debate of alternative economic concepts (van den Bergh & Kallis, 2012). Many degrowth approaches remain vague in their long-term design of a globalised economy on a highly digitised and interconnected planet (Albert, 2020). Although the idea of decoupling economic growth (in the sense of GDP) and resource consumption is still considered obsolete by many political economists (Vadén et al., 2020; Ward et al., 2016), it is also important to develop, investigate and evaluate much more concrete policy-perspectives, for alternative economic models (see van den Bergh, 2020, on circular economy). Therefore, there is an urgent need to include sufficiency perspectives in economic models and analyses (e.g. Millward-Hopkins et al., 2020), that are both communicable to important actors and exemplifying more detailed what sufficiency (orientation) exactly means for the various actors and what it actually leads to in terms of economic processes and outputs.

### 8.3 Practical implications

Apart from theoretical contributions, this dissertation would also like to contribute to socio-ecological transformation by increasing knowledge on how to actually embed sufficiency orientation more broadly on different levels of society to reduce carbon emissions and to enable a liveable future. Thus, multi-level responses are necessary and different actors have to pull together in order to realize transformation in an intended way and being overwhelmed by disruption or disaster. The multi-level perspective (Geels & Schot, 2007), which was already addressed in Manuscript 4 in more detail, offers a systems oriented approach with three analytical levels that will also be used to discuss some practical implications for various actors derived from the presented studies. This, however, is an interpretative step, which cannot be exhaustive at all, but should give first implementable ideas for actors and stakeholders in different fields of the society. Implications outlined in the following can be understood as first ideas that should be further explored and developed by future research and practical projects alike. Furthermore, arguing with the multi-level perspective: simple causality does not lead to transition – change is a multi-actor and multi-level process. It is always a question of power and agency within each of the systems and subsystems that should be kept in mind when considering the following implications.

#### 8.3.1 Micro level: individuals and niches

The present research in the first place addressed individuals and smaller groups of people that are already sufficiency-oriented or at least open towards a potential increase in sufficiency orientation. According to the multi-level perspective, these individuals and smaller groups of people constitute the core of radical innovations as they can build so-called niches in terms of small systems where innovations emerge and constituting a necessary first step for transition of socio-technical systems (Geels, 2011). Supporting this niche-building and stepwise emergence as they build vehicles of change is one important step in regard to implications. Further, focusing and supporting important niche actors, i.e. people that have a specific power within those

groups, would be of relevance as well. Niche actors can be very various, e.g. single individuals with their peers, entrepreneurs, start-ups or spin-offs that work on innovations somehow deviating from existing regimes. These niche actors, by definition, share a certain hope that their novelties diffuse into society, are used by the regime or even have the power to replace (parts of) the regime. They share the belief that their novelties build a soil for the idea itself or for innovations to grow further within society (Geels, 2011).

On the individual level, one can stimulate the consumer itself by giving them a concrete opportunity to enact their pro-sufficiency attitudes by opening or intervening in so-called “windows of opportunity” (Schäfer et al., 2012). This was tested in regard to plastic consumption during Lent and was indeed effective to reconfigure habitual behaviour (Heidbreder et al., 2020). This idea can be applied in various forms and target behaviours that are in line with sufficiency orientation such as giving up meat consumption and changing dietary patterns. The 'veganuary campaign', for instance, successfully questions people's habitual behaviours and shows that well-being increased in people taking the 'veganuary pledge' (Díaz et al., 2021). This finding corresponds to findings in Manuscript 5 that an actively agreed interruption and reflection about one's own consumption could support temporary shifts if there is an appropriate opportunity to reconfigure it. Furthermore, engaging people in formulating concrete plans about when, where and how to implement an appropriate sufficiency oriented behaviour is a successful tool to guide people towards their goals (see Gollwitzer & Oettingen, 2011, on theory and role of implementation intentions in successful goal attainment). Although sufficiency orientation indicated a superiority in regard to actual performance in predicting actual behaviour (see Manuscript 4), it is valuable to support people in "if-then planning" and aiming to partially automatize goal-enactment in critical consumption situations, for instance (Rees et al., 2018). Additionally, also groups can formulate such if-then goals and, thus, enhance collective goal striving and goal achievement (Thürmer et al., 2017). In line with this research, sufficiency-oriented actions can be potentially fostered by such if-then planning, and groups can commit themselves to sufficiency orientation and goals by applying this tool in their everyday

or business life (e.g. when strategically planning by which means of transport business trips should be made in the future).

Given the results from the presented studies, one approach could also be to empower individuals and groups to hold and share their already existing levels of sufficiency orientation which was evident across all empirical studies and support them in realizing their goals more straightforward. All samples explored in this research shared a comparatively high value of sufficiency orientation. Thus, they need more opportunities to enact according to their attitudinal stance and actually refrain from high impact consumption in concrete situations. Only recently, a comprehensive coaching programme to empower student sustainability initiatives in their work increased collective efficacy beliefs and participative efficacy in the trainees as also their action and collaborative skills, visionary competence and group identification (Hamann et al., 2021). According to the authors, the coaching programme supported people to organise as groups and also guided to increased protesting and volunteering. This, in accordance to the multi-level approach strengthens niche development and could be applied in contexts where sufficiency orientation and action should grow up further. By focusing on empowerment, an in-group identity (i.e. to be a sufficiency oriented consumer) would be strengthened and it is highly probable that people within the group act in accordance to the group norm. Boosting sufficiency orientation in practice, would also be effective by targeting peoples' group identities. For instance the “no-fly-climate-scientists”-initiative (Kalmus, 2017) targets at least two identities: the scientist-professional one but also the green-/pro-environmental identity. By such an initiative, these two identities should get closer together and close the awareness-action gap in particular groups of people (Whitmarsh et al., 2020; Whitmarsh & O’Neill, 2010).

According to Geels (2011, p. 28) niche development needs an “articulation (and adjustment) of expectations or visions, which provide guidance to the innovation activities, and aim to attract attention and funding from external actors.” Thus, to strengthen niche development many further opportunities are possible: research funds, real laboratories (Schäpke et al., 2015) and places where sufficiency can be probed and further developed as concept and in

practise, for instance, in community gardening projects (Questaed et al., 2018). In line with expert interviews and the notion that current infrastructures prevent from sufficiency oriented lifestyles, people need opportunities (without costs) to actually test how sufficiency would look and feel like in their private lives and how it would change certain spaces within the community. As outlined in Manuscript 5, the role of basic psychological needs as fundamental drivers for actions comes into play in such situations as well. For example, when people experience that a community garden can increase individual and community well-being (Questaed et al., 2018) and can be a place where sufficiency lifestyles can be tested, this would further stimulate niches to grow, which is an essential part of a transition process.

Many networks that incorporate ideas of sufficiency already gained popularity over the past years, e.g. the 'Laboratory for new economic ideas' (Konzeptwerk neue Ökonomie, 2021), the Degrowth network (Degrowth.info, n.d.). Also more loosely connected research networks with a focus on sufficiency were successfully established (see for an overview of sufficiency research initiatives in Germany, Eichhorn et al., 2019; see also the European 'ENOUGH' project, Toulouse et al., n.d.). These institutionalised platforms also give people from diverse (research) backgrounds the chance to contribute their perspectives and work. Such initiatives would further contribute to give sufficiency orientation a voice and open the debate across borders, increase an identity between the people that engage in these projects and their efficacy expectations. According to the multi-level approach this would change parts of the regime incrementally (Fritsche et al., 2018; Reese et al., 2020). Hence, practical approaches can further establish such networks and focus on engaging people to actively participate and collaborate with other people. Additionally, providing technical infrastructures and digital platforms by which people are supported to consume more sufficiency oriented can instigate niche development (e.g. platforms where people can buy second-hand or refurbished articles, or where people share their skills). However, such platforms and innovations can become part of a business-as-usual company strategy, thus become monopolized, follow profit-orientation and in its effects become contradictory to the goal of sustainability or sufficiency orientation (Schor, 2020; Vallas &

Schor, 2020). However, and in line with Juliet Schor (2014) "these new technologies of peer-to-peer economic activity are potentially powerful tools for building a social movement centered on genuine practices of sharing and cooperation in the production and consumption of goods and services. But achieving that potential will require democratizing the ownership and governance of the platforms."

As highlighted within all manuscripts, communication about sufficiency, sufficiency orientation and the positive associations in terms of outcomes for oneself and the community, is important. However, pure information raises awareness and openness to change but not necessarily enters in attitude and behaviour change (Abrahamse & Matthies, 2018). However, information in the first step is of importance as it can be a vehicle for new narratives and stories to be told about transformation and sufficiency orientation (Fløttum & Gjerstad, 2017; Moser, 2010). This, on the one hand would contribute to a counter-narrative to the infinite growth and consumption narrative, which is publicly often reproduced as the only grant for social and individual wellbeing. The current Covid-19 pandemic, for instance, also implies an opportunity to establish a new narrative that parallels the Covid-19 crises with ongoing unsustainable behaviour and outline that preventing future crises would be more possible by behaviour changes today during this window of opportunity and would lower risks for societal crises tomorrow (Bodenheimer & Leidenberger, 2020). As outlined in study 1, communicating about gains (instead of losses) and increase in resilience in personal and societal levels when actually living more sufficiency oriented would serve as key towards transformation (Fløttum & Gjerstad, 2017). To achieve this, it is also possible to combine various goals and integrate the idea of consuming less, as for instance, discussed in Manuscript 4. Sufficiency and a justice based global identity do not contradict each other and can be fruitfully combined in public campaigns, for instance, or when targeting travel behaviour in the public discourse. The initiative "terran"

demonstrates this in an appealing way by exemplifying how people can travel more sustainably while having fun and fostering their feelings of being connected to a globalised world (e.g. [www.terran.eco](http://www.terran.eco)).

As outlined in Manuscript 5, many communication suggestions can also be derived from findings on the relation between subjective well-being, life satisfaction and the satisfaction of basic psychological needs that seem to co-emerge in line with a sufficiency oriented life style. A sufficiency oriented life goes in line with environmental protection but also with having a 'good life', i.e. psychological well-being and time affluence. Sufficiency can thus also be promoted as a health-related aspect and, thus, would be accessible to a broader target group. It is possible that practices of voluntary simplicity and sufficiency orientation are more able to promote autonomy and thus contribute to well-being through the strongly focused element of voluntariness (Rich et al., 2017). It is conceivable that if the focus is only on the moral necessity to reduce consumption, as is often the case in the sustainability and sufficiency discourse, autonomy needs will be less satisfied. Depending on the target group, positive, need-satisfying aspects of sufficiency can be communicated together with the moral necessity of reducing consumption for socio-ecological justice in campaigns or when journalists write about climate change related aspects. Depending on the target group, sufficiency practices, that are both intrinsically satisfying and low in CO<sub>2</sub> (Hüppauff et al., 2021; Isham et al., 2019), can motivate behavioural change. Communication offers that are structured, caring and autonomy-promoting – and thus able to satisfy basic psychological needs – can support this (Martela et al., 2021).

Further communication recommendations can be derived from findings on materialism and well-being. For example, US Americans found lower ecological footprints appropriate when reminded of their intrinsic values in a supposedly independent context (Sheldon et al., 2011). Advertising intended to encourage (compensatory) consumption, on the other hand, often emphasises extrinsic values of competition, striving for status and success. As a consequence, Kasser (2016) recommends, among other things, avoiding advertising in public and private spaces, as it promotes materialistic values and increased consumption and thus lower

well-being and unecological behaviour. To avoid this one can install an ad blocker, mute advertisements and unsubscribe from advertisements. But all these single behavioural reactions depend on self-control and perceived self-efficacy by individuals and are of limited effectiveness for society as a whole. It is therefore important to find collective solutions and implement political measures again to enable people in really consuming less.

Companies indeed are important niche actors that are involved in many communicative processes, as they want to sell their goods and services. Recent insights found sufficiency also to serve as successful marketing strategy (Gossen & Kropfeld, 2022). For instance, by promoting longevity of products companies can address people's sufficiency orientation and give the companies' sustainability policy a voice that can contribute to a transformation. However, the question if marketing and advertising itself would be contradictory approach in regard to sufficiency needs to be further explored in terms of social, economic and ecological long-term effects of such more intrinsic value-oriented marketing strategies. Finally, there is a danger that sufficiency (orientation) itself, like sustainability in the past will become an empty signifier and hopes will fall short of expectations due to rebound effects and neoliberalism (Brown, 2016).

In line with our results from studies presented in Manuscripts 2 and 3, practitioners and niche innovators should also address peoples' moral convictions that both inform people's environmental attitudes (Feinberg & Willer, 2013) and predict behaviour (e.g. D. Li et al., 2019). Such convictions manifest in peoples' political actions (Fernandes, 2020), environmental policy support (e.g. Frey, 1999), and, in turn, can be used to facilitate political influence (e.g. Feinberg & Willer, 2015). Thus citizen participation projects might stimulate both private and public actions which are important for regime change (see Chapter 8.3.2). In such projects, one can ask about their visions and approaches on future food production and provisioning, housing or mobility system, and thus also satisfy their basic psychological need for competence and relatedness as they are perceived as actors that can contribute to a greater good. This, indeed could drive transition processes forward and let niches grow more and more (Gebhardt et al., 2019).



Private behaviour has its limits in transformative power and, thus, policy support and activism can be a result of individual and group activities (Bullard & Johnson, 2000; Hamann & Reese, 2020; Schulte et al., 2020). In line with study results presented in Manuscript 2 and 4 holding a sufficiency orientation goes along with substantial support for policies that encourage collective behavioural changes by infrastructures rewarding sufficiency orientation and increasing costs of environmental damaging behaviour. This was also highlighted by experts in Manuscript 1 and fits to the role of niches in general, as this expression of a strong will for changing regime structures is typical (Geels, 2011).

### 8.3.2 Meso level: socio-technical regimes

According to Geels (2011, p. 27) a socio-technical regime “refers to semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems”. Along these various rules (behavioural and consumption related) practices are manifested, system elements are reproduced and, in turn, stabilizing the system while regimes remain “dynamically stable” (ibid). There is a bidirectional dynamic between the actor and the rules as “on the one hand, actors enact, instantiate and draw upon rules in concrete actions in local practices; on the other hand, rules configure actors” (ibid.). Examples for such regime rules can both be non-material, more or less subtly performed by people in terms of practices, “cognitive routines and shared beliefs, capabilities and competences”, etc. but also materialized in terms of contracts, rules and regulations. And of course there are various regimes within a society, e.g. science, technology, user and market regime. According to the multi-level approach regimes are relatively stable and can only be changed in co-evolutionarily and incrementally with also undergoing conflicts.

