



An Environmental Psychology Perspective on Sufficiency-oriented Consumption in Online Environments

Thesis

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By M. Sc. Frick, Vivian
born on April 27, 1988 in Grabs

Examiner: Prof. Dr. Ellen Matthies
Prof. Dr. Gerhard Reese

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Abstract

Online environments are gaining importance in environmental psychology as a new contextual factor that can enable or hinder pro-environmental behaviour. In my thesis, I examined how online environments influence consumption, in particular sufficiency-oriented consumption. My first research question was whether perceived behavioural efficiency gains of online shopping (i.e., saving time, money and effort) correlated with consumption levels of sufficiency-oriented and conventional goods or services. The second research question addressed how the perception of sufficiency-promoting and consumption-promoting content of online advertisement or social media influences sufficiency-oriented consumption.

The methodological approach included cross-sectional representative online surveys in three consumption domains (clothing $N = 883$, digital devices $N = 860$, and leisure travel $N = 976$), as well as a quasi-experimental field study ($N = 2113$) and a laboratory experiment ($N = 881$) on online interventions fostering clothing sufficiency.

For the first research question, the survey results showed online shopping to be perceived more behaviourally efficient than in-store purchase. Also, these perceived behavioural efficiency gains correlated with a higher probability of purchasing second-hand products and booking sustainable transport alternatives (train, bus). Yet, results on overall consumption of new clothing, digital devices or air travel were mixed. There was no indication of a direct influence of efficiency gains on consumption levels; rather the effect depended largely on individuals' existing motives, and in the case of leisure travel, was moderated by consumption intentions.

Addressing the second research question in the surveys, I found that the perception of consumption-promoting content in online advertisement and social media was consistently linked to less sufficiency-oriented consumption, which was mediated by stronger social norms for consumption and higher aspiration levels (i.e., perceived consumption desires). In contrast, perceiving sufficiency-promoting content could predict personal and social norms for sufficiency, yet none of these predictors were correlated with sufficiency-oriented consumption. In the quasi-experimental field experiment, sufficiency-promoting communication was not effective in reducing consumption levels, but the laboratory experiment could show sufficiency-promoting social media content to foster sufficiency-oriented decisions in short term in the laboratory.

Insights derived from the thesis include the importance of predictors and antecedents of unsustainable consumption for future research in environmental psychology, as well as starting points for addressing the identified limitations to this work and other methodological challenges related to investigating the influence of online environments on behaviour.

Zusammenfassung

Online-Umwelten gewinnen in der Umweltpsychologie als neuer Kontextfaktor an Bedeutung. Sie können umweltfreundliches Verhalten ermöglichen, aber auch behindern. In meiner Dissertation habe ich untersucht, wie Online-Umgebungen den Konsum, und insbesondere den suffizienten Konsum beeinflussen. Meine erste Forschungsfrage lautete daher, ob die wahrgenommenen verhaltensbezogenen Effizienzgewinne des Online-Einkaufs (d.h., Zeit, Aufwand und Geld zu sparen) mit dem Konsumniveau von suffizienzorientierten und konventionellen Produkten oder Dienstleistungen korrelieren. Die zweite Forschungsfrage bezog sich darauf, wie die Wahrnehmung von suffizienzfördernden und konsumfördernden Inhalten in Online-Werbung und Social Media den suffizienten Konsum beeinflusst.

Der methodische Ansatz umfasste repräsentative Online-Querschnittsbefragungen in drei Konsumbereichen (Kleidung $N = 883$, digitale Geräte $N = 860$ und Freizeitreisen $N = 976$) sowie eine quasi-experimentelle Feldstudie ($N = 2113$) und ein Laborexperiment ($N = 881$) zu Online-Interventionen zur Förderung von Suffizienz im Kleidungsbereich.

Bezüglich der ersten Forschungsfrage zeigten die Befragungen, dass die wahrgenommene verhaltensbezogene Effizienz des Online-Kaufs höher war als jene des Ladenkaufs. Außerdem korrelierten diese wahrgenommenen verhaltensbezogenen Effizienzgewinne mit einer höheren Wahrscheinlichkeit, gebrauchte Produkte zu kaufen und nachhaltige Transportmittel (Bahn, Bus) zu buchen. Die Ergebnisse zum Konsumniveau neuer Kleidung, digitalen Geräte oder von Flugreisen waren jedoch heterogen. Es gab keine Hinweise auf einen direkten Einfluss des wahrgenommenen Effizienzgewinns auf das Konsumniveau, vielmehr hing die Wirkung weitgehend von den vorhandenen Motiven der Personen ab und wurde im Falle von Freizeitreisen durch die Konsumabsichten moderiert.

Im Hinblick auf die zweite Forschungsfrage zeigte sich, dass die Wahrnehmung konsumfördernder Inhalte in Online-Werbung und Social Media durchweg mit weniger suffizientem Konsum zusammenhing, was durch stärkere soziale Normen für Konsum und höhere Anspruchsniveaus (d. h., wahrgenommene Konsumwünsche) mediiert wurde. Im Gegensatz dazu konnte die Wahrnehmung von Suffizienz-fördernden Inhalten zwar persönliche und soziale Normen für Suffizienz vorhersagen, jedoch korrelierte keiner dieser Prädiktoren mit dem suffizientem Konsumverhalten selbst. Bezüglich der Förderung suffizienten Konsums konnte die suffizienzfördernde Kommunikation im quasi-experimentelle Feldexperiment keine Konsumreduktion bewirken. Im Laborexperiment jedoch konnten suffizienzfördernde Social-Media-Inhalte kurzfristig suffizienzorientierte Entscheidungen stärken.

Zu den aus der Arbeit ableitbaren Erkenntnissen gehören die Bedeutung von Prädiktoren des nicht-nachhaltigen Konsums für die künftige umweltpsychologische Forschung in der Umweltpsychologie sowie Ansatzpunkte für die Bewältigung der festgestellten Grenzen dieser Arbeit und anderer methodischer Herausforderungen in der Beforschung des Einflusses von Online-Umwelten auf das Verhalten.

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Summary

Humanity's increasing resource consumption is endangering the climate, biodiversity and other planetary boundaries (O'Neill, Fanning, Lamb, & Steinberger, 2018). To reduce resource consumption, individual consumption levels must decrease (Capstick, Lorenzoni, Corner, & Whitmarsh, 2014), and a combination of efficiency, consistency and sufficiency strategies is necessary at the societal and individual level (Lorek & Fuchs, 2013). This thesis focuses on the sufficiency strategy at the individual level. Sufficiency-oriented consumption entails acquiring fewer products, modal shifts to less resource-intense alternatives, prolonging product lifetime, and sharing practices (Sandberg, 2021).

With the increasing relevance of online environments in every-day life, the context in which individual consumption occurs is changing: The average German citizen now spends a daily 3.5 hours online (Beisch & Schäfer, 2020), and online shopping sales and online-marketing expenditures have been increasing steadily (Statista, 2021c, 2021d). Meanwhile, research on online environments and their influence on sustainable consumption remains scarce and needed (Van der Linden, 2019; WBGU, 2019). Reisch (2001) and Börjesson Rivera, Håkansson, Svenfelt, and Finnveden (2014) hypothesised that easy online access to consumption options enables sufficiency-oriented consumption such as second-hand purchase, but may also increase consumption levels overall. They further suggested that the high amount of consumption-related content online, i.e., advertisement or social media, fuels the desire to acquire more products (aspiration level). As of now, the state of research mostly includes conceptual approaches. Thus, my overarching research question is: How do online environments influence sufficiency-oriented consumption? I conceptualised potential influences by applying environmental psychology theories (e.g., Klöckner & Blöbaum, 2010; Midden, Kaiser, & Teddy McCalley, 2007; Steg & Vlek, 2009). These theories imply that as contextual factors, online environments determine behavioural cost (e.g., easier online shopping facilitates consumption). Moreover, informational strategies may influence consumption through motivational factors (e.g., personal or social norms) in online environments. These aspects are addressed in two parts.