Manuscript 1 highlights the lack of appropriate infrastructures and regulations that can guide people towards sufficiency orientation in the many parts of their life. Correspondingly, we found that this need for structural change is manifested in peoples’ strong policy support (see Manuscript 2 and 4). This is probably the reason why people perceive more obstacles in

their everyday life and it increases the likelihood to support progressive environmental policies that will ban these infrastructural barriers (Heidbreder et al., 2020). Thus, accelerating socio-ecological change and strengthening sufficiency orientation would happen when socio-technical regimes actually enforce it by their legislation or infrastructural changes. These can indeed make alternatives more easily available and attractive at the very beginning of action initiation, e.g. as shown in case of plastic consumption (Poortinga & Whitaker, 2018). Only recently the EU made plastic-free offers more convenient by banning particular single use plastic products in 2021 (European Commission, 2019). In line with Kanger et al. (2020) market-based policy instruments stimulate niches and also respect for the moral motivations of the people (see also Fesenfeld et al., 2020; Liao, 2018). Both stronger regulations and behavioural changes in terms of a collectively pursued culture of reduction in parallel is necessary (da Costa et al., 2020) but can be also accomplished when focusing sufficiency orientation on the regime levels.

As outlined in Manuscript 1 not only materialised infrastructures, such as a ban that prevents people from consuming plastics by default, but also social infrastructures shape non-ecological path dependencies (see also Manuscript 5). How our day is structured and if we experience time affluence within our daily lives goes hand in hand with routine behaviour (Aarts et al., 1998). In Western affluent cultures, people are embedded in working time structures that prevent autonomy and ecological behaviour (Bader et al., 2020; Burchardt & Ickler, 2021). Sufficiency, in contrast, means having time to not consume when people do not want to and not being forced to use CO<sub>2</sub>-intensive infrastructures, for instance, when travelling to work. Sufficiency oriented consumption would go in line with more freedom where people spend their times and when they work. With regard to actors on the regime level, this implies that new indicators can be established and used to measure societal well-being and transformative change in the future (Burchardt & Ickler, 2021). For example, policy regulations that reduce working time could be effective in stimulating sufficiency orientation and socio-ecological

transformation (Bader et al., 2020; Nässén & Larsson, 2015; Rosnick & Weisbrot, 2007). Furthermore, arguing against the negative connotation of sufficiency in terms of loss is aversive to people. It should be replaced by emphasising social and ecological benefits. This goes in line with Wullenkord and Hamann (2021), who argue that regime actors should target collective need satisfaction as a mediator of socio-ecological change. Bans, regulations and infrastructural change can indirectly address this and in consequence would shift norms and people's beliefs about sufficiency incrementally which again have the power to stabilize a new regime.

### 8.3.3 Macro level: socio-technical landscape

The socio-technical landscape constitutes the wider context, which influences niche and regime dynamics such as, for instance, climate change, demographical trends or rapid external shocks. Niche actors and regime levels cannot influence this external context in the short run (Geels & Schot, 2007, p. 403). Thus, it is not easy to derive practical implications in light of the given study results. However, types of environmental change within the landscape differ (e.g. "hyperturbulent", "disruptive" or "avalanche", *ibid.*) and again influence both niche and regime activities. These changes within the landscape can destabilise regimes and open windows of opportunities for niche actors to anchor their innovations within regimes. So, given this idea, it is important for any practitioner interested in change or actively engaging in transition towards sufficiency orientation to have these systems' perspectives and interdependencies in mind. A sociotechnical landscape shock can generate a change in meanings and social representations of technologies, as shown by Upham et al. (2020) by analysing German newspaper coverage after the Fukushima accident. The authors showed that anti-nuclear representation became dominant after this landscape shock because of "affective, ethical and risk associations of nuclear power at this time drew on and arose, in part because of the long-held values and cultural traits that the [multi-level perspective] locates conceptually and exogenously in the sociotechnical 'landscape' at a national level" (Upham et al., 2020, p. 10).

A current and ongoing landscape shock is the Covid-19 pandemic as disruptive event that permeates all socio-technical systems and transforms society in many ways (Wells et al., 2020). It questions all levels and structures of society and socio-technical systems alike. It opens the opportunity for long-term changes towards sufficiency and degrowth which practitioners and actors can use in favour of establishing sufficiency orientation within regimes. For instance, provisional bike infrastructures – which is mobility that is in line with sufficiency orientation – increased biking tremendously (Kraus & Koch, 2021). The Covid-19 pandemic opens possibilities for addressing societal challenges through the lens of collective transition oriented perspectives and also to implement sufficiency orientation in the current debate on resilience and liveable futures (Bodenheimer & Leidenberger, 2020; Reese et al., 2020; Wullenkord & Hamann, 2021). Politicians and social actors alike can redefine “social and economic possibilities for the future, and the implications that the different futures would have for ecological burdens” (Wells et al., 2020, p. 29) and give sufficiency a substantial weight.

To conclude, sufficiency orientation is already a transformative power within society as it flourishes in niches and there are groups of people acting in favour of gaining more power within the regime level and transform current rules towards a non-consumerist climate friendly culture. Some regimes such as science have already partly reconfigured and shifted in such a way that sufficiency and sufficiency orientation is a term of common (research) interest, that sustainability is argued to be only reached if social innovations get listened to and implemented – and reinforcing that technology alone would not save the world (O’Neill et al., 2018). However, within powerful regimes, such as the political system, this (narrative) turn has not happened yet. So it is important to engage all actors (in niches and regimes alike) and to realize themselves as actors within a system that can transform by intention (and does not need disruption). Furthermore, the presented practical approaches need to be combined and a change of the whole choice architecture is essential for sufficiency orientation to establish more broadly. Societal transformation is a transformative and participatory process, thus, we need

to involve people at all levels alike. And it is important to change the context (regime, landscape) people embedded for instance, by reconfiguring decision infrastructures (e.g. by nudging approaches).

According to the multi-level perspective reconfiguration of systems and regimes only happen because more than one system act together and co-generate. Societal transitions come about through interactions between processes at all three levels: (a) niche-innovations that build up an "internal momentum", through learning processes, price/performance improvements, and support from powerful groups, (b) changes at the landscape level to create pressure on the regime and (c) destabilisation of the regime that creates windows of opportunity for niche-innovations (Geels & Schot, 2007, p. 400). This should thus be kept in mind when addressing one of the presented levels and establishing sufficiency orientation in socio-technical infrastructures. However, humans can change systems and are the important actors in niches and also in regime structures. They are the actors who can engage in actions against climate change or not. Regime rules do not come out of the blue – people make these laws, maintain and perform them, they can decide to make resources or infrastructures available for people, they elect politicians that represent their views, and they can engage in niches together with other people towards more sufficiency orientation and a socio-ecological change (Göpel, 2016).

#### 8.4 Limitations and future directions

Several limitations have already been discussed in the respective papers. The most fundamental and overarching ones will be mentioned in this section. In detail, I discuss limitations due to the a) variety of theoretical approaches used within this thesis, b) concerns regarding measuring sufficiency orientation (and behaviour), c) design and timing of the studies, and d) generalisability of results as well as e) gender aspects that were not addressed adequately. Accordingly, ideas for future research are presented.

*Variety of theoretical approaches.* Throughout this dissertation project many theories were connected to the concept of sufficiency orientation – but each discussed more or less only

in one single study and not followed up in consecutive studies or by a broader range of investigations. Although it was a goal to show the relevance of sufficiency orientation in many theoretical fields and emphasize sufficiency as part of an interdisciplinary discourse of transition, this conceptual variety throughout the studies comes at the expense of precision and specificity of how, where and when to call for sufficiency orientation. A focus on fewer theoretical approaches would have contributed to more concise results regarding when and how to address sufficiency orientation in which particular fields of theory (and action). Furthermore, every single study points out the interdisciplinary quality of sufficiency (orientation) on the one hand, but on the other hand seeks to connect sufficiency to the psychological debate. Actually this goal cannot be measured through the presented studies, i.e. if these studies really could contribute to any dialogue within the psychological discourse. This would be a question of subsequent researchers picking up these ideas and also criticise them. It would have been significant if psychological theories would have been pursued across the several papers but instead I connected sufficiency orientation to many different approaches (i.e. the leverage points concept, socio-technical systems, justice sensitivity, self-determination theory and basic psychological needs concept, TPB). This shows that sufficiency is indeed a connectable concept. However, it would have been fruitful to dive a bit deeper into one of these theories and more systematically investigate the relationships. Future research should more closely look into each (psychological) theory and the particular connectivity to sufficiency orientation. For instance, future research should elaborate if the extended model presented in Manuscript 2 enclosing sufficiency orientation could explain other behavioural actions in the field of mobility such as car driving. Or one should question if and in particular when sufficiency orientation can be a source or a consequence of basic psychological need satisfaction as discussed in Manuscript 5. Current results are not robust enough. A closer look into sufficiency orientation in relation to all the mentioned theories on the other hand are needed to proof the validity of the results.

*Measuring sufficiency orientation and action.* The sufficiency orientation scale, based on Verfuërth et al. (2019), was slightly extended and measured sufficiency orientation reliably in

our studies. The CFA of the extended version showed satisfactory model fit but very high inter-correlations between both subscales (see Supplementary Material, Manuscript 4). On the one hand this shows that general concerns about ecological impact from ones consumption is genuinely a part of the sufficiency concept but leaves room for the question if this is distinct enough from instruments that assess pro-environmental values and identities (e.g, Sparks et al., 2021) and in regard to the overall goal of predicting pro-environmental behaviour in various domains (Lange & Dewitte, 2019). The scale needs further refinement by running a comprehensive study that evaluates convergent and divergent validities as also ecological validity more precisely. Related concepts such as frugality (Iwata, 2006; Lastovicka et al., 1999), voluntary simplicity (Alexander & Ussher, 2012; Fujii, 2006; McDonald et al., 2006; Rich et al., 2017), or minimalism (Sandlin & Wallin, 2021; Kang et al., 2021), which were not in the scope of this dissertation, should be examined together with sufficiency orientation in order delineate what distinguishes these concepts.<sup>12</sup> For instance, Kropfeld et al. (2018) showed, that frugality was not associated with reduced ecological impact whereas voluntary simplicity was indeed positively correlated (with lower impact) and, thus, contributes to further understand reduced consumption.

In line with these considerations, it still remains an open question what sufficiency orientation actually measures. According to Kaiser et al. (2010), sufficient behaviour could be very hard pro-ecological behaviour such as not flying anymore or not possessing a car, and will be determined by the same and the strength of peoples' underlying a single motivational dimension to act pro-environmentally (Kaiser et al., 2010; Kaiser & Wilson, 2004; Schultz & Kaiser, 2012). In his rational-choice approach the more motivated the person is the more costs and barriers she/he will take and overcome in order to approach the goal. This idea overlaps with the definition of sufficiency and its core goal to cut down emissions by acting in a non-consum-

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<sup>12</sup> Preliminary results are presented in a Master thesis by Barthen (2021) which was conducted in the context of this dissertation project.

erist way. So the question is, if another intention-oriented scale really brings something fundamentally new to the debate or is just an extension of measuring a higher-level of goal-directed motivation to protect the environment. However, in a more recent study Henn and colleagues (2020) argue that for long-term effects, behaviour should be changed comprehensively and not with a single behaviour. Sufficiency orientation, however, fits to this argument as it implies that, people's overall attitude should elicit goal directed behaviour. Therefore, further refinement of the scale is needed and overlapping concepts should be investigated and discussed. Future research can develop a more complex assessment of sufficiency orientation and further evaluate its predictive power in other fields of action that is of relevance for a socio-ecological transformation.

*Research design, timing of the studies.* The project applied a mixed methods approach and aimed to combine qualitative (Manuscript 1) with quantitative study methods (Manuscripts 2-5). However, study one did not derive a clear message that was later integrated in the subsequent studies. The studies were planned independently due to various open questions that were discussed within the research team and many open questions remaining in the field of sufficiency research. There is no overarching flow of the study design in this dissertation project but it is more a puzzle of different approaches and questions combined in order to contribute pieces of a puzzle to understanding if, how, and when sufficiency orientation can be relevant in a socio-ecological transformation. Furthermore, studies presented in Manuscript 3 and 5 lacked a control group, but this would have been crucial to derive clearer results. In particular, within the study presented in Manuscript 5, a control group which were only monitored while neither writing down anything related to consumption at all would have helped to understand the effects of the diary intervention as sufficiency orientation increased in both groups similarly over a short term. Future studies should target more explicit situations of refraining from consumption and target better in terms of times and locations of decision-making (see Frick et al., 2020, in regard to an online shopping intervention).



Furthermore, we only analysed self-reported data (albeit very close to actual behaviour data, see Manuscript 4). It would be highly valuable to analyse trace data in order to further evaluate the power of a sufficiency orientation in real time points of consumption and when people actually refrain from consuming anything (or not). One recent study showed that the 'KonMari' method was effective in actually 'decluttering' people's homes and slowing down consumption for motivated people (Chamberlin & Callmer, 2021). By the KonMari method people are invited to intensively reflect about their relationships to their material belongings and their approach to acquisition as well as their related experience of well-being. Results of the study indicate that there is a lower interest in shopping for new belongings and a different way of handling material possessions, which seem to come along with increased physical and psychological well-being (*ibid.*, p. 25).

Within the samples selected in this project sufficiency orientation was relatively high (both before and after interventions, see Manuscripts 3 and 5). One could argue that sufficiency is already a high injunctive norm (at least for certain groups) but still not a descriptive norm within society. The studies however did not target this discrepancy in detail and did not investigate the role of social norms in detail. If people were to perceive sufficiency-oriented actions as being normative, people would also be more motivated to actively cope with the climate change threat, and if they believed that they were part of a collective who is taking action. Given the fact that social norms have a fundamental influence on our behaviour, future research should investigate how to change these norms (see also Manuscript 1) and influence action taking in particular (Nolan et al., 2008; Soliman et al., 2018). When sufficiency orientation really enjoys such a high level of approval, one may ask why sufficiency actions still remain absent on a larger scale. In line with this, systemic and structural influences (such as narratives, paradigms, visions) have been understudied in the pro-environmental psychological research domain (Steg & Vlek, 2009; Wullenkord & Hamann, 2021). According to the multi-level perspective (see Manuscript 4, Geels, 2011; Geels & Schot, 2007) and the extension by Göpel (2016) it is important to understand when and on which societal level (see also a

psychologically relevant update by Wullenkord & Hamann, 2021) to intervene in order to succeed in transforming any system. When asking how to stop and change habitual consumption behaviour, it is important to understand which path dependencies shape particular habits and which structural strategies (legislation, availability of products, financial incentives that target the meso and meta level of societies). This might establish sufficiency orientation and actions in different social groups. The current Covid-19 crisis shows that policies could indeed act effectively and engender concerted actions towards a collectively wanted goal. This is valuable also to understand how we could better act in face of the climate crisis (Reese et al., 2020; Sheth, 2020). Manuscript 1 tackled this question of structural influences genuinely, Manuscript 4 discussed the multi-level perspective and the relevance of sufficiency orientation for behavioural change, but all other studies did not embed systems perspective in detail.

*Generalisation and sample.* The study samples of the quantitative studies were recruited at random with all participants being Germans – people from an affluent Western society where the debate around sustainability has a long lasting history and grew out of a powerful situation of being mostly unaffected by consequences from the climate crisis. All participants were highly educated with an average to high environmental consciousness. The present studies do not investigate people from the Global South or people from lower social status groups. Although it may be justified that we targeted groups with high consumption in our studies, the discussion of sufficiency should also address individuals with lower levels of consumption. Future studies should investigate more representative samples and investigate their ideas and stance about sufficiency orientation and action. Studies across different countries and within countries with lower GDP levels would potentially highlight the pitfalls of such a new (Western) concept. It is probable that we learn very much from other cultural contexts what a sufficiency orientation and practise could look like. For instance Kleres & Wettergren (2017) highlighted that emotions work very differently in managing people's fear and mobilis-

ing actions in the north vs. the south. In a similar vein, the sufficiency debate could be interpreted and valued very differently depending on the political and socio-material contexts and experiences when more diverse samples are analysed.

*Gender.* The present studies were neither balanced in regard to gender nor did we explicitly research gender differences in detail. However, recent findings highlight that the gendered nature of pro-environmental intentions and behaviour is very much under-researched (Bloodhart et al., 2019; Bloodhart & Swim, 2020). It is highly probable that, in particular sufficiency orientation and the discourse of sufficiency in general would be a more “female” way of coping with the climate crises and engaging in climate protection (Dzialo, 2017) than efficiency orientation and techno-centered solutions of the climate crisis. Women engage more in household related behaviour such as recycling, purchasing food and performing other private-sphere behaviours than men do (Hunter et al., 2004). In contrast, men in their traditional roles as “breadwinners” are those who drive by car to the office and buy new electric vehicles to save the planet (Sovacool et al., 2019). Given that gender stereotypes are shaping people’s attitudes and behaviour, it is highly probable that it could be easier for women to affirm and actually perform sufficiency oriented behaviour in contrast to men since sufficiency is neither a general societal norm nor combined with an increase in status (cf. Swim et al., 2019). Sufficiency orientation conflicts the norm of accumulating material possessions in order to display a higher social status and thus, refraining from consumption would come along with “negative” social consequences such as reputational loss when not consuming (e.g. Griskevicius et al., 2010). Sufficiency will not be attractive for people who want to demonstrate their social identities and show their green (but still consumerist) identity publically. Such potentially negative evaluation by the in-group (i.e. peers, colleagues at work) is often greater for men than for women as this is consistent with their gender role (Zelezny et al., 2000). Thus, future research should investigate if these stereotypes contribute accordingly to the low attractiveness of sufficiency consumption and ask how to transform them into “ecological masculinities” (Hultman & Pulé,

2018). Furthermore, it would be interesting to focus on who are the actors that speak and research about sufficiency and to outline who are the actors that embed sufficiency in their business models with a more gendered focus (Niessen & Bocken, 2021). This could help to create more inclusive and gender-sensitive interventions towards climate change mitigation. “Centralization of power and the privileges” is a major question that comes along with gender (Stoddard et al., 2021) and is crucial in systemic changes (Meadows, 1999). Given that sufficiency orientation incorporates systemic changes and constitutes the antithesis to the normative consumerist culture, the role of gender and power is highly relevant.

*Future fields of interest and research directions.* The project targeted two particular fields of behaviour, namely plastic consumption (Manuscript 2) and flying behaviour (Manuscript 4). The first one was of interest because of the raising interest in plastic consumption reduction and increased research in health risks from plastic consumption over the last years (Heidbreder et al., 2019). The second one – flying – was selected because of its prototypically of a high impact behaviour (Wynes & Nicholas, 2017). However, future research should also address other relevant fields of action such as switching to a plant-based diet, reducing car-driving and living car-free and perhaps also the question on having fewer children as this is also a current issue within the sustainability debate (ibid.). But it is not only a question of specific behavioural fields of actions. High impact lifestyles and behaviours come along with high income and are associated with social status (Bilharz & Schmitt, 2011; Capstick et al., 2014; Moser & Kleinhüchelkotten, 2018). Sufficiency research needs to investigate these interrelations. Sufficiency also faces the risk of rebound effects through monetary savings and can also mean symbolic behaviour in one field of action but not in the other (Sorrell et al., 2020). Future research should also investigate positive or negative spillover effects from sufficiency orientation and action. For instance, one can imagine that cycling every day is could be accompanied with a subsequent long-distance travel trip by a motorized van (negative spillover) or inspire people to avoid long-distance travelling altogether (positive spillover, Sorrell et al., 2020).

Based on the current research, two major fields of research can be outlined: Firstly, as it is necessary to make sufficiency a new and attractive norm, communicative strategies and normative influences should be investigated in relation to sufficiency. Here, shaping identities and establishing shared social identities of low emission consumers play a role, for instance. People change their behaviour because performing the one or the other behaviour is a symbol of being part of a social group or expressing a certain identity and not to reach the goal of consuming less (Kurz et al., 2020). So it is important to find ways on how and when to shape sufficiency oriented identities on several societal levels.

Secondly, we need more research on how to re-configure systems in order to satisfy basic psychological needs so that people can adequately cope with threats from climate change and perform in a sufficiency oriented manner. As argued in Manuscript 5, the role of competence, social relatedness and autonomy would play a fundamental role in long lasting motivation for uneasy pro-environmental behaviour (cf. Wullenkord, 2020). It is necessary to further understand how we are embedded in systems that hamper basic psychological need satisfaction and prevent sufficiency orientation to get into practice. Future research should target systemic and structural changes that increase basic psychological need satisfaction on the one hand and, on the other hand, how and under which circumstances these changes are supported by relevant groups and actors in society, e.g. politicians, company holders, intermediaries. Actors are part of influential networks and have the ability to actively shape the climate discourse into a desired direction. And people as part of larger groups and networks can decide whether to engage in delaying tactics in the climate change discourses (see for instance Lamb et al., 2020) or not.

## 8.5 Conclusion

In light of the present research, sufficiency orientation in terms of an individual stance to consume less is a necessary but not a sufficient condition to decrease emissions and engender transformation. Sufficiency orientation embraces a mind-set that could serve as a leverage

point if it diffuses through the various levels of the society and gain more power when it is implemented by actors who have “the power to transcend” such new paradigms (Meadows, 1999, p. 19) in terms of certain principles of thinking and behaving. Thus, sufficiency orientation is *one key* for transformation as more conceptually outlined and condensed in the framework derived from expert interviews and basically supported in terms of individual psychologically relevant variable by the empirical insights given throughout this dissertation. However, proof of causality in regard to how exactly sufficiency orientation is increased is still lacking. Investigating causal relationships to foster sufficiency orientation and subsequent behavioural changes in regard to lowering individual and collective footprints should be the main focus of future research on sufficiency orientation.

Throughout the project, important correlates were investigated that are first pieces of a puzzle towards explaining the facets, sources and consequences of sufficiency orientation. This nevertheless offers a few important starting points to address in future research such as, to clarify the role of justice sensitivity and emotional reactions when people are instigated to downsize particular behaviour; to identify the influence (and consequence) of individual as well as societal well-being in case of voluntarily downsizing consumption; or the integration of the flourishing concept “time affluence” (Geiger et al., 2021). Furthermore, basic psychological need satisfaction seems to play a more profound mechanism that could drive individual sufficiency orientation as also collective changes in regard to climate mitigation (see, for instance, Wullenkord, 2020).

Furthermore, sufficiency orientation seems both associated to people’s will of political and infrastructural change and to higher individual compliance to actively contribute to such a change in order to reduce emissions. Two studies exemplified this in the field of plastic consumption and flight travel behaviour. Given these findings, one may cautiously conclude that holding a sufficiency orientation is related to an increased possibility that people’s intentions are in line with their actions and that they also stand up for more structural support of these

actions by expressing this 'political will' through public behaviour. This is good news, both theoretically and practically, as it indicates intention-behaviour consistency and raises the credibility of the concept in the public debate on transition and socio-ecological change. In line with Stoddard et al. (2021, p. 678) "we need concerted efforts to actively reconfigure the knowledge systems and institutions (including their funding) that keep reproducing the very problems driving climate change are urgently needed." Such a reconfiguration can only be based on a societal and a political will – which seems to be at least partially embedded in sufficiency orientation.

Facing the climate crisis, lowering CO<sub>2</sub> emissions is nothing less than a moral and historic obligation only recently reinforced by the successful Fridays for Future's lawsuit against the Constitutional Court (BVerfG, 2021). The German government is now officially committed to climate protection and climate neutrality by specifying more precisely the reduction targets for greenhouse gas emissions for the period after 2030. That is a signal for sufficiency (orientation) from legislation. And indeed, there is actually no further need to empirically demonstrate that a decarbonisation of our consumption and lifestyles implying a sufficiency strategy would have a powerful impact (Glavovic et al., 2021; Stoddard et al., 2021). The concept of social tipping points even emphasises the outstanding role of social drivers for system changes (Winkelmann et al., 2022) – which such a change towards sufficiency orientation in niches and levels of socio-technical systems could signify.

Sufficiency orientation also helps to create a perspective in which an ecologically just and healthy future is possible. It is about doing less with less, but with probably better outcomes for many. And we can just start right now as "[t]hose who stand up for the right thing don't do so because they think it will work. They do so because it is the right thing to do. Ethical action doesn't have to be scalable to make it ethical" (Haberkorn, 2018).

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## APPENDIX I: SUPPLEMENTARY MATERIAL MANUSCRIPT 2

*Questionnaire*

<i>Attitude</i>	
<p>In my opinion, using plastic packaging is...</p> <ul style="list-style-type: none"> <li>• ...practical</li> <li>• ...cheap</li> <li>• ...hygienic</li> <li>• ...useful</li> </ul>	5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)
<i>Perceived behavioural control</i>	
<ul style="list-style-type: none"> <li>• For me, it is easy to avoid using products that come in plastic packaging.</li> <li>• It's up to me to avoid using products that come in plastic packaging.</li> <li>• I know how to avoid using products that come in plastic packaging.</li> <li>• I am able to find alternatives to plastic packaging.</li> </ul>	5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)
<i>Social norms</i>	
<ul style="list-style-type: none"> <li>• Most people whose opinions I value try to use fewer products that come in plastic packaging.</li> <li>• Many people in my close environment deal with problems that have arisen from plastic packaging.</li> <li>• Important people in my close environment would support me if I tried to avoid using products that come in plastic packaging.</li> <li>• Most people who are important to me expect me to avoid using products that come in plastic packaging.</li> </ul>	5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)
<i>Personal norms</i>	
<ul style="list-style-type: none"> <li>• I feel morally obliged to use fewer products that come in plastic packaging.</li> <li>• I should do everything within my power to reduce my use of products that come in plastic packaging.</li> <li>• Due to my values, I should do everything to curb the negative consequences of plastic packaging.</li> </ul>	5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)
<i>Collective efficacy</i>	
<ul style="list-style-type: none"> <li>• I think that we as consumers can solve the plastic packaging problem together.</li> <li>• I think that we as consumers can curb the negative consequences of plastic packaging.</li> <li>• I think that we as consumers can all push together to support political programs that will help reduce the number of products that come in plastic packaging.</li> <li>• I think that we as consumers can all push together economy to reduce the number of products that come in plastic packaging.</li> </ul>	5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)

<p><i>Sufficiency orientation</i></p> <ul style="list-style-type: none"> <li>• I think it is unnecessary to have so many different products in our supermarkets.</li> <li>• I feel that many popular products are a big waste of resources.</li> <li>• High consumption leads to an unjust distribution of natural resources in the world.</li> <li>• To reduce environmental pollution, it is necessary to reduce consumption.</li> <li>• High consumption usually increases environmental pollution.</li> <li>• Current lifestyles lead to a waste of valuable resources.</li> </ul>	<p>5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)</p>
<p><i>Intentions</i></p> <ul style="list-style-type: none"> <li>• Thinking of my next purchase, I plan to buy fresh products (e.g. milk, yoghurt) that come in glass instead of plastic.</li> <li>• Thinking of my next purchase, I plan to put food into several containers I bring with me.</li> <li>• Thinking of my next purchase, I plan to avoid buying fruits and vegetables that are wrapped in plastic.</li> <li>• I'm willing to support organisations that strive to avoid plastic packaging.</li> <li>• I'm willing to participate in a demonstration that is aimed at calling on policy and industry to curtail their use of plastic packaging.</li> <li>• I'm willing to vote for a party that campaigns for a ban on plastic packaging.</li> <li>• I'm willing to support policy regulations that limit the use of plastic packaging.</li> <li>• I'm willing to sign a petition for the prohibition of plastic packaging in supermarkets.</li> <li>• I'm willing to pay more for food that is not wrapped in plastic. (later excluded from analyses)</li> </ul>	<p>5-point-Likert scale ranging from 0 (do not agree at all) to 4 (agree completely)</p>

## APPENDIX II: SUPPLEMENTARY MATERIAL MANUSCRIPT 3

### *Appendix A – Sufficiency Orientation Item List*

- a) I strive for wasting as less as possible resources throughout my daily life (e.g. mineral oil, scarce minerals and rare earth, etc.).
  - b) To me personally, my comfort is much more important than changing my lifestyle in favour of more environmental protection. (Negatively coded.)
  - c) To me it seems superfluous that there is such a wide range of products offered in supermarkets.
  - d) To my opinion many things that can be bought are useless and wasting valuable natural resources.
  - e) High consumption leads to unfairly distributed natural resources (e.g. water, mineral resources etc.) in the world.
  - f) Due to high consumption environmental pollution increases.
  - g) To reduce environmental pollution one has to downsize individual consumption.
  - h) A way of living that decreases resource consumption substantially prevents from ongoing climate change.
- Response options ranged from 1 (totally disagree) to 6 (totally agree).