Part I: Online environments as enablers of consumption behaviour

Online shopping is expected to make purchasing more convenient both for conventional and sustainable consumption (e.g., Frick & Santarius, 2019). This convenience means that online shopping is expected to decrease behavioural costs for acquiring goods or services (i.e., less effort, time and financial expenses, Verhallen & Pieters, 1984), compared to in-store

shopping. These behavioural cost reductions can be seen as behavioural efficiency gains. Efficiency gains that directly lead to increased consumption levels are defined as rebound effects in economic theory (Berkhout, Muskens, & Velthuisen, 2000). Psychologists tend to predict a moderated effect: Bandura (2002) describes digital technologies as increasing individuals' agency to fulfil their intentions. Accordingly, Midden et al. (2007) state that technology acts as an intermediary, amplifier, or determinant in the pursuit of consumption intentions, or as a promoter if individuals pursue sustainable consumption.

Empirical evidence on the topic is scarce. Marketers found online shops' perceived ease of use to increase consumption intentions (e.g., Ashraf, Thongpapanl, & Auh, 2014; Sulaiman, Ashraf, & Jaafar, 2016). In an experiment, individuals changing from a stationary to a mobile device increased their online shopping level and frequency (R. J.-H. Wang, Malthouse, & Krishnamurthi, 2015). At the same time, online platforms have been found to enable second-hand consumption (Behrendt, Henseling, & Scholl, 2019). Yet existing studies have not empirically assessed and compared the individual perception of online shopping's behavioural costs to those of in-store shopping, and the relation to sufficiency-oriented consumption. The first research question (*RQ1*) addresses this research gap:

***RQ1:** Are perceived behavioural efficiency gains of online shopping correlated with higher consumption levels of sufficiency-oriented and conventional goods or services?*

Part II: Online environments changing motives for consumption behaviour

Online environments have more qualities than simply increasing behavioural efficiency. They are also environments where individuals inform themselves, interact, and discuss their views with others. When presented in an effective way, information is expected to influence attitudes and behaviour (Abrahamse & Matthies, 2012). Marketers particularly emphasise the informational influence of online advertisement and social media on consumption behaviour (Stephen, 2016). These online environments are therefore expected to have an increasing influence on attitudes, motives, and behaviour the more people spend time online. Research on the extent to which online environments influence behaviour through motivational factors is, however, at an early stage. As an example, social media content including descriptive social norms could influence voter behaviour (Bond et al., 2012). Further, social media use correlates with conspicuous consumption and materialism (Taylor & Strutton, 2016). Online advertisement was found to be more effective in inciting purchase than traditional "offline" ads (Dinner, Heerde Van, & Neslin, 2014). Yet whether an advertisement's effectiveness results more in a shift in product choice or in an increase of consumption levels remains unclear. Also, both online marketing (Gossen, Ziesemer, & Schrader, 2019) and social media (Ballew, Omoto, & Winter, 2015) have been described as

potential tools to promote sufficiency-oriented consumption. As informational strategies, they are expected to influence consumption behaviour the direction of either sufficiency or overconsumption, by changing normative (e.g., personal norm, social norm), hedonic, and gain motives (Steg & Vlek, 2009), such as the aspiration level (Jenny, 2016; Karlsson, Dellgran, Klingander, & Gärling, 2004). To answers to some of these open questions, the second research question is:

***RQ2:** How does the perception of sufficiency-promoting and consumption-promoting online content influence sufficiency-oriented consumption?*

Methodology

Online environments such as social media or websites with advertisement placement are responsive to their users' online behaviour and preferences. Therefore, the relationship of online content with consumption behaviour and motives can be expected to be reciprocal rather than simply unidirectional. This reciprocity can create a positive feedback loop, also termed "echo chambers", which can intensify existing motives (Luzsa & Mayr, 2019). At the same time, online environments are far more dynamic than built or natural environments. These traits pose additional challenges to the empirical assessment of causal relationships. Environmental psychology research on online environments is at an early stage, and may benefit from a transactionalist approach, which recognises the relationship of environments and individual behaviour in its complexity (Stokols, 2018; Uzzell & Rätzzel, 2009), as well as from insights from cyberpsychology (Wallace, 2015).

My methodological approach (Study design in Table 1), therefore, commenced with a broad and explorative scope, examining different aspects of online environments and their relation to sufficiency, taking into account the methodological challenges in this relatively new field. I first identified three aspects of online environments (online shopping, marketing, social media) relevant for consumption behaviour. Then I conceptualised these aspects' relationship with sufficiency-oriented consumption, analysing interdisciplinary literature and interpreting it through an environmental psychology perspective. On this basis, I designed a survey and applied it in three consumption domains (clothing, digital devices, leisure travel) to test the hypothesised relationships. Whereas *RQ1* was limited to correlations, I addressed *RQ2* also in terms of causality. I followed up on correlations of consumption-related online content and sufficiency-oriented consumption in a field and laboratory experiment, where online content was manipulated. The field experiment addresses external validity and a long-term effects of online content. The laboratory experiment complemented the field experiment by providing internal validity and testing short-term effects.