### *Appendix B – Justice Message Manipulation (Study 1 and Study 2)*

*Please read attentively through the text<sup>13</sup> and answer the following questions!*

*Uprooting of forests, oceanic pollution and an extensive combustion of fossil fuels – between environmental harms and social living conditions there are very close relationships.*

**(1) Between people on a local level:** The lower the individual income, the lower the pollutants and waste products – but, the more the people are affected by the consequences of the pollution from others. For example, in Germany people with a low income (less than 1500€) own only a half of the cars than people with an equivalent higher income. In average people with a low income annually drive 8 600 kilometers whereas people with a higher income annually drive 28 000 kilometers by using their own cars. However, people with lower income are affected stronger by noise and harmful exhaust fumes because they live in urban areas with a higher average traffic volume (see results from the study by infas and DLR, 2010, about mobility in Germany<sup>14</sup>)

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<sup>13</sup>Text excerpt is based on: Klostermeyer, T., & Inden-Heinrich, H. (2014), Nachhaltige Transformation - Ohne Umweltschutz keine soziale Gerechtigkeit [Sustainable Transformation – without environmental protection there will be no social justice], *Politische Ökologie*, 136, 18–24, and partially adapted for the study purpose.

<sup>14</sup> Source: infas, DLR (2010). *Mobilität in Deutschland 2008*. [Mobility in Germany 2008] *Ergebnisbericht im Auftrag des Bundesministeriums für Verkehr, Bau und Stadtentwicklung*, abgerufen unter: [www.mobilitaet-in-deutschland.de](http://www.mobilitaet-in-deutschland.de).



**2) Between people of different countries and regions:** countries with high economic power have the capacity to relocate environmental costs and environmental damages to other countries. For instance, clothes can be produced very cheap and with lacking environmental standards in countries of the global south, for instance in Bangladesh. However, these clothes are not distributed at its place of production but in countries with higher economic power like Germany. In these countries of high economic power potential shoppers face an intact and clean environment that is not affected by the wastage of the clothing industry, yet. Prices for these products can remain very low, as social and ecological costs that emerge during and after production are not included. The people in Bangladesh carry the social and ecological costs: they produce the clothes under insanitary conditions but cannot consume these products as they earn very low wages. They perceive the consequences of the environmental damages, for example, through the increase of extreme weather events (e.g. storms and heavy rain in vulnerable areas) and suffer from the immediate pollution in the course of the production.

**(3) Between people of different generations and age groups:** The current generation and elderly people still can highly profit from the benefits of consuming natural goods. However, the younger people will have to carry the costs and consequences of this consumption patterns. For instance, raw materials such as natural gas or mineral oil have been exploited and burned at high levels during the last years and there has been no change in trend yet (e.g. through the increase of flights). These natural resources become more and more scarce and also more expensive for its usage. Consequences of this resource exploitation will substantially change familiar life styles. Severe weather events will increase and the cultivation of food will get more difficult, which potentially leads to rising prices and increased group conflicts.

#### *Appendix C – Manipulation Check (Study 1 and Study 2)*

*Knowledge questions served for checking if people had processed the text message. In order to be coded as “correctly answered” at least one of the respective keywords (listed in brackets) had to be entered by the participants.*

Costs and Benefits of environmental damages are often unfairly distributed. This can be obtained:

- a) [Locally between single persons, at place, between people with different income]
- b) [Between people of different countries, between nations, between industrial countries and newly emerging countries / developing countries]
- c) [Between people of different generations, between different generations, between the generation today and the next generation]

## APPENDIX III: SUPPLEMENTARY MATERIAL MANUSCRIPT 4

### Supplementary Material: Methods

#### 1.1. Power Analysis

We conducted two a priori power analyses, aiming at a test power of .80 at  $\alpha = .05$ . On the basis of prior research that reports relations between global identity, travel experiences, pro-environmental behaviour, policy support, and sufficiency orientation (Loy & Reese, 2019; Sparkman & Eidelman, 2018; Verfuërth et al., 2019), we determined a necessary sample size of  $N = 270$  to detect correlations of at least  $r = .15$ . We expected a lower potential effect of our experimental manipulation to raise the salience of global identity in an online setting compared to prior experimental studies (Reese et al., 2015; Römpke et al., 2019). Thus, we determined a necessary sample size of  $N = 204$  to detect small to medium group differences of at least  $d = .35$ .

In order to allow for a potential exclusion of participants after quality checks as well as potentially more complex analyses beyond our pre-defined hypotheses, we recruited an extended convenience sample of  $N = 322$  participants.

#### 1.2. Participant Characteristics

The recruited sample consisted of  $N = 322$  participants (258 females, 61 males, 3 diverse;  $M = 28.6$  years of age,  $SD = 10.2$ , range = 18-65). The sample was highly educated: university entrance certificate ( $n = 140$ , 43.5%), university degree or similar qualification ( $n = 122$ , 37.9%), PhD ( $n = 20$ , 6.2%), traineeship ( $n = 6$ , 1.9%), secondary school certificate ( $n = 6$ , 1.9%), pupils ( $n = 2$ , 0.6%), without any certificate ( $n = 1$ , 0.3%). The majority were students ( $n = 171$ , 53.1%), followed by employed people ( $n = 113$ , 35.1%), public officers ( $n = 11$ , 3.4%), unemployed ( $n = 6$ , 1.9%), and self-employed people ( $n = 4$ , 1.2%).

### 1.3. Exclusion of Outliers and Implausible Values

First, we examined the relative speed index and excluded  $n = 2$  participants with values over 2.0 as speeders (Leiner, 2019). Second, we excluded  $n = 3$  further participants who indicated that they did not speak German. All following analyses were conducted with a reduced data set of  $N = 317$  participants.

Moreover, we examined plausibility and outliers for the variables with open answer formats. First, we examined the plausibility and completeness of *flight-related CO<sub>2</sub> emissions*. We excluded  $n = 15$  cases whose answers were obviously not serious (e.g., indicated wrong or implausible destination names) or incomplete (indicated to fly but did not list any flight afterwards). In addition, we determined people with values more than two standard deviations (i.e., 50.53) above the median (i.e., 6.87), which was the case for  $n = 14$  participants. As this number is rather large, we report results without their exclusion in the main manuscript and repeat the analyses with the reduced sample in Supplement 2 (see below).

Second, we examined the plausibility and completeness of the *willingness to accept a higher price of train alternatives*. We excluded  $n = 2$  missing cases and  $n = 4$  outliers. Outliers were determined as follows: We excluded two extreme cases (i.e., 100100 €). Then, we calculated the median (i.e., 100) and the standard deviation (i.e., 487.46), and defined people with values more than 2 SD above the median as outliers (i.e., 7007, 5050). Similarly, we examined the plausibility and completeness of the *willingness to accept a higher duration of train alternatives*. We excluded  $n = 2$  missing cases and  $n = 4$  outliers. Outliers were determined as follows: We excluded one extreme case (i.e., 1515100 h). Then, we calculated the median (i.e., 6) and the standard deviation (i.e., 62.32), and defined people with values more than 2 SD above the median as outliers (i.e., 801, 653, 400).

### 1.4. Measures

An overview on the psychometric properties of the measures is provided in Table 18.

### 1.4.1 Global Identity

Participants stated their agreement with five statements respectively on global self-definition (e.g., “I think of people all over the world as ‘we’”) and global self-investment (e.g., “I want to help people all over the world”) on a 7-point scale (*does not apply at all to fully applies*). The confirmatory factor analysis (CFA) of the two-dimensional model with correlating factors had a satisfactory model fit,  $\chi^2(34) = 99.37, p < .001$ ; CFI = .97; TLI = .96; RMSEA = .078, 90% CI [.062, .094]; SRMR = .034. Factor loadings were between .76 and .89. The correlation of the two dimensions was .90. A one-dimensional model did not yield satisfactory model fit,  $\chi^2(35) = 173.31, p < .001$ ; CFI = .93; TLI = .91; RMSEA = .112, 90% CI [.097, .126]; SRMR = .046. The two-dimensional model fit the data significantly better,  $\chi^2_{diff}(1) = 111.07, p < .001$ . However, the strong relation speaks for a second-order factor of global identity.

This is the full item list for global identity (German wording, see Loy & Reese, 2019; McFarland et al., 2012; Reese et al., 2015):

Answer scale: 1 = trifft überhaupt nicht zu, 2 = trifft überwiegend nicht zu, 3 = trifft eher nicht zu, 4 = trifft teilweise zu, 5 = trifft eher zu, 6 = trifft überwiegend zu, 7 = trifft voll und ganz zu

Global self-definition:

1. Ich fühle mich Menschen auf der ganzen Welt verbunden.
2. Ich denke an Menschen auf der ganzen Welt als „Wir“.
3. Ich habe viel mit Menschen auf der ganzen Welt gemeinsam.
4. Ich empfinde Menschen auf der ganzen Welt als eine Gemeinschaft.
5. Ich identifiziere mich mit Menschen auf der ganzen Welt.

Global self-investment:

6. Ich Sorge mich um Menschen auf der ganzen Welt.
7. Ich fühle mich betroffen, wenn Menschen auf der ganzen Welt schlimme Dinge passieren.
8. Ich möchte ein verantwortungsvolles Mitglied der Weltgemeinschaft sein.
9. Ich fühle mich solidarisch mit Menschen auf der ganzen Welt.

10. Ich möchte Menschen auf der ganzen Welt helfen.

1.4.2. *Travel Experiences*

We asked participants how often in the past five years they had travelled in Europe on average per year on a 7-point scale (*never, less than one time, one time, two times, three times, four times, five times or more*), how long their respective longest stay had been (*in years, months, weeks*), how often in their lives they had travelled outside of Europe on a 7-point scale (*never, one time, two times, three times, four times, five times, six times or more*), and again, how long their respective longest stay had been (*in years, months, weeks*).

We used a measure by Islam and Hewstone (1993) to assess the quantity and quality of contact with people met during travelling with five items, respectively (see also Sparkman & Eidelman, 2018). Participants indicated on a 7-point scale (*never, very rarely, rarely, occasionally, often, very often, all the time*) how often they had met local people in a professional/university context, as neighbours, and as close friends, visited their homes, and engaged in informal conversations. A one-dimensional CFA had a satisfactory model fit,  $\chi^2(5) = 14.67$ ,  $p = .012$ ; CFI = .98; TLI = .96; RMSEA = .078, 90% CI [.037, .123]; SRMR = .027. Factor loadings were between .56 and .83. Moreover, they stated on 7-point semantic differentials to what extent they experienced the contact as *not at all equal to absolutely equal, very involuntary to very voluntary, very superficial to very intimate, not at all pleasant to very pleasant*, and *very competitive to very cooperative*. A one-dimensional CFA had a satisfactory model fit,  $\chi^2(5) = 12.62$ ,  $p = .027$ ; CFI = .97; TLI = .93; RMSEA = .070, 90% CI [.034, .106]; SRMR = .038. Factor loadings were between .54 and .78.

1.4.3. *Calculation of Flight-Related CO<sub>2</sub> Emissions.*

We used the CO<sub>2</sub> calculator “KlimAktiv” (<https://klimaktiv.co2-rechner.de/>; Schächtele & Hertle, 2007, accessed May, 2020). In order to calculate the emissions of occasional flyers, we entered their indicated destinations. KlimAktiv then calculated the CO<sub>2</sub> emissions and we built

a sum index per person. In order to calculate the emissions of frequent flyers, we entered the examples for the chosen reference categories (e.g., Hamburg – Munich for the distance category 500-1,000 km) and also built a sum index. Hence, the calculation for the frequent flyers is less precise than that for occasional flyers. However, we deemed it an unbearable burden to ask frequent flyers to list all of their flights in the last five years.

#### *1.4.4. Refraining from Flight Travel*

We asked participants how often in the past five years they had refrained from flying on a 7-point scale (*never, very rarely, rarely, occasionally, often, very often, always*). The original item in German wording read: Haben Sie in den letzten 5 Jahren bewusst auf Flugreisen verzichtet? Answer scale: 1 = nie, 2 = sehr selten, 3 = selten, 4 = gelegentlich, 5 = oft, 6 = sehr oft, 7 = immer. We asked people who had refrained from flying in the last five years to indicate the reasons, with the option to select multiple answers. In the following, we give an overview on the frequencies:

- Climate protection ( $n = 184$ )
- Support of alternative ways to travel (e.g., train,  $n = 134$ )
- No desire or need to fly ( $n = 88$ )
- Flights too expensive ( $n = 54$ )
- Illness (e.g., travel sickness, flight anxiety,  $n = 29$ )
- Not able to pay for flights in general ( $n = 21$ )
- Private commitments (e.g., caring for family member,  $n = 18$ )
- Health-related reasons (e.g., cardiovascular disease,  $n = 8$ )
- Other reasons (open answer field;  $n = 22$ )

#### 1.4.5. Flight Shame

Participants indicated their agreement to the statements “I feel ashamed/guilty that I have travelled by airplane” on 7-point scales (*does not apply at all* to *fully applies*). The items highly correlated ( $r_s = .76, p < .001$ ) and we used mean scores for our analysis. The  $n = 26$  participants who had not flown did not receive this question (missing values).

#### 1.4.6. Policy Support

On a 7-point scale (*fully against* to *fully in favour*), participants rated five restrictive measures relating to cars (e.g., “creation of car-free city centres”), three restrictive measures relating to flying (e.g., “prohibition of private domestic flights below 1,000 km”), and three supportive measures relating to public transport and train travelling (e.g., “using public funds to provide free public transport”). We excluded one further assessed supportive item regarding biking from the final scale, because it reduced the model fit considerably. The CFA of the three-dimensional model with superordinate factor had an acceptable model fit except for CFI which is below the recommended threshold of .95 (Hair et al., 1998; Hu & Bentler, 1999),  $\chi^2(41) = 98.20, p < .001$ ; CFI = .93; TLI = .91; RMSEA = .066, 90% CI [.051, .082]; SRMR = .049. Factor loadings were between .42 and .78. Hence, the scale still needs improvement in future research, as also the average variance extracted (AVE) was below .50 (see Table 18).

In the following, we provide the full item list for policy support (German wording, see Loy & Reese, 2019; Tobler et al., 2012).