Table 1: Overview of the empirical studies answering RQ1 and RQ2

Publication	A - Frick & Matthies (2020). Everything is just a click away. Online shopping efficiency and consumption levels in three consumption domains.	B - Frick, Matthies, Thøgersen & Santarius (2021). Do online environments lead to sufficiency or overconsumption? Online advertisement and social media effects on clothing, digital devices and air travel consumption.	C - Frick, Gossen, Santarius & Geiger (2021). When your shop says #lessismore. Online communication interventions for clothing sufficiency.	
Hypotheses	Behavioural efficiency gains of online shopping are positively correlated with consumption levels of (i) sufficiency-oriented and (ii) conventional goods or services.	The perception of sufficiency-promoting online content correlates positively, and consumption-promoting online content correlates negatively with sufficiency-oriented consumption.	Sufficiency-promoting online content increases and consumption-promoting content decreases sufficiency-oriented consumption.	
Study design	Three cross-sectional representative surveys in the consumption domains of clothing, digital devices and leisure long-distance travel		Longitudinal quasi-experimental field intervention	Online laboratory experiment with a 3×2 design
Sample	Clothing survey $N = 886$; Digital devices $N = 860$; Travel $N = 976$		$N = 2113$ online shop customers	$N = 881$ participants
Predictors (online environment)	Behavioural efficiency gains of online shopping (difference of perceived behavioural costs of online and in-store purchase)	Self-reported frequency of seeing sufficiency- and consumption-promoting online content (advertisement; social media)	Customers' self-reported perception of sufficiency-promoting online communication intervention from a sustainable online shop in the field	Manipulation of social media communication; conditions: neutral, sufficiency promotion and consumption-promoting, each with or without peer endorsement
Psychological intermediates	<ul style="list-style-type: none"> Perceived behavioural costs of shopping Consumption motives (intention for regular consumption; intention for sufficiency) 	<ul style="list-style-type: none"> Personal norm for sufficiency Social norms for sufficiency (peers) Aspiration level 	<ul style="list-style-type: none"> Personal norm for sufficiency Social norms for sufficiency (fellow customers) Aspiration level 	<ul style="list-style-type: none"> Personal norm for sufficiency Social norms for sufficiency (fellow social media users) Aspiration level
Outcome variables	Self-reported consumption level of new and second-hand clothing or digital devices; air and alternative travel	Self-reported consumption level of new clothing, digital devices and air travel	Self-reported consumption level of new clothing	Sufficiency – oriented voucher choice
Statistical methods	T-test for comparison of behavioural cost of online-/offline consumption; Moderation analyses	Structural equation modelling	Repeated-measure variance analysis; Longitudinal mediation analysis	Hierarchical step-wise regression; Mediation analysis
Results	Behavioural efficiency gains of online shopping for sufficiency-oriented products correlated with consumption levels of these products, with no interaction effect with intentions. Behavioural efficiency gains negatively correlated with sufficiency-oriented consumption for new digital devices and air travel (moderated effect), but not clothing.	Sufficiency-promoting content did not correlate with sufficiency-oriented consumption. Consumption-promoting advertisement and social media content correlated negatively with sufficiency-oriented consumption, this was mediated by aspiration level and social norm for consumption.	Experimental and control group increased sufficiency-oriented consumption. The intervention was not effective. The aspiration level predicted sufficiency-oriented consumption.	The experimental group (sufficiency-promoting content) showed more sufficiency-oriented consumption than the control groups of neutral condition and consumption-promotion. The aspiration level mediated this relationship.

Outcomes and discussion

I evaluated the studies on whether the perception of online environments relates to sufficiency-oriented consumption in two parts. I analysed, first, relations with online shopping efficiency gains (*RQ1*) and, second, with content in online advertisement or social media (*RQ2*).

Shopping online was perceived less behaviourally costly than that in-store, for all domains except train or bus travel. Behavioural efficiency gains were directly correlated with sufficiency-oriented product purchase in all domains. This finding indicates that facilitating second-hand consumption or flightless travel-booking by online platforms can help foster sufficiency. In contrast, behavioural efficiency gains were linked to consumption levels of conventional products in heterogeneous ways. For clothing, consumption levels did not correlate with behavioural efficiency gains. So, individuals perceiving online shopping as less behaviourally costly did not buy more new items, but rather shifted their purchases from in-store to online. Although I found a direct relationship between online shopping efficiency gains and digital devices purchase, a general technology interest may also explain this link. For air travel booking, those with high consumption intention showed a stronger correlation of behavioural efficiency gains and consumption levels. Here, results supported the psychological perspective that efficiency gains through online shopping increase the agency for fulfilling consumption intentions (enabling effect, [Bandura, 2002](#); [Midden et al., 2007](#)). In conclusion, I found no empirical evidence that the lowering of behavioural cost for purchase directly increases purchase, as would be expected in rebound- or induction effects. Rather, the relationship varied depending on consumption domains and consumption motives. In this first study, consumption motives consistently predicted consumption levels: it was thus less the opportunity to shop per se, but rather consumption motives and their interaction with behavioural efficiency gains that accounted for higher consumption levels.

In light of these motives' relevance, the further studies addressed in more detail how online environments may change sufficiency-oriented consumption through motive change (*RQ2*, Publication B and C in Tab. 1). In the survey and the field experiment, perception of sufficiency-promoting online content did not correlate with sufficiency-oriented consumption (B, C1). However, in the laboratory experiment (C2), sufficiency promotion increased sufficiency-oriented consumption. At the same time, consumption-promoting content correlated with lower sufficiency-oriented consumption (B), but consumption-promoting social media posts did not decrease sufficiency-oriented consumption more than a neutral condition in the laboratory (C2). The low prevalence of sufficiency promotion in the field may explain why I found a short-term effect, but no long-term correlation of sufficiency promotion. Its unusual content raised attention in a laboratory setting. In the field however, its low prevalence hindered long-term behaviour change. Finding long-term correlations

(B), but no short-term influence for consumption promotion (C2) can equivalently be explained by the high prevalence of consumption promotion. Consumption promotion frequency correlated with consumption levels. Yet in the short-term intervention, it may not have captured participants' attention due to habituation towards marketing.

Turning to the mediating motives, I found sufficiency promotion to correlate with a higher personal and social norm for sufficiency in the survey (B). In the laboratory experiment, it led to a higher personal norm for sufficiency. There was no correlation of these motives with aspiration levels or sufficiency-oriented consumption (B, C). This result replicates other findings that moral motives do not suffice to foster sufficiency in domains such as travel or clothing (Herziger, Berkessel, & Steinnes, 2020; S. Moser & Kleinhüchelkotten, 2018). Yet, aspiration levels were mediators in the survey and the laboratory experiment, and negatively correlated with sufficiency-oriented consumption across all analyses.

Drawing practical implications, I found two ways how online environments' design can enable sufficiency. First, behavioural efficiency gains in online shopping improve online access to sufficiency-oriented products. Booking possibilities for alternative transport modes should become more convenient; they were not perceived as convenient in the survey. Second, short-term effects of online sufficiency promotion can encourage practitioners (e.g., comparison platforms) to apply sufficiency promotion as a nudging strategy during purchase decisions. Results on the detrimental effects of online environments were less straightforward. There was no indication of overconsumption risks due to easier access to consumption options, unless consumption motives were high. Concerning the informational influences of online content, consumption promotion was more prevalent than sufficiency promotion in the field. Online environments enable individuals to fulfil their consumption motives. Thus, the impact of online environments on consumption motives needs further attention. These empirical results only give first insights on these impacts.

Implications for future research include examining the determinants of overconsumption in affluent societies, due to these determinants' relevance in online environments Frick, Gossen, Pentzien, Piétron, and Tangens (2021) and to overconsumption's impact on planetary boundaries (O'Neill et al., 2018). The studies of this thesis underlined the role of determinants such as aspiration levels and its predictors, e.g., societal consumption norms and advertisement (Thøgersen, 2014). Finally, a learning from the empirical studies was that the complex and reciprocal relationship of human motives and behaviour with online environments requires new methodological approaches in psychology (Stokols, 2018).

Table 2: Glossary

Construct	Definition	Operationalization
<i>Dependent variable</i>		
Sufficiency-oriented consumption	Consumption reduction, smaller dimensions, and frugal use of products, prolonged product lifetime (Jenny, 2016; Sandberg, 2021)	<ul style="list-style-type: none"> • Consumption level of conventional products or services (A, B, C1) • Consumption level of sufficiency-oriented products or services (A) • Sufficiency-oriented voucher choice (C2)
<i>Independent variables: 3 aspects of online environment</i>		
Online shopping	Acquiring goods and services online	Behavioural costs of purchase online (A)
Online advertisement	Marketing in online environments (Bala & Verma, 2018)	Frequency of perceiving online advertisement (B)
Social media peer content	Posts, comments, or likes by social media users Peer endorsement: Likes by social media users	Frequency of perceiving social media peer content (B) Promotion of sufficiency or consumption (C)
<i>Enabling factors</i>		
Behavioural costs	Perceived physical, time, and financial cost (Verhallen & Pieters, 1984)	Perceived physical, time, and financial cost of purchase (A)
Perceived behavioural efficiency gains of online shopping	Difference in behavioural cost of in-store and online shopping	Difference between behavioural costs of shopping online and in-store (A)
<i>Motivational factors</i>		
Consumption intention	Behavioural intention to purchase (Ajzen, 1991)	Intention to consume regularly and intention for sufficiency-oriented consumption (A)
Personal norm for sufficiency	Moral obligation to behave ethically (S. H. Schwartz, 1977)	Moral obligation for sufficiency
Social norm for sufficiency	Perception of a peer group's behaviour (descriptive) and their expectation of own behaviour (injunctive, Cialdini, Kallgren, & Reno, 1991)	Social norm of peer group's sufficiency-oriented consumption and expectations (B, C)
Social norm for consumption	see definition above	Social norm of peer group's regular consumption and expectations (B)
Aspiration level	Perceived need and desire for consumption goods (Jenny, 2016; Karlsson et al., 2004)	Sufficient and ideal level of consumption (B, C)

1 Introduction

As you are scrolling through your smartphone, your favourite influencer presents a new product, you look it up on Google, then buy it on Amazon and, as it arrives at your door the next day, you post a selfie of you and your newest acquisition on Instagram. This scenario describes a typical consumption process in the digital age. The German population is now spending an average 3.5 hours per day online (Beisch & Schäfer, 2020), 78% of Germans engage in online shopping regularly, and as many use social media (Initiative D21, 2021). Meanwhile, expenditure on online marketing has had a double-digit annual growth rate in the last decade and has been rising especially in social media (Statista, 2021b). And constantly, new ways of marketing and selling products and services are emerging in the online environments (e.g., instant shopping, influencer marketing, personalised content, Kahlenborn, Keppner, Uhle, Richter, & Jetzke, 2018).

At the same time, climate change, biodiversity loss, and other threats to planetary boundaries are endangering the future of society (Global Footprint Network, 2020; Steffen et al., 2015). Humanity has to reduce its resource and energy consumption, land use, environmental pollution, and CO₂-emissions (Ruckelshaus et al., 2020; Steffen et al., 2015). This reduction primarily concerns affluent societies of the Global North, where consumption-related environmental footprints per capita by far exceed what the earth's carrying capacity can bear (O'Neill et al., 2018). To reach this sustainability goal of consumption reduction, the concept of social-ecological transformation has been proposed (Brand & Wissen, 2017; WBGU, 2011). The German Advisory Council on Global Change (WBGU, 2019) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (2020) have conceptualised how to harmonise the ongoing digital transformations and the necessary social-ecological transformation.

Digital transformations can both support and hinder the required social-ecological transformation. They hold enormous potential for more efficient resource and energy use, yet at the same time enable resource and energy consumption growth (S. Lange, Pohl, & Santarius, 2020). These materialise in different consumption domains, such as mobility, housing, or nutrition. Individual consumption behaviour is a decisive aspect in determining whether digitalisation's optimisation potentials are implemented to reduce absolute energy and resource use on a societal level or whether they are applied in a way that leads to more resource-intensive consumption patterns (O'Neill et al., 2018). In light of the internet's growing influence on consumption behaviour, more research is needed on exactly *how* it influences (un-)sustainable consumption (e.g., WBGU, 2019, p.167).

Since the early days of the internet, interdisciplinary researchers have been wary of its effects on sustainable consumption (Hilty, 2008; Reisch, 2001; Sui & Rejeski, 2002). Sustainable consumption is defined as “the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations” (Oslo Roundtable, on Sustainable Production & Consumption, 1994). Research on the role of digitalisation for sustainability often conceptualised digitalisation as a two-edged sword that holds both opportunities and risks (Börjesson Rivera et al., 2014; S. Lange & Santarius, 2020; Reisch, 2001; WBGU, 2019). As a closely linked debate, the more general relationship between technology and pro-environmental behaviour has long been a central issue in environmental psychology:

Technology is a concern of many environmental psychologists; it is the 200 kilogram gorilla that cannot be ignored, and it evokes very mixed feelings. Some view technology with suspicion, while others subscribe to the optimistic belief that it can help achieve the goals of sustainability. (Gifford, 2007, p. 203)

Psychological concepts of technology’s role in sustainable consumption have recognised these two sides of technology as a tool both to satisfy consumption needs and desires and to help individuals act more sustainably (Midden et al., 2007; Steg & Vlek, 2009). The influence of digital technologies can be conceptualised correspondingly: Online environments may change the quality and quantity of individual consumption (Frick & Santarius, 2019). Concerning qualitative changes, online environments offer more information on and access to consumption options, helping individuals to find both more sustainable, but also cheaper and more varied products and services. This easy access to consumption options, accompanied by online marketing, may lead to increased purchases of products or services (Reisch, 2001; Sui & Rejeski, 2002). Then again, easier access may also benefit more sustainable consumption patterns, such as the sharing economy, by enabling access to second-hand products (Behrendt et al., 2019). Increasing efficacy for both new and second-hand product consumption are examples that concern sufficiency-oriented consumption, which is introduced in the following chapter.

1.1 Sufficiency-oriented consumption

Proposed measures to reach sustainability goals can be grouped in three strategies; efficiency, consistency, and sufficiency (Linz et al., 2002). Sachs (1993) and Linz et al. (2002) stated that efficiency gains from technological innovations (which are often decimated by rebound or growth effects) and consistency strategies (which are often in a niche or early development phase) alone are not sufficient to reach sustainability goals. The authors therefore introduced sufficiency as an indispensable sustainability strategy. They defined it

as consumption reduction at the macro-level of society and economy, setting limits to the extraction of natural resources and deterioration of natural habitats. They also applied sufficiency to individual consumption of resource-intense goods and services, and argue that it is indispensable for the wealthier part of society to limit their material consumption. These limits to consumption are oriented towards a consumption level necessary to satisfy basic needs and to ensure social equality (Defila & Di Giulio, 2020; Princen, 2005).

Sufficiency stems from “sufficere”, meaning “to suffice”, and therefore defines a maximum of consumption levels limited by planetary boundaries, as well as a minimum consumption level necessary for a good life. Together, these minimum and maximum consumption levels build a safe space for human consumption, as laid out in concepts such as the Doughnut Economy (Raworth, 2012) or the Consumption Corridors (Fuchs et al., 2021). In terms of individual behaviour, sufficiency-oriented consumption has been defined as consumption reduction of products and services including the choice of smaller dimensions of acquired products and services, and the frugal use of products and services (Jenny, 2016). Sandberg (2021) defines four behavioural categories of sufficiency, including absolute reduction of the amount an individual consumes (e.g., buying less clothes), modal shifts (e.g., travelling by train instead of plane), prolonged use (e.g., repairing, or not renewing the smartphone before it stops functioning), and shared use of products (e.g., second-hand or shared consumption of goods). She further argues that modal shifts, longer use, and sharing can compensate for consumption decreases, allowing individuals to still fulfil their consumption needs.