The original introduction sentence in German wording read: „Sind Sie grundsätzlich gegen oder für die folgenden politischen Maßnahmen, um CO<sub>2</sub>-Emissionen zu reduzieren und so das Klima zu schützen? Bitte überlegen Sie dabei, welche Folgen diese Maßnahmen für Ihr Leben haben.“

Answer scale: 1= vollkommen dagegen, 2 = überwiegend dagegen, 3 = eher dagegen. 4 = unentschieden, 5 = eher dafür, 6 = überwiegend dafür, 7 = vollkommen dafür

Restrictive measures relating to cars:

1. CO<sub>2</sub>-Bepreisung für Treibstoffe (Benzin, Diesel, Kerosin) \*
2. Einführung eines generellen Tempolimits 130 km/h auf Autobahnen
3. Schaffung autofreier Innenstädte
4. Verbindliche Grenzen für die CO<sub>2</sub>-Emissionen neuer Fahrzeuge
5. Keine Neuzulassung für Benzin- und Dieselfahrzeuge ab 2030

Restrictive measures relating to flying:

6. Verbot privater Inlandsflüge unter 1000 km
7. Verbindliches Kilometer-Budget für private Flugreisen pro Person
8. Verpflichtende Kompensationszahlungen für private Flugreisen \*\*

Supportive measures relating to public transport:

9. Verwendung öffentlicher Gelder für den Ausbau eines klimafreundlichen Transportsystems (Busse, Bahnen)
10. Verwendung öffentlicher Gelder für die Einführung eines kostenlosen öffentlichen Nahverkehrs
11. Verwendung öffentlicher Gelder für Urlaubszuschüsse zu Bahn- oder Busreisen

Supportive measure relating to biking (excluded from final scale):

12. Verwendung öffentlicher Gelder für den Ausbau von Radwegen

\* Infobox: Ein CO<sub>2</sub>-Preis wird für jede Tonne Kohlenstoffdioxid (CO<sub>2</sub>) gezahlt, die ausgestoßen wird. Er soll für Privatpersonen und Unternehmen einen Anreiz schaffen, weniger CO<sub>2</sub>-Emissionen zu verursachen und klimafreundlicher zu wirtschaften. Der CO<sub>2</sub>-Preis kann als CO<sub>2</sub>-Steuer oder als CO<sub>2</sub>-Emissionshandels-System umgesetzt werden.

\*\* Infobox: Eine Reise mit einem Flugzeug verursacht CO<sub>2</sub> und trägt damit zur globalen Erwärmung bei. Durch eine Spende an Klimaschutzprojekte (sogenannte „Kompensationszahlungen“) sollen die entstandenen CO<sub>2</sub>-Emissionen so weit wie möglich ausgeglichen werden. Klimaschutzprojekte setzen sich z. B. für den Erhalt von Wäldern ein oder fördern erneuerbare



Energien. Kompensation kann das Klimaproblem nicht lösen, weil sie nichts an den eigentlichen CO<sub>2</sub>-Quellen ändert. Sie ist eine vorübergehende Lösung für (noch) nicht vermeidbare Emissionen.

#### *1.4.7. Sufficiency Orientation*

We measured sufficiency orientation with six items from the sufficiency orientation short scale, capturing people's attitude towards a low-carbon lifestyle (e.g., "I find it desirable to possess few things only", Verfuert et al., 2019) and added one further item from a former version (i.e. "I reject the idea that more and more is being consumed", Henn, 2015). Moreover, we added seven items capturing people's conviction that consumption reduction is a necessary means to environmental and climate protection (e.g., "I think renouncing consumption is helpful for environmental and climate protection"). Participants stated their agreement on a 7-point scale (*fully against to fully in favour*). We excluded two reverse-coded items because they built a separate method factor, leaving six positively formulated items for each dimension. We excluded the values of  $n = 5$  cases (missing values). The CFA of the two-dimensional model with correlating factors had a satisfactory model fit,  $\chi^2(53) = 109.14, p < .001$ ; CFI = .96; TLI = .95; RMSEA = .058, 90% CI [.045, .072]; SRMR = .047. Factor loadings were between .48 and .86. The correlation of the two dimensions was .73. As the AVE of the low-carbon lifestyle dimension was below .50 (see Table 18), the scale can still be improved in future research.

This is the full item list for sufficiency orientation (German wording; see Verfuert et al., 2019):  
Answer scale: 1 = stimme überhaupt nicht zu, 2 = stimme überwiegend nicht zu, 3 = stimme eher nicht zu, 4 = stimme teilweise zu, 5 = stimme eher zu, 6 = stimme überwiegend zu, 7 = stimme voll und ganz zu

Low-carbon lifestyle:

1. Durch meinen Lebensstil will ich möglichst wenige Ressourcen verbrauchen.<sup>15</sup>
2. Ich finde es erstrebenswert, wenig zu besitzen.
3. Ich finde es erstrebenswert, so viele Lebensmittel wie möglich selbst anzubauen oder herzustellen.
4. Ich halte all die neuen Dinge, die ständig verkauft werden, für eine große Ressourcenverschwendung.
5. Ich finde es überflüssig, dass es in unseren Supermärkten so eine riesige Auswahl an Produkten gibt.
6. Ich lehne es ab, dass immer mehr konsumiert wird.

Consumption impact:

7. Hoher Konsum führt zu ungerechten Verteilungsverhältnissen der natürlichen Ressourcen (z.B. Bodenschätze, Wasser) in der Welt.
8. Durch hohen Konsum steigt die Umweltbelastung.
9. Um Umweltbelastungen zu reduzieren, ist es auch notwendig den eigenen Konsum zu reduzieren.
10. Ich denke, Konsumverzicht ist hilfreich für Umwelt- und Klimaschutz.
11. Konsumverzicht reduziert das Ausmaß der Klimaerwärmung.
12. Ich bin davon überzeugt, dass wir mit einer Lebensweise, die den Ressourcenverbrauch maßgeblich reduziert, auch das Fortschreiten des Klimawandels verhindern können.

Excluded:

13. Mein Komfort ist mir wichtiger als eine sparsame Lebensweise. (umgepolt)
14. Mein Komfort ist mir wichtiger als eine Änderung meiner Lebensweise zu Gunsten eines höheren Umweltschutzes. (umgepolt)

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<sup>15</sup> We assessed a slightly shortened version recommended by Henn (2015) that gave no examples on particular resources people want to use less. The 2019 version was formulated as follows: „Through my lifestyle, I want to use as little resources as possible (e.g., water, energy, wood)“ (Verfuerth et al., 2019).

Assessed but not used:

15. Ich bin ein genügsamer Mensch.

### **Supplementary Material: Results**

We repeated the correlation analyses involving flight-related CO<sub>2</sub> emissions excluding the  $n = 14$  outliers determined above (see Supplement 1.3). We found neither significant correlations of flight-related CO<sub>2</sub> emissions with the dimensions of global identity, namely global self-definition ( $r = .04$ ) and global self-investment ( $r = -.00$ ), nor with the dimensions of sufficiency orientation, namely support of a low-carbon lifestyle ( $r = -.10$ ) and the conviction that consumption reduction is helpful for environmental and climate protection ( $r = -.07, ps \geq .098$ ). Hence, specifically our results involving flight-related CO<sub>2</sub> emissions should be replicated before drawing firmer conclusions.

### Supplementary Material: Tables

Table 18 *Descriptives and psychometric properties of the measures*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	range	items	$\alpha$	$\omega$	AVE
Global identity	317	5.31	1.19	1.30-7.00	10	.95	.95	.69
Self-definition	317	5.07	1.31	1.00-7.00	5	.91	.92	.69
Self-investment	317	5.55	1.18	1.00-7.00	5	.92	.92	.70
Frequency of travelling Europe	317	4.53	1.71	1-7	1	-	-	-
Duration of travelling Europe (in weeks)	317	20.26	104.26	0-1637	1	-	-	-
Frequency of travelling beyond Europe	317	4.49	2.29	1-7	1	-	-	-
Duration of travelling beyond Europe (in weeks)	317	16.50	49.59	0-728	1	-	-	-
Quantity of contact with locals	314	3.86	1.46	1.00-7.00	5	.84	.84	.51
Quality of contact with locals	314	5.59	0.91	2.00-7.00	5	.78	.78	.41
Flight-related CO <sub>2</sub> emissions (in tons per person)	302	23.05	50.35	0-590	1	-	-	-
Refraining from flight travel	317	3.54	1.86	1-7	1	-	-	-
Flight shame	291	3.12	1.68	1.00-7.00	2	-	-	-
Willingness CO <sub>2</sub> compensation	317	4.41	1.74	1-7	1	-	-	-
Amount CO <sub>2</sub> compensation (in €)	313	23.26	19.55	0-100	1	-	-	-
Accepted train price (in €)	311	102.52	88.63	1-1000	1	-	-	-
Accepted train duration (in h)	311	9.44	10.33	1-84	1	-	-	-
Policy support (3-dim)	317	4.88	1.11	1.08-7.00	11	.85	.88	.45
Sufficiency orientation	312	5.25	0.96	1.92-7.00	12	.90	.91	.50
Low-carbon lifestyle	312	4.82	1.08	1.00-7.00	6	.82	.82	.43
Consumption impact	312	5.69	1.05	1.83-7.00	6	.89	.90	.59

Note.  $\alpha$  = Cronbach's alpha;  $\omega$  = Raykov's omega; AVE = average variance extracted.

Table 19 *Bivariate correlations of the main study variables*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Global self-definition <sup>a</sup>																	
2. Global self-investment <sup>a</sup>	.94*																
3. Sufficiency orientation – low-carbon lifestyle <sup>a</sup>	.44*	.47*															
4. Sufficiency orientation – consumption impact <sup>a</sup>	.42*	.49*	.80*														
5. Frequency of travelling Europe <sup>b</sup>	.03	.03	-.14*	-.08													
6. Duration of travelling Europe	-.05	-.05	-.08	-.17*	.18*												
7. Frequency of travelling beyond Europe <sup>b</sup>	.08	.07	-.06	-.08	.17*	.16*											
8. Duration of travelling beyond Europe	.10	.10	.08	.04	.16*	.39*	.56*										
9. Quantity of contact with locals <sup>a</sup>	.24*	.21*	.09	.03	.20*	.16*	.28*	.25*									
10. Quality of contact with locals <sup>a</sup>	.27*	.27*	.08	.08	.11*	.04	.12*	.08	.37*								
11. Flight-related CO <sub>2</sub> emissions	-.08	-.12*	-.14*	-.15*	.31*	.00	.51*	.08	.22*	.21*							
12. Refraining from flight travel	.22*	.25*	.39*	.31*	-.02	-.04	-.17*	.02	.03	-.01	-.18*						
13. Flight shame	.35*	.40*	.46*	.45*	-.07	-.08	-.08	.03	.10	.05	-.04	.38*					
14. Willingness CO <sub>2</sub> compensation	.34*	.39*	.39*	.36*	-.05	.01	-.05	.08	.09	.12*	-.16*	.28*	.37*				
15. Amount CO <sub>2</sub> compensation	.21*	.22*	.20*	.17*	.01	-.01	-.01	-.00	.01	-.00	-.09	.20*	.22*	.27*			
16. Accepted train price	.15*	.16*	.22*	.19*	.07	.01	.05	.02	.13*	-.01	.00	.27*	.14*	.22*	.20*		
17. Accepted train travel duration	.13*	.12*	.17*	.17*	.00	-.03	-.06	-.01	.06	-.04	-.08	.15*	.11	.12*	-.02	.14*	
18. Policy support <sup>a</sup>	.43*	.48*	.65*	.65*	-.13*	-.12*	-.14*	.06	.04	.10	-.19*	.44*	.62*	.52*	.31*	.29*	.20*

Note. \*  $p < .05$ . We used pairwise exclusion of missing cases. <sup>a</sup> Factor scores resulting from CFA were used. <sup>b</sup> Spearman correlations were calculated for ordinal variables; all others are Pearson correlations.

## APPENDIX IV: SUPPLEMENTARY MATERIAL MANUSCRIPT 5

All Supplementary Material is available online: <https://osf.io/f68nc/>

### Supplementary Material S3

#### 1. Methods

##### 1.1. Information about sufficiency (provided to the Intervention Group)

###### A) German version

*Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,  
bevor Sie Ihr Konsumtagebuch beginnen, möchten wir Sie bitten, sich die folgenden Informationen durchzulesen:*

*Im Fokus unserer Untersuchung steht das Thema "Suffizienz". Was ist Suffizienz und warum brauchen wir sie? Ein suffizienter Lebensstil zeichnet sich durch freiwilligen Verzicht auf übermäßigen Konsum aus. Es geht dabei nicht um Verzicht auf Notwendiges, sondern darum, mit dem Ausreichenden zufrieden zu sein. Wer sich suffizient verhält, verzichtet ganz einfach auf bestimmte materielle Güter oder Aktivitäten, nutzt Produkte gemeinsam mit anderen und versucht im Alltag generell weniger Ressourcen zu verbrauchen. Welche positiven Auswirkungen auf die Umwelt diese Lebensweise mit sich bringt, ist naheliegend: Ressourcen werden geschont und Emissionen vermieden! Suffizienz kann auch von materiellem Ballast befreien und dadurch das eigene Wohlbefinden steigern.*

*Wie gelingt es, sich suffizient zu verhalten?*

*Ein erster möglicher Schritt besteht darin, sich den eigenen alltäglichen Konsum und die damit einhergehenden Gedanken und Gefühle genauer anzusehen. In Ihrem Tagebuch geht es deshalb um die Auseinandersetzung mit Situationen, in denen Sie etwas kaufen, verbrauchen oder auf Konsum verzichten.*

*Bitte klicken Sie nun auf "Weiter", um mit Ihrem Tagebuch zu beginnen.*

###### B) English version

*Dear participant,*

*Before you start your consumption diary, we would like to ask you to read the following information: The focus of our study is on the topic of "sufficiency". What is sufficiency and why do we need it? A sufficient lifestyle is characterized by voluntarily refraining from excessive consumption. It is not a matter of doing without what is necessary, but of being satisfied with what is sufficient. Those who behave sufficiently simply do without certain material goods or activities, share products with others, and generally try to use fewer resources in everyday life. The positive environmental effects of this way of life are obvious: resources are conserved and emissions avoided! Sufficiency can also free us from material ballast and thus increase our own sense of well-being.*

*How do we succeed in behaving sufficiently?*

*A first possible step is to take a closer look at one's own everyday consumption and the thoughts and feelings that go along with it. Your diary is therefore about dealing with situations in which you buy something, consume something or abstain from consuming*

*something.*

*Please click on "Continue" to start your diary.*

## 1.2. Instructions

### A1) Intervention group (German version)

*Bitte nehmen Sie sich ein paar Minuten Zeit und versuchen Sie sich an die Situationen zu erinnern, in denen Sie heute etwas gekauft, verbraucht oder bewusst darauf verzichtet haben. Das können sowohl Situationen sein, in denen sie Artikel wie z.B. ein Kleidungsstück erworben haben, als auch Situationen, in denen Sie Ressourcen wie Benzin oder Einwegartikel verbraucht haben.*

*Wie viel Zeit Sie dafür aufwenden wollen, ist Ihnen überlassen.*

*Notieren Sie anschließend im untenstehenden Feld die Gedanken und Gefühle, die bei der Erinnerung an Ihren Konsum aufgetaucht sind.*

*Es könnte sein, dass es Ihnen am Anfang nicht leichtfällt, sich zu erinnern. Mit der Zeit kann das Tagebuch Sie aber dabei unterstützen.*

*Ihr Eintrag wird höchst vertraulich behandelt und nicht bewertet. Er dient lediglich Ihrer persönlichen Reflexion.*

*Zur Unterstützung beim Schreiben können Sie die folgenden Fragen heranziehen:*

- 1. Was habe ich heute gefühlt und gedacht, als ich etwas konsumiert habe, konsumieren wollte oder auf Konsum verzichtet habe?*
- 2. Wie fühle und denke ich jetzt darüber?*
- 3. Benötige ich die Waren, die ich gekauft habe, tatsächlich?*
- 4. Kann ich aus meinem heutigen Konsumverhalten irgendwelche Erkenntnisse gewinnen? Wenn ja, welche?*

### A2) Intervention group (English version)

*Please take a few minutes and try to remember the situations in which you bought, consumed, or deliberately did without something today. These can be situations in which you bought items such as a piece of clothing as well as situations in which you used resources such as petrol or disposable items.*

*How much time you want to spend on this is up to you.*

*Then write in the field below the thoughts and feelings that came up when you remembered your consumption.*

*It could be that it is not easy to remember at the beginning. However, over time, the diary can help you do so.*

*Your entry will be treated in the strictest confidence and will not be judged. It serves only your personal reflection.*

*You can use the following questions to help you write:*

- 1. What did I feel and think today when I consumed something, wanted to consume, or refrained from consuming?*
- 2. How do I feel and think about it now?*
- 3. Do I really need the goods I bought?*
- 4. Can I gain any insights from my current consumption behavior? If so, which ones.*

B1) Instructions control group (German version)

*Bitte nehmen Sie sich ein paar Minuten Zeit und notieren Sie, was Sie heute alles gekauft, verbraucht und verzehrt haben.*

*Um sich möglichst gut zu erinnern, kann es hilfreich sein, den Tag in Gedanken von morgens bis abends durchzugehen.*

*Der folgende Tagebucheintrag veranschaulicht, wie Sie Ihren Eintrag gestalten könnten.*

*Unser Beispiel Amanda notiert Folgendes:*

*Wasser beim Duschen, Zahnpasta, Duschgel und Make-Up, Strom und Wasser bei der Zubereitung des Frühstücks, Strom bei der Bahnfahrt zur Uni, Kaffee-To-Go-Becher, Papierhandtücher und Wasser auf der öffentlichen Toilette, Einwegbesteck und -geschirr, Strom beim Laden von Laptop und Handy, Kauf von Batterien, Kauf von 2 T-Shirts, Strom beim Fernsehen, Strom und Lebensmittelverpackungen beim Kochen, Strom und Wasser bei der Verwendung des Geschirrspülers, Wasser beim Gesicht waschen und Zähneputzen, Zahnpasta und Abschminklotion, Strom für Licht zum Lesen*

*Es könnte sein, dass es Ihnen am Anfang nicht leichtfällt, sich an alle Konsumsituationen zu erinnern. Mit der Zeit kann das Tagebuch Sie aber dabei unterstützen, sich leichter zu erinnern. Es ist auch nicht schlimm, falls Sie mal etwas vergessen haben sollten und es Ihnen erst im Nachhinein einfällt. In diesem Fall können Sie einfach versuchen beim nächsten Eintrag daran zu denken.*

*Ihr Eintrag wird höchst vertraulich behandelt und nicht bewertet. Er dient lediglich Ihrer persönlichen Reflexion.*

*Zweck dieses Eintrags ist es, sich vor Augen zu führen, wie viel man tatsächlich im Alltag konsumiert.*

*Zur Unterstützung beim Schreiben können Sie die folgenden Fragen heranziehen:*

- 1. Welche materiellen Güter habe ich heute konsumiert? Beispiele: Kleidung, Hygieneartikel, Elektronik etc.*
- 2. Welche Verpackungen und Einwegartikel habe ich heute konsumiert? Beispiele: nicht-wieder verwendbare Kaffeebecher, Papierhandtücher etc.*
- 3. Welche sonstigen Ressourcen habe ich heute verbraucht? Beispiele: Strom, Wasser, Treibstoff etc.*

B2) Instructions control group (English version)

*Please take a few minutes and write down everything you bought, used, and consumed today.*

*In order to remember what you consumed as well as possible, it can be helpful to go through the day in your mind from morning to night.*

*The following diary entry illustrates how you could design your entry. Our example Amanda notes the following:*

*Water when taking a shower, toothpaste, shower gel and make-up, electricity and water when preparing breakfast, electricity when taking the train to the university, coffee to-go cups, paper towels and water in the public toilet, disposable cutlery and dishes, electricity when charging laptop and mobile phone, purchase of batteries, purchase of 2 T-shirts, electricity for television, electricity and food packaging when cooking, electricity and water for dish washer, water for washing face and brushing teeth, toothpaste and make-up remover, electricity for reading lights*



*You may find it difficult to remember all consumption situations at the beginning. But over time, the diary can help you to remember more easily. It is also not a problem if you forgot something that you remember later. In that case you can simply try to remember it the next time you make an entry.*

*Your entry will be treated in the strictest confidence and will not be judged. It only serves your personal reflection.*

*The purpose of this entry is to show you how much you actually consume in everyday life.*

*You can use the following questions to help you write your entry:*

- 1. What material goods have I consumed today? Some examples: clothing, hygiene products, electronics, etc.*
- 2. What packaging and disposables have I consumed today? Examples: non-reusable coffee mugs, paper towels, etc.*
- 3. Which other resources have I consumed today? Examples: electricity, water, fuel, etc.*

### *1.3. E-mail conversation with participants and diary entry reminder*

We present the German original versions and the English translations below.

#### A1) E-mail 1 (German version)

*Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,*

*vielen Dank, dass Sie sich für unsere **Studie zu umweltschützendem Verhalten** interessieren!*

*Wir werden Sie **innerhalb der nächsten 3 Tage** kontaktieren, nachdem sich alle an der Studienteilnahme Interessierten bei uns gemeldet haben. Im Anschluss erhalten Sie per E-Mail einen Link, mit dem Sie zum ersten Fragebogen gelangen.*

*Die Beantwortung dieses Fragebogens nimmt **ca. 20 Minuten** Zeit in Anspruch. Ihre Daten werden selbstverständlich **anonym** behandelt und nur für wissenschaftliche Zwecke verwendet.*

*Nachdem Sie den ersten Fragebogen ausgefüllt haben, beginnt am nächsten Tag gegen 18 Uhr Ihr Online-Tagebuch. Alle weiteren Infos zum Ablauf der Studie erhalten Sie in der nächsten E-Mail. Bitte sorgen Sie daher dafür, dass Sie über Ihre E-Mailadresse erreichbar sind und kontrollieren Sie notfalls Ihren **Spam-Ordner**.*

*Sollten Sie sich in der Zwischenzeit gegen die Teilnahme an unserer Studie entscheiden, möchten wir Sie bitten uns dies kurz per E-Mail mitzuteilen.*

*Wir würden uns freuen, Sie als Teilnehmer/in begrüßen zu dürfen!*

#### A1.1) E-mail 1 (English version)

*Dear participant,*

*Thank you for your interest in our study on environmentally protective behavior!*

*We will contact you within the next 3 days after all those interested in participating in the study have contacted us. You will then receive an e-mail with a link that will take you to the first questionnaire.*

*Answering this questionnaire will take about 20 minutes. Your data will of course be treated anonymously and will only be used for scientific purposes.  
After you have completed the first questionnaire, your online diary will begin at around 6 p.m. the next day. You will receive all further information about the course of the study in the next e-mail. Therefore, please make sure that you can be reached via your e-mail address and check your spam folder if necessary.  
Should you in the meantime decide not to participate in our study, we would like to ask you to inform us briefly via e-mail.  
We would be pleased to welcome you as a participant!*

A2) E-mail 2 (German version)

*Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer, vielen Dank, dass Sie sich zur Teilnahme an unserer Studie bereit erklärt haben.*

*Bevor es morgen mit Ihrem Online-Konsumtagebuch losgehen kann, ist es **wichtig**, dass Sie **heute den ersten Fragebogen ausfüllen**. Ihre Daten werden selbstverständlich anonym behandelt und nur für wissenschaftliche Zwecke verwendet.*

*Die Bearbeitung dauert einmalig **ca. 20 Minuten**. Den Link, mit dem Sie zur Umfrage gelangen, finden Sie **weiter unten in dieser E-Mail**.*

***Ab morgen** bekommen Sie täglich über den Zeitraum von einer Woche eine E-Mail mit einem Link zu Ihrem Online-Tagebuch von uns.*

***Folgen Sie diesem Link zur Umfrage:***

*`\${l://SurveyLink?d=Fragebogen zur Konsumstudie}` Oder kopieren Sie folgende URL in Ihren Internetbrowser: `\${l://SurveyURL}`*

*Falls es irgendwelche Schwierigkeiten gibt, können Sie sich jederzeit bei uns per E-Mail (konsum-studie@web.de) melden.*

*Vielen Dank im Voraus für Ihr Engagement*

A2.1) E-mail 2 (English version)

*Dear participant,*

*Thank you for agreeing to participate in our study.*

*Before you get started with your online consumption diary tomorrow, it is **important** that you **complete the first questionnaire today**. Your data will of course be treated anonymously and used only for scientific purposes.*

*This survey will take **about 20 minutes** to complete and will only be answered once. The link that will take you to the survey can be found **further down in this email**.*

***Starting tomorrow**, for one week you will receive a daily email from us with a link to your online diary.*

***Follow this link to access the survey:***

*`\${l://SurveyLink?d=consumer survey questionnaire}` Or copy the following URL into your internet browser: `\${l://SurveyURL}`*

*If there are any difficulties, please feel free to contact us via email (konsum-studie@web.de).*

*Thank you in advance for your commitment!*

A3) E-mail 3 (German version)

*„Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,*

*über die Beantwortung des Fragebogens haben Sie bereits den ersten Teil dieser Studie abgeschlossen. Falls Sie ihn noch nicht ausgefüllt haben, bitten wir Sie, dies über Anklicken des Links aus der gestrigen E-Mail noch zu tun.*

***Heute** beginnt Ihr Tagebuch. Hier geht's zu Ihrem ersten Tagebucheintrag. Falls es Schwierigkeiten bei der Bearbeitung gibt, können Sie sich jederzeit bei uns per E-Mail (konsum-studie@web.de) melden. Vielen Dank für Ihre Unterstützung! In diesem Sinne wünschen wir Ihnen eine achtsame Konsumwoche!*

*Folgen Sie diesem Link, um zukünftig keine weiteren E-Mails zu erhalten: [{/OptOut-Link?d=Klicken Sie hier, um sich abzumelden}](#)“*

A3.1) E-mail 3 (English version)

*Dear participant,*

*By answering the questionnaire, you have already completed the first part of this study. If you have not yet completed it, please still do so by clicking on the link from yesterday's email.*

***Today** your diary starts. Click here to access your first diary entry. If there are any difficulties in editing, please feel free to contact us by email (konsum-studie@web.de). Thank you very much for your support! On that note, we wish you a mindful consumption week!*

*Follow this link to stop receiving emails in the future: [{/OptOutLink?d=Click here to unsubscribe}](#)*

A4) Reminder during intervention (E-mails 4 – 8, German version)

*Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,*

- Version 4: wir hoffen, Sie hatten einen guten Einstieg in Ihr Konsumtagebuch. Es ist kein Problem, falls Sie gestern keinen Eintrag verfasst haben sollten. Sie können weiterhin an der Studie teilnehmen und heute mit Tag 2 weitermachen, indem sie auf den untenstehenden Link klicken.*
- Version 5: schön, dass Sie noch dabei sind.*
- Version 6: die Hälfte der Zeit Ihres Konsumtagebuches ist bereits rum.*
- Version 7: wir hoffen, das Konsumtagebuch läuft zu Ihrer Zufriedenheit.*
- Version 8: wir hoffen, Sie haben bereits einige interessante Erkenntnisse über Ihren Konsum gewonnen. Auch wenn Sie vielleicht nicht jeden Tag Tagebuch geführt haben, freuen wir uns, wenn Sie sich heute noch einmal Mal die Zeit nehmen. Hier geht's zu Ih-*

*rem nächsten Tagebucheintrag. Falls es irgendwelche Schwierigkeiten bei der Bearbeitung gibt, können Sie sich jederzeit bei uns per E-Mail (konsum-studie@web.de) melden. Vielen Dank für Ihre Unterstützung!*

*Hier geht's zu Ihrem nächsten Tagebucheintrag. Falls es irgendwelche Schwierigkeiten bei der Bearbeitung gibt, können Sie sich jederzeit bei uns per E-Mail (konsum-studie@web.de) melden. Vielen Dank für Ihre Unterstützung!*

*Folgen Sie diesem Link, um zukünftig keine weiteren E-Mails zu erhalten: [\\${!://OptOut-Link?d=Klicken Sie hier, um sich abzumelden}](#)“*

#### A4.1) Reminder during intervention (E-mails 4 – 8, English version)

*"Dear Participant,*

- Version 4: We hope you had a good start to your consumption diary. It is not a problem if you did not write an entry yesterday. You can still participate in the study and continue with Day 2 today by clicking on the link below.*
- Version 5: We are glad you are still participating.*
- Version 6: Half of your consumption diary time is already up.*
- Version 7: We hope the consumption diary is running to your contentment.*
- Version 8: We hope you have already gained some interesting insights into your consumption behavior. Even though you may not have kept a diary every day, we would be happy if you took the time to do so again today. Here is the link to your next diary entry. If there are any difficulties in editing, please feel free to contact us by email (konsum-studie@web.de). Thank you for your support!*

*Here is the link to your next diary entry. If there are any difficulties in editing, you can always contact us by email (konsum-studie@web.de). Thank you for your support!*

*Follow this link to stop receiving emails in the future: [\\${!://OptOutLink?d=Click here to unsubscribe}](#)“*

#### A5) E-mail 9 and invitation to post-intervention measurement (T2, German version)

*Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer, heute ist der **letzte Tag** Ihres Konsumtagebuchs.*

*Wir freuen uns, dass Sie bis zum Ende mitgemacht haben und wir Ihre Daten für unsere Forschung verwenden dürfen. An dieser Stelle ein **herzliches Dankeschön!***

*Darüber hinaus hoffen wir natürlich, dass Sie durch Ihre Teilnahme an unserer Studie vielleicht auch für sich persönlich etwas mitnehmen konnten!*

*Nachdem Sie Ihren letzten Tagebucheintrag verfasst haben, werden Sie sogleich zum **zweiten Fragebogen** dieser Studie weitergeleitet. Die heutige Aufgabe dauert daher insgesamt ca. 10 Minuten länger als üblich.*

**Bitte füllen Sie beides heute aus.** Ihre Daten werden selbstverständlich anonym behandelt und nur für wissenschaftliche Zwecke verwendet.