The three sustainability strategies are only effective if they are applied in combination (Linz et al., 2002). Most famously, this precondition is shown by the rebound effect of the efficiency strategy, where an increase in efficiency only partly leads to energy savings due to an increase in consumption (Berkhout et al., 2000). The sufficiency strategy at the individual level is also prone to rebound effects if it is not accompanied by structural measures (Alcott, 2008). Further, a social-ecological transformation (i.e., establishing a sustainable society, Brand & Wissen, 2017) requires the adoption of these sustainability strategies both at the political, economic and societal level and at the individual level (Anantharaman, 2018; Newell, Daley, & Twena, 2021). The role of the individual in this transformation is manifold: from voting and supporting environmental policy, to political activism, workplace behaviour, land stewardship, and sustainable consumption (e.g., Larson, Stedman, Cooper, & Decker, 2015; Uzzell & Rätzhel, 2009). It is a core research topic of environmental psychologists to promote behaviour change towards acting sustainably in all of these roles, but especially in the field of sustainable consumption.

Environmental psychology research can further lend support in all of the sustainability strategies. It has been applied to foster the choice of and investment in energy-efficient technology (e.g., Bobeth & Matthies, 2018), to increase acceptance of renewable energy as a consistency strategy (e.g., Huijts, Molin, & Steg, 2012), or to motivate and nudge

sufficiency-oriented consumption, be it curtailing energy use (Abrahamse, Steg, Vlek, & Rothengatter, 2005) or reducing purchase (e.g., Joanes, Gwozdz, & Klöckner, 2020). For affluent societies of the Global North, behaviour change toward sufficiency at the household level is especially necessary (O'Neill et al., 2018; Ruckelshaus et al., 2020). Consumption reductions in the wealthy parts of the world is one of the most effective strategies to lower environmental impact without limiting human well-being (Ivanova et al., 2020; O'Neill et al., 2018). But behaviour change towards sufficiency that goes beyond private households' energy use is still at an early research state in environmental psychology (Verfuërth, Henn, & Becker, 2019). This thesis therefore focuses on sufficiency-oriented consumption behaviour as one necessary, but not sufficient, aspect at the individual level of the social-ecological transformation.

1.2 Online environments

The context in which sufficiency-oriented consumption is taking place has changed in recent years as consumption behaviour in general, from search to purchase, is increasingly taking place in online environments (Initiative D21, 2021). Online environments include the websites, platforms, search engines and other web interfaces that constitute the internet. They are primarily used for searching information, communicating in social media, and for online shopping (Initiative D21, 2021). It has been repeatedly shown that online environments influence psychological processes and thus individual behaviour. The related details have been studied intensely in media psychology, internet psychology, cyberpsychology or human-technology-interaction (Wallace, 2015). Researchers in these areas find that people often behave and perceive differently in an online context. For example, they are more prone to distraction and multitasking (Firth et al., 2019; Jeong & Hwang, 2016), less inhibited in sharing intimate feelings, but also insulting others (e.g., hate speech), compared to the offline world and face-to-face contact (Wallace, 2015). They are more inclined to perform impression management, especially when presenting themselves in social media (Krämer & Winter, 2008), and they fall victim to the privacy paradox, meaning they continue to use digital services even though these exploit their personal data (Kokolakis, 2017). Further, some preliminary evidence suggests that the ubiquitous exposure to online environments enforces impulsive behaviour and decreases the ability to delay rewards (Wilmer & Chein, 2016). Considering these various ways in which online environments have been found to change cognition, motives, and behaviour, these environments and the processes described are likely to change environmentally relevant behaviour such as sufficiency-oriented consumption.

Environmental psychologists typically examine the relationships of built and natural environments with human beings, and the influence of these environments on well-being and behaviour. With the increasing relevance of information and communication technology

(ICT) for work, private, and public life, environmental psychologists have argued for adding digital environments (e.g., online environments, apps, virtual realities) to the set of environments they analyse (Gifford, 2014; Stokols, 2018; Van der Linden, 2019). For determining how online environments change consumption behaviour, it matters which of these environments individuals spend a considerable amount of their time in and which contextual characteristics define those environments. In a consumption-specific context, I identified three characteristics by which online environments differ from physical environments. These characteristics are outlined in the following; They (i) have a dynamic and fast-growing architecture, (ii) their content is personalised, and (iii) their construction is mainly financed by advertisement.

For dynamic architecture, whereas natural and built environments usually grow or are constructed at a slow pace, and then stay in a certain structure for years, online environments are formed, reconstructed, and adapted within very short time spans. As an illustration of the constant changes and growth of online environments, the internet archive "Wayback Machine" can be consulted. As a consequence of these dynamics, research topics can quickly shift and the measurement in such a dynamic research field poses methodological challenges (e.g., Aguilera, Guillot, & Rallet, 2012).

Second, the design of online environments differs for every individual user, due to selection effects from both the user and the environmental side. From the user side, it has been broadly established in media psychology that individuals prefer and seek information consistent with their attitudes and avoid contradictory information, be it in traditional or online media (confirmation bias, Knobloch-Westerwick, 2014; Nickerson, 1998). This bias means that, for example, individuals chose which online media platform they visit or which peers or influencers they follow on social media. Accordingly, Luzsa and Mayr (2019) found that social media use intensity correlates with a higher False Consensus Effect (Ross, Greene, & House, 1977). This effect means individuals tend to perceive public opinion less objectively and distorted towards their own opinion. Reference groups that support one's own opinion can reinforce an individual's opinions through increasingly expressed social norms and thus accentuate their expression, a phenomenon researched in social psychology as groupthink (Janis, 1972).

Personalisation and selection of information thus is not a trend that only emerged with personalised online environments. Yet, online environments react to individuals' confirmation bias. Exposure to online content is subject to personalisation, especially in search engines and social media. Tracking functions personalise web content according to a user's information or preferences shared online (e.g., browser histories, location, "likes" on social media). As psychological research has shown, information tailored to an individual's preferences or circumstances is especially effective in changing attitudes, motives or behaviour (Abrahamse & Matthies, 2012; Pelletier & Sharp, 2008). Therefore, in the online environment, individual preferences and online environments can be expected

to interact with each other in a mutually reinforcing way: while ecologically conscious users receive sustainability-oriented consumption information and offers that correspond to their values, users that are also interested in hedonic consumption may receive personalised consumer offers for the latest trends and consumer goods.

Third, internet architecture is determined by its designers and the underlying financing model. In contrast to built environments, online environments are not subject to spatial limits, as new “environments” in the form of websites can be created at very low cost. Informational content abounds, and for a certain piece of information to catch attention and be consumed, designers are inclined to make content addictive (Alter, 2017). Therefore, human attention, rather than space or information, is the limiting factor to the influence of online environments, a dynamic defined as attention economy (Davenport & Beck, 2001). Most search engines, online news media, social media platforms, and other websites and blogs are not paid by their readers. Rather, these platforms are financed through advertisement placement, and trading with personal data. They gather data from users, in order to personalise information, services, and advertisement to their individual interests and sell ad space to companies in real-time bidding. As a result, the internet’s prime financial source is advertisement (Kingaby, 2021). Digital platforms exploit the above-mentioned confirmation bias, keeping their users engaged with the platform for as long as possible to generate more data and advertisement exposure (Kokolakis, 2017).