Hier geht's zu Ihrem letzten Tagebucheintrag und zum Fragebogen.

In einem Monat melden wir uns ein letztes Mal mit einer Nachbefragung bei Ihnen. Wir würden uns freuen, wenn Sie auch diese beantworten, da sie ein wesentlicher Bestandteil unserer Studie ist.

Vielen Dank für Ihre Zeit und Unterstützung!

Folgen Sie diesem Link, um zukünftig keine weiteren E-Mails zu erhalten: [\\${l://OptOut-Link?d=Klicken Sie hier, um sich abzumelden}](#)

#### A5.1) E-mail 9 and invitation to post-intervention measurement (T2, English version)

Dear participant,

Today is the **last day** of your consumption diary.

We are pleased that you have participated until the end and that we may use your data for our research. We would like to take this opportunity to **thank you!**

In addition, we of course hope that you were able to take something away for yourself through your participation in our study!

After you have written your last diary entry, you will be immediately forwarded to the **second questionnaire** of this study. Today's task will therefore take a total of about 10 minutes longer than usual.

**Please complete both today.** Your data will of course be treated anonymously and used for scientific purposes only.

[Click here](#) for your last diary entry and the questionnaire.

In one month we will contact you one last time with a follow-up survey. We would be pleased if you would also answer this one, as it is an essential part of our study.

Thank you for your time and support!

Follow this link to stop receiving emails in the future: [\\${l://OptOutLink?d=Click here to unsubscribe}](#)"

#### A6) E-mail 10 – invitation to follow up measurement (T3)

Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,  
Sie haben **vor vier Wochen** an unserer Konsumstudie im Rahmen unserer Masterarbeit teilgenommen.

Um den Erkenntnisgewinn unserer Untersuchung zu erhöhen, führen wir nun eine **10 bis 20-minütige Nachbefragung** durch.

Wir würden uns freuen, wenn Sie uns erneut dabei unterstützen würden! Ihre Daten werden selbstverständlich anonym behandelt und nur für wissenschaftliche Zwecke verwendet.

**Bitte beantworten Sie die Umfrage innerhalb der nächsten Woche. Bitte klicken Sie erst auf den Link, wenn Sie auch die Zeit zur Bearbeitung des Fragebogens haben, da der Zugang zum Fragebogen nach einiger Zeit verfällt.**

**Hier geht's zur Nachbefragung.**

Falls Schwierigkeiten auftreten sollten, melden Sie sich gerne unter [konsum-studie@web.de](mailto:konsum-studie@web.de) bei uns.

Nach Ausfüllen dieses dritten und letzten Fragebogens ist Ihre Teilnahme an unserer Studie **offiziell beendet**. Es folgen keine weiteren E-Mails und Befragungen mehr.

Wenn Sie die Teilnahme an der Studie abgebrochen haben, können Sie diese Mail als gegenstandslos betrachten.

Falls Sie **Interesse an den Ergebnissen** unserer Studie haben, können Sie sich gerne unter [konsum-studie@web.de](mailto:konsum-studie@web.de) bei uns melden. Die Ergebnisse werden voraussichtlich innerhalb der nächsten Wochen vorliegen.

Vielen Dank für Ihre Zeit und Unterstützung!

Folgen Sie diesem Link, um zukünftig keine weiteren E-Mails zu erhalten: [\\${l://OptOutLink?d=Klicken Sie hier, um sich abzumelden}](#)“

A6.1) E-mail 10 – invitation to follow up measurement (T3, English version)

Dear participant,

**Four weeks ago**, you participated in our consumption study as part of our master's thesis. In order to increase the knowledge gain of our study, we are now conducting a **10 to 20 minute follow-up survey**.

We would be pleased if you would support us again! Your data will of course be treated anonymously and used for scientific purposes only.

**Please answer the survey within the next week. Please do not click on the link until you have the time to complete the questionnaire**, as access to the questionnaire expires after some time.

**Click here to access the follow-up questionnaire.**

If you encounter any difficulties, please feel free to contact us at [konsum-studie@web.de](mailto:konsum-studie@web.de).

After completing this third and final questionnaire, your participation in our study **has officially ended**. No further emails or surveys will follow.

If you have discontinued your participation in the study, you can consider this mail as irrelevant.

**If you are interested in the results** of our study, please feel free to contact us at [konsum-studie@web.de](mailto:konsum-studie@web.de). The results are expected to be available within the next few weeks.

Thank you for your time and support!

Follow this link to stop receiving emails in the future: [\\${l://OptOutLink?d=Click here to unsubscribe}](#)

A7) Reminder to follow-up measurement (T3, English version)

„Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,  
hiermit möchten wir Sie an die **Nachbefragung** im Rahmen unserer Konsumstudie **erinnern**. Die Bearbeitung dauert **ca. 10 bis 20 Minuten**. Wir würden uns freuen, wenn Sie uns dabei unterstützen!

Wenn Sie schon teilgenommen haben, können Sie diese E-Mail als gegenstandslos betrachten.

**Bitte klicken Sie erst auf den Link, wenn Sie Zeit für die Beantwortung haben, da die Antworten nicht zwischengespeichert werden können. Falls der untenstehende Link nicht funktioniert, verwenden Sie bitte den Link aus der E-Mail "Konsumstudie - kurze Nachbefragung" vom 27.10. oder schreiben Sie uns an konsum-studie@web.de.**

**Hier geht's zur Nachbefragung.**

Ihre Daten werden selbstverständlich anonym behandelt und nur für wissenschaftliche Zwecke verwendet.

Mit Beantwortung der Nachbefragung ist Ihre Teilnahme an unserer Studie **offiziell beendet**. Es folgen keine weiteren E-Mails und Befragungen mehr.

Vielen Dank für Ihre Zeit und Unterstützung!

Folgen Sie diesem Link, um zukünftig keine weiteren E-Mails zu erhalten: [\\${l://OptOutLink?d=Klicken Sie hier, um sich abzumelden}](#)

#### A7.1) Reminder to follow-up measurement (T3, English version)

Dear Participant,

We would hereby like to **remind** you of **the follow-up survey** as part of our consumption study. It will take about **10 to 20 minutes** to complete. We would be pleased if you would support us with this!

If you have already participated, you can consider this e-mail as irrelevant.

**Please do not click the link until you have time to respond**, as responses cannot be cached. If the link below does not work, please use the link from the "Consumption study - short follow-up survey" email dated Oct. 27 or write to us at konsum-studie@web.de.

**Click here for the follow-up survey.**

Your data will of course be treated anonymously and used for scientific purposes only.

By answering the follow-up questionnaire, your participation in our study **has officially ended**. No further emails or surveys will follow.

Thank you for your time and support!

Follow this link to stop receiving emails in the future: [\\${l://OptOutLink?d=Click here to unsubscribe}](#)

## 1.4. Participant flowchart

Figure 8 Participant flow chart diary intervention study

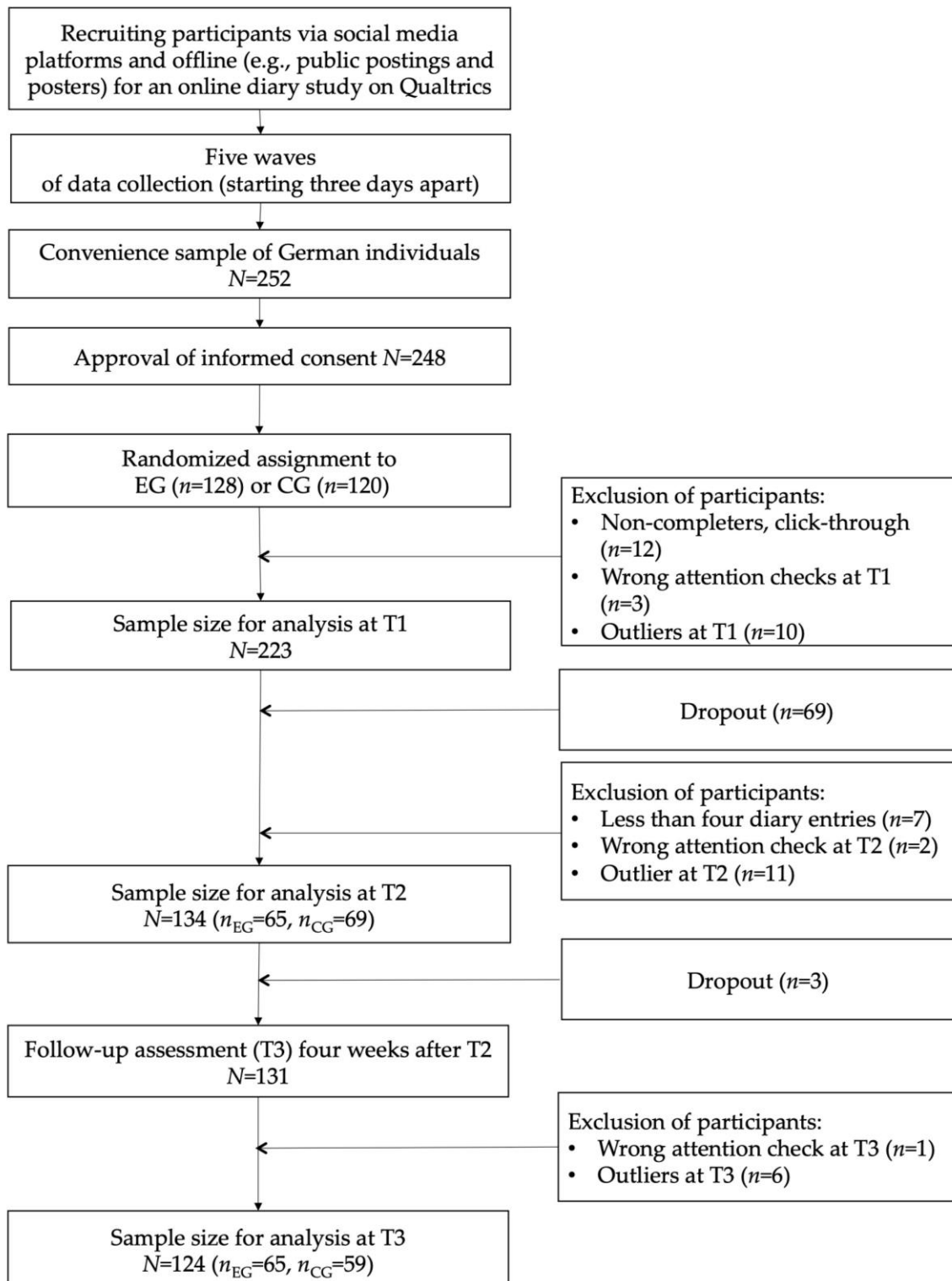




Table 20 *List of constructs, study items and response formats reflective diary intervention study*

<b>Construct</b>	<b>Source (Original)</b>	<b>Study Items</b>	<b>Item Response Format</b>
Sufficiency (SB)	CSC, Environmental Friendly Consumption [1]	If there is the possibility, I prefer to buy the product that ...	1 = strongly disagree ... 7 = strongly agree
		1. ... is made from recycled materials.	
		2. ... can be disposed of in an environmentally friendly manner.	
		3. ... is packaged in an environmentally friendly manner.	
		4. ... is produced in a manner which minimizes the use of resources.	
		5. ... is produced in an environmentally manner.	
		6. ... is produced in a climate-friendly manner.	
	CSC, Social Dimension [1]	I buy a product only if I believe that during manufacturing ...	1 = strongly disagree ...
		7. ... workers' human rights are adhered to.	7 = strongly agree
		8. ... no illegal child labor is involved.	
		9. ... workers are not discriminated against.	
		10. ... the minimum standards for workers' health and safety are adhered to?	
		11. ... Workers are treated fairly or are fairly compensated?	
	CSC, Voluntary Simplicity [1]	Even if I can financially afford a product, I only buy it if ...	1 = strongly disagree ...
		12. ... I really need it.	7 = strongly agree
		13. ... it is a useful product.	
		14. ... I absolutely require it.	
		15. ... it is unnecessary luxury.*	
	CSC, Collaborative Consumption [1]	Even with products that I can afford financially I consider ...	1 = strongly disagree ...
		16. ... borrowing them from friends or acquaintances.	7 = strongly agree
		17. ... sharing them with others rather than owning them myself.	
		18. ... whether I can rent the product instead of buying it.	