The environmental setting is not a neutral and value free space; it is culture-bound. It is constantly conveying meanings and messages and is an essential part of human functioning and an integral part of human action. G. Moser and Uzzell (2007, p.5)

Online environments are not value-free spaces. As things stand today, online environments most often visited, such as search engines, online news media, and social media, are designed by profit-oriented platform companies whose financing models are based on advertisement and data collection (Kozyreva, Lewandowsky, & Hertwig, 2020). As a consequence, large parts of behavioural and psychological research examine how online marketplaces and marketing have to be designed to increase purchase from a marketing perspective (Chan, Cheung, & Lee, 2017; Stephen, 2016). Conversely, research on how to design the internet in terms of sustainability and in citizens’ interest remains short-handed. This thesis examines these influences with a focus on sufficiency-oriented consumption, as described in the next chapter.

1.3 Aim and structure of the thesis

Fostering sufficiency-oriented consumption at the individual level in the context of an increasingly digitalised society is highly relevant if environmental impacts of affluent

societies are to be kept within planetary boundaries. At the same time, research on sufficiency-oriented consumption (Verfuert et al., 2019) and online environments' influence on behaviour (Gifford, 2014; Stokols, 2018; Van der Linden, 2019) are at an early stage in environmental psychology. In the context of online environments, research on whether and how online environments foster sufficiency-oriented consumption or an increase of consumption levels remains mostly on a conceptual level (Börjesson Rivera et al., 2014; Frick & Santarius, 2019; Reisch, 2001). These existing concepts, as well as the interdisciplinary state of research (e.g., Stephen, 2016; R. J.-H. Wang et al., 2015), however, suggest that online environments may influence consumption behaviour by increasing purchase efficacy through online shopping, as well as influencing consumption motives through informational content in online marketing or social media. In this thesis, the influence of these three types of online environments on sufficiency-oriented consumption is therefore examined from an environmental psychology perspective.

To address this research aim, Chapter 2 describes separately both the behavioural efficiency aspects of online shopping (Part I) and the motivational aspects of online content in online advertisement and social media (Part II). In each part, I give an overview on the theoretical background, relevant theoretical approaches in environmental psychology, and the state of research on online environments and sufficiency-oriented consumption. From this overview, research hypotheses are defined. In the method description in Chapter 3, the research setting and design is explained, the operationalisation of relevant constructs and methodological instruments are specified, and the choice of consumption domains in the empirical studies is justified. The results are given in Chapter 4, where I present the three journal publications that constitute the cumulative dissertation. In Chapter 5, the results and implications of the empirical studies are integrated, compared and discussed in light of psychological theory and methodology. These findings will be synthesised into implications for future research and practice for a sustainable online environment. Finally, conclusions and an outlook are presented in Chapter 6.

2 Theoretical background and research questions

To arrive at hypotheses on how the online environment may influence and foster sufficiency-oriented consumption, I consulted and analysed theories from environmental psychology. As the research field of online environments is relatively novel in environmental psychology (Van der Linden, 2019), I applied a broad exploratory analysis of existing theories to find suitable starting points.

I found two main strands of theory in environmental psychology to be suitable for deepening understanding of how online environments impact environmentally relevant consumption. First, environmental psychologists examine human-environment relations (for an overview, see G. Moser & Uzzell, 2007). As an example, they examine how different environments influence human action and cognition and also how humans shape their environments. This perspective on human-environment relations is transferable to online environments (Stokols, 2018). Second, environmental psychology offers a wide range of action determination models that guide prediction and promotion of pro-environmental behaviours (for an overview, see Bamberg & Möser, 2007; Gifford, 2014). Presumably, these models can also be applied to foster pro-environmental behaviour in the context of online environments. In the following paragraphs, I analyse how these two directions prepare and underpin the empirical work of this thesis.

I start by introducing the first strand of theory. In online environments, users are constantly shaping the spheres they spend time in, due to their own choices on which websites or platforms to visit but also due to the design aspects of personalisation and responsiveness applied by many online platforms. Accordingly, it can be presumed that not only the environments influence the individual but also that individual behaviour in turn affects those online environments' appearances and content. Therefore, I consulted theories that broach the issue of such a reciprocal human-environment relationship. Uzzell and Rätzkel (2009) wrote "instead of looking at individuals, society and the environment as if they existed independently of each other, there is a need to take a relational view of individuals and society and their relationship to the environment, and in so doing look precisely at the reciprocity between people and environment" (pp.349-350).

According to G. Moser and Uzzell (2007), this reciprocity corresponds to a transactionalist research perspective, which states that transactions between individuals and environments form behaviour. They define the transactionalist framework as constant mutual exchange between individuals and their environments. This means that not only the person is influenced by contextual factors but also the person's reaction influences these

factors. For example, the social cognitive theory (Bandura, 2001) described in Chapter 2.2.1 is a transactionalist framework. The theory depicts how personal factors (e.g., motives), behaviour, and contextual (i.e., environmental) factors operate as interacting determinants that mutually influence each other. According to Bandura (2001), individuals do not only react to environments, they are "producers as well as products of social systems" (p. 266). This perspective evolved from a research tradition in which the physical and social environments or settings were depicted as strong predictors of behaviour (Barker, 1968; Lewin, 1951). Gibson (1979) stated that individuals interpret the environment through affordances, i.e., perceived opportunities and behavioural barriers. In a digital environment context, this affordance theory has been applied in technology studies and thus influenced the design of information and communication technologies (Faraj & Azad, 2012).

Applying a transactionalist approach to digital spheres, Stokols (2018) proposed an integrative framework in which natural, built, socio-cultural, and digital environments are intertwined layers that influence cognition and behaviour. He stated that not only should the environment and its contextual factors be considered more strongly as predictors of behaviour, but respective research should also take into account that the individual and its environments influence each other mutually. I concluded that the transactionalist perspective would be especially useful for research on online environments. However, transactionalist approaches are macro-level theories (Gifford, 2014), and their operationalisation and application in empirical research is challenging and rare (Uzzell & Rätzsch, 2009).

The second strand of theory involves action determination models and behaviour change models that predict pro-environmental behaviour. In contrast to transactionalist theories, they are situated at the meso-level and thus more applicable in empirical research (Gifford, 2014). The Theory of Planned Behaviour (Ajzen, 1991), the Norm Activation Model (S. H. Schwartz, 1977; S. H. Schwartz & Howard, 1981), the Value-Belief Norm Theory (Stern, Dietz, Abel, Guagnano, & Kalof, 1999), and the Focus Theory of Normative Conduct (Cialdini et al., 1991) are among the most widely applied and studied action determination models. Other models were developed to integrate these approaches, such as the Comprehensive Action Determination Model (Klößner & Blöbaum, 2010) or the stage model of self-regulated behavioural change (Bamberg, 2013). These theories, as well as the empirical research on pro-environmental behaviour in environmental psychology that is often grounded on these theories, have had a focus on motivational factors that explain behaviour. They identified personal norms and social norms as central motivational determinants of behaviour (Bamberg & Möser, 2007). It can be presumed that online content influences motivational factors, and thus behaviour, through providing information (Abrahamse & Matthies, 2012). As studies have found that people in Germany spend most of their time online gaining information and communicating (Initiative D21, 2021), online environments can be expected to influence motivational factors. Such motivational factors may include motives to act or to not act pro-environmentally, as for example the

personal norm (S. H. Schwartz, 1977) or the social norm (Cialdini et al., 1991).

Contrary to motivational factors, environmental or contextual factors have been less intensely studied and have been assigned a less central role in action determination models (Gifford, 2014; Steg & Vlek, 2009). Most action determination or behaviour change models do not directly assess contextual factors. Rather, they include the perceived ability or agency to act pro-environmentally, e.g., perceived behavioural control or self-efficacy (Steg & Vlek, 2009). As a consequence, there have been repeated calls to *contextualise* behaviour and to more intensely study the role of environments and context as behavioural determinants (Clayton et al., 2016; Steg & Vlek, 2009).

As a positive example of a theory focusing on contextual factors, Midden et al. (2007) conceptualised four roles of technology for pro-environmental behaviour. These include an intermediary, determinant, and amplifier role, in which technology enables individuals to fulfil their needs and pursue their goals, as well as a promoter role, in which technology specifically serves to foster pro-environmental behaviour. Thus, applying Midden et al. (2007)'s framework, online environments function as a technology or tool that enables certain behaviours by making goal achievement and need satisfaction more effective. Similarly, Bandura (2002) described digitalisation as increasing individuals' agency for fulfilling their needs. By shopping online, for example, individuals can find more and cheaper options for product purchase, meaning that online shops amplify consumption behaviour. Alternatively, through second-hand platforms, they may assist individuals to consume in a more sufficiency-oriented way. Therefore, I propose that, when investigating the influence of online environments on sufficiency-oriented consumption, the application of these action determination theories can guide the forming of hypotheses both on motivational mediators as well as on online contexts increasing behavioural efficiency for consumption behaviour.

In a nutshell, applying these two strands of theories in environmental psychology to online environments shows that online environments' influences on sufficiency-oriented consumption can be expected to be mediated by motivational factors and to enable consumption behaviour as contextual factors. From a transactionalist view and by design of online environments, not only the environments influence motives and behaviour, but individuals can easily choose the online environments they spend time in, and algorithms further personalise many forms of content, for instance in social media or advertisement. These interrelations between online environments and individual consumption behaviour are subsumed in Figure 1. Therein, I integrated the models and concepts related to online environments and sustainable consumption on a theoretical level (Midden et al., 2007; G. Moser & Uzzell, 2007; Steg & Vlek, 2009; Thøgersen, 2014). I identified the following effects that are supported by the literature:

- **Direct effect (1a, 1b):** The availability of technology directly influences its use by actual or perceived behavioural costs.

⇒ [Steg and Vlek \(2009\)](#): direct effect; [Midden et al. \(2007\)](#): intermediary and determinant role).

Example: The availability of sharing platforms increases second-hand consumption.

- **Moderated effect (1c):** Digital technology strengthens the influence of motivational factors on behaviour through facilitation.

⇒ [Steg and Vlek \(2009\)](#): moderated effect; [Midden et al. \(2007\)](#); amplifier role; [Bandura \(2002\)](#); [Thøgersen \(2014\)](#): technology strengthens the influence of motives on consumption behaviour.

Example: The availability of sharing platforms increases second-hand consumption if individuals intend to buy second-hand.

- **Mediated effect (2a, 2b):** Digital technology changes motivational factors and, thereby, consumption behaviour.

⇒ [Abrahamse and Matthies \(2012\)](#): information strategies; [Steg and Vlek \(2009\)](#): Contextual factors determine which motivational factors affect behavior in a situation.

Example: Social media content changes consumption behaviour through social norms.

- **Dynamic effect (3):** Personalisation of online content and individual choice of online environments lead to a mutual influence of individuals and online environments.

⇒ [G. Moser and Uzzell \(2007\)](#): transactionalist human-environment-relationship.

Example: Personalised advertisement increases consumption motives.

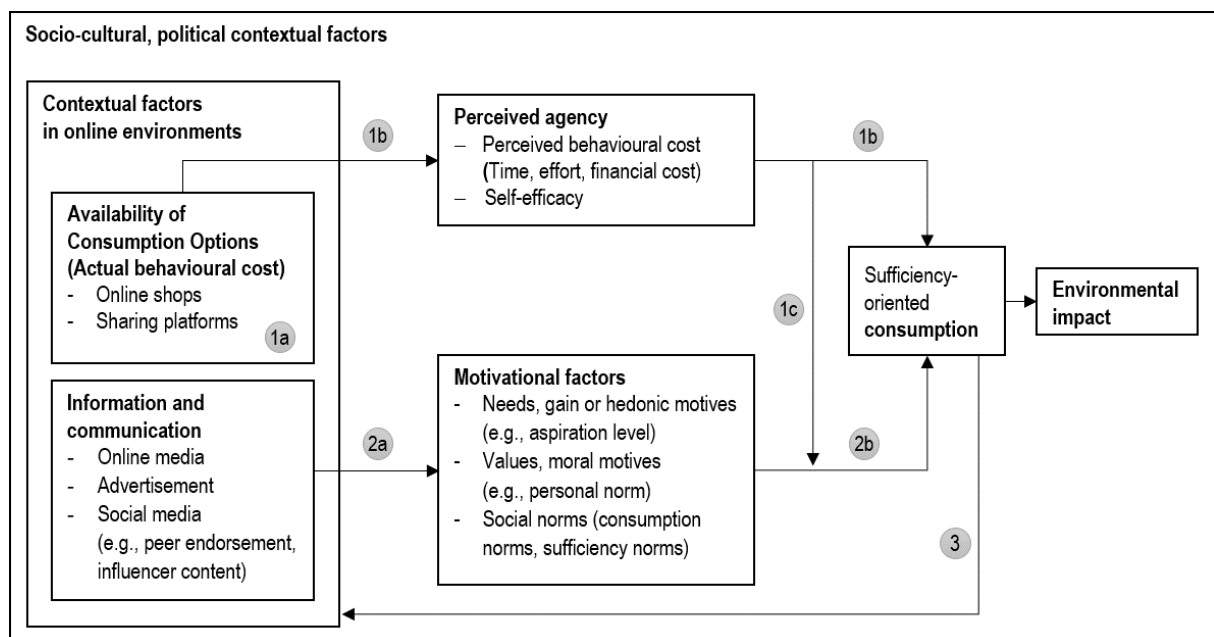


Figure 1: Effects of online environments on sufficiency-oriented consumption, integrated from [Midden et al. \(2007\)](#); [Steg and Vlek \(2009\)](#); [Thøgersen \(2014\)](#).

Note. Pathways 1a, 1b and 1c correspond to research question (RQ) 1 introduced in Chapter 2.1. Pathways 2a and 2b correspond to RQ2 introduced in Chapter 2.2.

After this brief introduction of contextual factors of online environments and their influence on motivational factors, I discuss existing theoretical approaches and research on these two topics separately. In Chapter 2.1, I introduce the theoretical framework, state of research, and the first research question (*RQ1*) on online environments' role in reducing perceived behavioural costs of consumption behaviour (1a, 1b and 1c in Figure 1). Chapter 2.2 describes how information and communication in online environments influences behaviour by addressing motivational factors (pathways 2a and 2b) and presents respective theory, the state of research and the second research question *RQ2*. The dynamic effects (3) are considered within both the chapters.

2.1 Part I: Online environments as consumption enablers

Online shops, platforms, and marketplaces allow users to purchase almost any product or service, from anywhere in the world, at any time. With online shopping, opening hours, choice restriction, or product characteristics such as size and weight are no longer a barrier to consumption. This freedom increases the efficiency of purchase behaviour (Voropanova, 2015) or *shopping convenience* (L. A. Jiang, Yang, & Jun, 2013). As shopping has been getting easier and more convenient through online shopping, researchers such as Börjesson Rivera et al. (2014), Reisch (2001) or Sui and Rejeski (2002) have expected these efficiency gains to increase consumption levels. At the same time, they expected that these efficiency gains would also increase sufficiency-oriented consumption, such as second-hand purchase.