Sufficiency (SO)	Sufficiency Attitude [2]	<p>1. Through my lifestyle I want to use as little resources as possible (e.g. water, energy, wood).</p> <p>2. I find it desirable to possess few things only.</p> <p>3. I find it appealing to grow and produce as much food by myself as possible.</p> <p>4. My comfort is more important than a frugal way of life.*</p> <p>5. All the new things that are sold all the time are a big waste of resources to me.</p> <p>6. I think it is unnecessary to have this affluence of different products in our supermarkets.</p>	<p>1 = strongly disagree ...</p> <p>5 = strongly agree</p>
	Sufficiency Consumption impact (own formulation, [3])	<p>7. I am a frugal person.</p> <p>8. High consumption leads to unfair distribution of natural resources in the world.</p> <p>9. Abstaining from consumption can significantly reduce the extent of global warming.</p> <p>10. A lifestyle that significantly reduces the consumption of resources prevents progression of climate change.</p> <p>11. High consumption increases environmental pollution.</p> <p>12. To reduce environmental pollution, it is also necessary to reduce consumption.</p> <p>13. Consumption renunciation is usually helpful for environmental and climate protection.</p>	<p>1 = strongly disagree ...</p> <p>5 = strongly agree</p>
Basic Psychological Needs	BMPNS, Autonomy [4] (German translation by [5])	<p>1. I was free to consume my own way.</p> <p>2. My consumption choices expressed my “true self”.</p> <p>3. In consumption situations I had a lot of pressure I could do without.</p> <p>4. There were people telling me what I had to consume.</p> <p>5. I had to change my consumption behavior against my will.</p>	<p>1 = strongly disagree ...</p> <p>7 = strongly agree</p>
	Autonomy [6]	<p>6. My consumption choices were based on my true interests and values.</p>	<p>1 = strongly disagree ...</p> <p>7 = strongly agree</p>
	BMPNS, Competence [4] (German translation by [5])	<p>8. When it came to consumption I took on and mastered hard challenges.</p> <p>9. I did well even at the hard consumption situations.</p> <p>10. I experienced some kind of failure, or was unable to do well at the consumption situations.*</p> <p>11. While consuming I did something stupid, that made me feel incompetent.*</p>	<p>1 = strongly disagree ...</p> <p>7 = strongly agree</p>

	Competence [7]	12. I am able to live frugally.	1 = strongly disagree ... 7 = strongly agree
	BMPNS, Relatedness [4] (German translation by [5])	13. I felt a sense of contact with people who care for me, and whom I care for. 14. I felt close and connected with other people who are important to me. 15. I felt a strong sense of intimacy with the people I spent time with. 16. I was lonely.* 17. I felt unappreciated by one or more important people.* 18. I had disagreements or conflicts with people I usually get along with.*	1 = strongly disagree ... 7 = strongly agree
Self-Reflection	Groningen Reflection Ability Scale [8]	In the last week's consumption situation, ... 1. ... I wanted to know why I do what I do. 2. ... I was aware of the emotions that influenced my behavior. 3. ... I took a closer look at my own habits of thinking. 4. ... I was able to view my own behavior from a distance. 5. ... I wanted to understand myself. 6. ... I sometimes found myself having difficulty in thinking of alternative solutions. 7. ... I was aware of the emotions that influenced my thinking.	1 = strongly disagree ... 7 = strongly agree
Subjective Well-being	SPANE [9] (German translation by [10])	Please think about what you have been doing and experiencing during the past week. How often did you experience each of the following feelings? This past week I have been feeling ... 1. ... positive. 2. ... good. 3. ... pleasant. 4. ... happy. 5. ... joyful. 6. ... contented. 7. ... negative. 8. ... bad. 9. ... unpleasant. 10. ... sad. 11. ... afraid. 12. ... angry.	1 = very rarely or never 2 = rarely 3 = sometimes 4 = often 5 = very often or always

Time Af- fluence	MATAS [11] (German trans- lation by [12])	1. My life has been too rushed.	1 = very
		2. I have had plenty of spare time.	rarely or
		3. I have been racing from here to there.	never
		4. I have had enough time to do what I need to do.	2 = rarely
		5. I have been able to take life at a leisurely pace.	3 = some-
		6. There have not been enough minutes in the day.	times
		7. I have had enough time to do the things that are important to me.	4 = often
		8. I have felt like things have been really hectic.	5 = very often or always

*Note.* CSC: Consciousness for Sustainable Consumption. SO: Sufficiency Orientation, SB: Sufficiency Behavior, BMPNS: Balanced Measure of Psychological Needs Scale, SPANE: Scale of Positive and Negative Experience, MATAS: Material and Time Affluence Scale. \* Reversely coded items.

## 2. Some author comments

We want to briefly make some comments why we judge our interventino as unsuccessful and contributed to the special issue:

1. We made some methodological errors: We did not include a “real” control group and we missed a manipulation check on self-reflection.
2. We did make mistakes in our preregistration and preregistered different hypotheses, as well as modified our analyses afterwards which is not, in essence, the point of preregistration. However, we only afterwards realized that we formulated hypotheses that were to far reaching. We had an underpowered design thus we had to change our hypotheses.
3. Qualtrics made several mistakes: Coding of answers were partially wrong and needed to be re-coded in a very tedious process.

## 3. References

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Place of Residence Konstanz, Germany

**Education**

- Since 12/2017 Ph.D. Candidate at Environmental Psychology Research Group, University of Koblenz-Landau, Germany
- 03/2013 – 07/2013 Study abroad at Università degli Studi di Catania, Italy
- 05/2005 – 07/2012 Psychology (Diploma) and Literature, Arts & Media (Minor) at University of Konstanz, Germany, degree: 1.7 (good)  
Diploma Thesis: "Inducing the creation of implementation intentions through pictorial stimulation. A strategy to communicate consumer behaviour?"
- 08/2008 – 12/2008 Study abroad at Universidad de Monterrey, Mexico
- 08/1996 – 07/2004 Glückauf-Gymnasium Dippoldiswalde, Germany, degree: Abitur (1.0)

**Work Experience**

- Since 04/2021 Researcher at Fraunhofer Institute for Systems and Innovation Research ISI, Business Unit "Actors and Social Acceptance in the Transformation of the Energy System", Karlsruhe, Germany
- 03/2020 – 03/2021 Research assistant in the project "Überprüfung des NBS-Gesellschaftsindikators zum Bewusstsein für Biologische Vielfalt sowie Entwicklung eines alternativen Messverfahrens" [*Review of the NBS Social Indicator on Biodiversity Awareness and Development of an Alternative Measurement Method*], Steinbeis Transfer Centre Intervention and Evaluation Research represented by Prof. Dr. Sebastian Bamberg and Prof. Dr. Gerhard Reese
- 11/2017 – 03/2021 Research assistant at the University of Koblenz-Landau, Institute of Social, Environmental and Economic Psychology Personality
- 01/2017 – 11/2017 Staff member at Unit Communications and Marketing, University of Konstanz
- 09/2013 – 12/2016 Research assistant at Interdisciplinary Research Group on Environmental Issues, University of Koblenz-Landau, Campus Landau
- 09/2015 – 03/2016 Freelance work for the publishing house konstanz|university press
- 04/2013 – 05/2015 Conception and participation in the project ZukunftsWerkStadt 2.0, Translake GmbH, Konstanz
- 09/2012 – 02/2013 Staff member, Dep. for Sustainable Development, University of Konstanz

- 08/2010 – 02/2013    Freelance work for ECOCAMPING e.V., Konstanz
- 04/2010 – 07/2010    Research internship in the Peace Research Project Group with Prof. Dr Wilhelm Kempf, University of Constance
- 01/2009 – 03/2009    Internship at the Instituto Estatal de las Mujeres, Nuevo Leon, Mexico

### Teaching Experiences

Psychology teaching courses (M.A.):

- Test construction

Interdisciplinary and applied teaching courses (B.A.):

- Scientific inter- and transdisciplinary work and research II
- Entscheidungstheoretische Grundlagen von Umwelthandeln (*Theoretical decision basics of environmental action*)
- Case study

Key skills programme (M.A., B.A.)

- „Von Zero Waste, Suffizienz und dem Mut, mal Nein zu sagen.“ (*About zero waste, sufficiency and the courage to say "no"*, transferable skills programme, University of Konstanz)

### Publications

Tröger, J. & Wullenkord, M.C. (in press). Was ist genug? Begründung, Potentiale und Empfehlungen für mehr Suffizienz(orientierung). *Psychosozial-Verlag*.

Etzkorn, N., Tröger, J. & Reese, G. (in press). Klimakrise, Kolonialismus und sozial-ökologische Transformation. In C. Cohrs, N. Knab & G. Sommer (Eds.), *Handbuch Friedenspsychologie*.

Heidbreder, L.M., Tröger, J. & Schmitt, M. (in press). Reducing plastic consumption: exploring psychological antecedents of private and public behaviour towards ecological transition in consumerist sphere. *Environment, Development and Sustainability*

Tröger, J.\*, Wullenkord, M. C.\*, Barthels, C., & Steller, R. (2021). Can Reflective Diary-Writing Increase Sufficiency-Oriented Consumption? A Longitudinal Intervention Addressing the Role of Basic Psychological Needs, Subjective Well-Being, and Time Affluence. *Sustainability*, 13(9), 4885. <https://doi.org/10.3390/su13094885>

Wullenkord, M. C., Tröger, J., Hamann, K. R. S., Loy, L. S., & Reese, G. (2021). Anxiety and climate change: A validation of the Climate Anxiety Scale in a German-speaking quota sample and an investigation of psychological correlates. *Climatic Change*, 168(3–4), 20. <https://doi.org/10.1007/s10584-021-03234-6>

Tröger, J. & Menzel, C. (2021). Widerstandsfähig in einem sich wandelnden Klima? *Evangel Magazin für missionarisches Pastoral*, 1. <https://www.euangel.de/ausgabe-1-2021/resilienz/widerstandsfahig-in-einem-sich-wandelnden-klima/druck.html>

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- Hamann, K.R.S., Heidbreder, L.M., & Tröger, J. (2019). Mit Psychologie die Hebel zum Umweltschutz verstehen und fördern. *Report Psychologie*, 2/2019, 4-6.
- Reese, G., Drews, S., & Tröger, J. (2019). Warum haben wir Angst vor dem Weniger? Umweltpsychologie und Suffizienz im Fokus. In L. Voget-Kleschin, L. Bossert, & S. Meisch (Eds.), *Damit gutes Leben mit der Natur einfacher wird. Suffizienzpolitik für Naturbewahrung* (pp. 135–149). Metropolis-Verlag GmbH.
- Steinmetz, Z., Wollmann, C., Schaefer, M., Buchmann, C., David, J., Tröger, J., ... & Schaumann, G. E. (2016). Plastic mulching in agriculture. Trading short-term agronomic benefits for long-term soil degradation? *Science of the total environment*, 550, 690-705. <https://doi.org/10.1016/j.scitotenv.2016.01.153>

### **Presentations (selection)**

- Tröger, J., Loy, L. S., Prior, P., & Reese, G. (2021). *Sufficiency orientation and global identity: their contribution regarding sustainable travel behaviour and the support of a socio-ecological transformation in the mobility system*. Digital Poster presentation, ICEP Conference, Syracuse, 5<sup>th</sup> to 8<sup>th</sup> October, 2021.
- Tröger, J.\*, & Wullenkord, M.C.\* (2019). *Ohne Bedürfnisbefriedigung keine Suffizienz? Die mögliche Rolle psychologischer Grundbedürfnisse in suffizienzorientierten Gesellschaften*. Research talk at the specialist group symposium on environmental psychology, Bonn, 26. September 2019.
- Tröger, J., & Reese, G. (2019). *The potential of sufficiency: bridging intention-behavior gap and promoting societal change. A qualitative interview study with experts from science, politics, and economy exploring the transformative power of sufficiency*. Poster presentation, International Conference on Sustainability Research and Transformation „Leverage Points“, Lüneburg, 6<sup>th</sup> -8<sup>th</sup> February, 2019.
- Tröger, J. (2018). *Bedingungsloses Grundeinkommen – ein Schlüssel zur suffizienzorientierten Gesellschaft? Psychologische Perspektiven auf Wege in nachhaltigere Konsumverhältnisse. Psychologische Perspektiven auf nachhaltigere Konsumverhältnisse*. Research talk at Workshop „Lebensweise Grundeinkommen. Neues Schaffen durch anders (tätig) Sein?“, Postwachstumskolleg Jena, 15<sup>th</sup> – 16<sup>th</sup> November, 2018.
- Tröger, J., & Reese, G. (2018). *How to bridge the intention behaviour gap and promote a societal change? A qualitative interview study with experts from science, politics, and economy exploring the transformative potentials of sufficiency*. Research talk, Vilm Summerschool on Environmental Psychology, Insel Vilm, 18<sup>th</sup> - 21<sup>th</sup> June, 2018.



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## Transfer and Activism

since 06/2021	Board member of directors of the Heinrich Böll Foundation Baden-Württemberg
11/2020	Guest lecture "Üben für die sozial-ökologische Transformation? Umweltpsychologische Blicke auf die Klima- und die Coronakrise", Heinrich Böll Stiftung Baden-Württemberg
01/2020	Guest lecture "Mit Psychologie zu mehr Zukunftsfähigkeit" at Maria Ward High School, Landau
Since 10/2019	"Scientists for Future Podcast – Gespräche über Klimawandel und eine lebenswerte Zukunft", founding member, moderation, editorial board
03/2019 – 03/2021	Founding member and group management of the Scientist for Future Local group at University Koblenz-Landau, Campus Landau
2014 – 2018	Chairperson "Verein ehemaliger Stipendiat*innen der Heinrich Böll Stiftung e.V."
2006 – 2012	Study scholarship, Heinrich Böll Foundation e.V.
2009 – 2012	Founding member of the student sustainability council and conceptualisation of the department for sustainable development (today Green Office) through successful acquisition of third-party funding



Landau/Konstanz, 9<sup>th</sup> February, 2022

## EIDESSTATTLICHE ERKLÄRUNG

Hiermit erkläre ich eidesstattlich, dass ich, Josephine Tröger,

- die Dissertation selbst angefertigt habe und alle Hilfsmittel in der Dissertation angegeben habe,
- dass die Dissertation noch nicht als Prüfungsarbeit für eine staatliche oder andere wissenschaftliche Prüfung eingereicht wurde und
- die gleiche oder eine andere Abhandlung nicht bei einer anderen Hochschule als Dissertation eingereicht habe.

Bei gemeinsam verfassten Publikationen habe ich folgende individuelle Beiträge erbracht:  
Manuskript I

- Konzeption, Planung, Durchführung und Analysen (95%)
- Verfassen des Manuskripts (95%)

Manuskript II

- Konzeption und Planung der Studie in gemeinsamer Absprache mit der Erstautorin
- Verfassen des Manuskripts (Einleitung und Diskussion zu 40%; Methoden- und Ergebnissteil zu 10%)

Manuskript III

- Konzeption, Planung (70%)
- Durchführung und Analysen (95%)
- Verfassen des Manuskripts (90%)

Manuskript IV

- Konzeption, Planung, Durchführung und Analysen inb. für den Anteil zu Suffizienzorientierung in gemeinsamer Projektverantwortung und zu gleichen Teilen mit der geteilten Erstautorin (40% Eigenanteil).
- Gemeinsames Verfassen und Editieren des Manuskripts, insb. Textanteil zu Suffizienz mit der geteilten Erstautorin (40% Eigenanteil).

Manuskript V

- Konzeption, Planung, Durchführung und Analysen in gemeinsamer Verantwortung und zu gleichen Teilen mit der geteilten Erstautorin sowie in Zusammenarbeit mit den zwei Co-Autorinnen (40% Eigenanteil)
- Verfassen des Manuskriptes gemeinsam und zu gleichen Anteilen mit der geteilten Erstautorin (50% Eigenanteil)

Landau, den 9. Februar 2022