2.1.1 Theoretical considerations on contextual factors

Following the short introduction of contextual factors above, I now deepen the theoretical background on behavioural efficiency gains of online environments to derive corresponding research hypotheses. In an interdisciplinary setting, the effects of online environments on environmentally relevant consumption was conceptualised within taxonomies of *higher order*, *indirect*, or *behavioural* effects of information and communication technology (ICT) (Börjesson Rivera et al., 2014; Hilty & Aebischer, 2015; Horner, Shehabi, & Azevedo, 2016; J. Pohl, Hilty, & Finkbeiner, 2019). In contrast to what those authors describe as *direct effects* of ICT, which includes ICT's material and energy demand, *indirect effects* assess the behavioural and structural effects that the application of ICT (for example, online environments) brings about (Röpke, 2012). These may include positive or neutral effects, such as substitution, or negative effects that increase consumption, such as rebound effects or induction (Börjesson Rivera et al., 2014).

All of these indirect effects, however, are based on the presumption that online environments enable individuals to purchase consumption goods and services for less money, time, and effort, i.e. to decrease behavioural costs for purchase (Verhallen & Pieters, 1984). The

increased choice of options has been framed as an induction effect, where technological innovations stimulate consumption through new consumption possibilities (Røpke, 2012). If individuals use such perceived behavioural efficiency gains to increase their consumption levels, this consumption-increasing effect can also be defined as a rebound effect. The rebound effect was first conceptualised in economic theory in the context of energy consumption: Sorrell and Dimitropoulos (2008) describe it as an increased consumption of energy services as a result of technical efficiency improvements of delivering those services. Also authors in psychology have made their case for the rebound effect:

By freeing up resources such as time and money, gains in technological efficiency unavoidably spark further consumption by serving the as-yet-unmet personal ends of individuals. (Otto, Kaiser, & Arnold, 2014, p. 97)

As it is customary in economic rebound effect theories, Otto et al. (2014) also adopt the premise that consumption preferences or motives are a given condition. According to this logic, the online availability of consumption options directly induces consumption increase (pathway 1b in Figure 1). Other psychological theories predict a moderated effect of online shopping (effect 1c in Figure 1), in which digital technologies increase individuals' agency to fulfil their needs and motives (see above, moderated effect, Bandura, 2002; Midden et al., 2007; Steg & Vlek, 2009). In contrast to economic theory on the rebound effect, by and large, these theories do not take consumption-oriented motives for a given, but include them as a varying and interacting factor in behavioural prediction.

Furthermore, whereas in economic theory, efficiency gains are primarily measured in financial savings, psychologists argue that mental representations of behavioural costs influence behaviour more than do actual costs (Friedrichsmeier & Matthies, 2015). Accordingly, behavioural costs as a psychological construct include not only financial expenses but also the perception of physical, mental, and temporal effort to perform a target behaviour (Verhallen & Pieters, 1984). These interdisciplinary debates on ICT effects additionally revealed that agency-related effects of online shopping are best addressed by perceived behavioural costs (as operationalised by, e.g., Diekmann & Preisendörfer, 2003; Kaiser & Wilson, 2019; Verhallen & Pieters, 1984), including the decrease in such costs as efficiency gains. Behavioural costs are more suitable to investigate these effects than the perceived behavioural control (Ajzen, 1991), perceived ability (Stern et al., 1999) or self-efficacy (Bandura, 1977), because these constructs are constituted both out of behavioural costs of the situation and the individual's competence.

In environmental psychology, perceived behavioural costs are included in several theories that predict a direct effect or a moderated effect of behavioural costs on consumption. Theories that predict a direct influence of behavioural costs on behaviour include rational choice theories, which propose an additive effect of behavioural costs (within the construct of perceived behavioural control; Ajzen, 1991) and technology posing constraints or

affordances for specific behaviour that can be both objective or perceived by the individual (Tanner, 1999). Also, the Technology Acceptance Model (TAM, Davis, 1989) claims that a direct effect of the perceived ease of use plays an important role in the acceptance or use of a technology.

Theories that predict a moderated effect of behavioural costs and individuals' consumption intentions on behaviours state that, depending on individual's intention (e.g., pro-environmental or materialistic), online environments will change her or his consumption behaviour in different ways. According to Bandura (2002), online environments increase individuals' agency, enabling them to pursue their consumption intentions. Thøgersen (2014) also introduced technology as a predictor that makes consumption options more or less easily available and that moderates the relationship of consumer values and needs with consumption levels. Further, Midden et al. (2007)'s amplifier role can be interpreted as behavioural cost reduction, allowing consumption intentions to be satisfied more efficiently. Additionally, the low cost hypothesis (Diekmann & Preisendörfer, 2003) states that the lower the behavioural costs, the more likely it is that pro-environmental attitudes lead to corresponding behaviour. Similarly, the Campbell paradigm states that with higher behavioural costs, pro-environmental attitudes are less likely to result in behaviour, although an additional relationship between attitude and behavioural cost is expected (Kaiser & Wilson, 2019). Yet in contrast to other authors, Kaiser and Wilson (2019) address actual, and not perceived costs. In the tradition of the Campbell paradigm, Otto et al. (2014) explain the rebound effect with behavioural costs for consumption and propose that only a strong pro-environmental attitude can prevent rebound effects. Santarius and Soland (2018) describe this rebound effect as an economic or "improved control" effect of efficient technologies that can lead to rebound or beneficiary effects. Strictly speaking however, this conceptualisation of the rebound effects does not directly apply to behavioural gains of online shopping, as online shopping only saves energy or resources under specific circumstances (Horner et al., 2016; Rai, 2021). In this case, the broader definition of induction effects would apply, as this describes consumption-increasing effects of ICT (Røpke, 2012). In a nutshell, I take from these theories that both direct and moderated enabling effects of online shopping possibilities can be expected.

2.1.2 Empirical findings

As the empirical research on enabling effects of online shopping is discussed in detail in Publication A, only a concise overview and literature update is given here. Empirical evidence on the topic can be found in several disciplines. In sustainability research, life-cycle analysis, and technology assessment, often the environmental impact of online and in-store purchases per item are compared, yet research examining effects on overall consumption is scarce (for a detailed literature review, see Rai, 2021). Such literature focuses on the effects of online shopping possibilities on macro-level environmental impact.

A broad set of reports and grey literature measured a strong increase of online shopping volume, which was often found not to crowd out stationary retail (Rai, 2021), with some studies finding even a positive relationship between online shopping and in-store shopping trips (Cao, 2012; R. J. Lee, Sener, Mokhtarian, & Handy, 2017).

In economics and marketing studies, the research aim is often reversed to that of sustainability research: Applying the Technology Acceptance Model, marketers usually treat purchase intentions as the target outcome and find online shops' perceived ease of use to increase purchase intentions (e.g., Ashraf et al., 2014; Shang, Chen, & Shen, 2005; Tong, 2010). Convenience, perceived time savings, and lower prices, all of which are aspects of online shopping's perceived behavioural costs, have been found to correlate with higher purchase intentions for air travel (Amaro & Duarte, 2015; Bigné, Hernández, Ruiz, & Andreu, 2010). In a field experiment, individuals changing from a stationary to a mobile device increased their online shopping level and frequency (R. J.-H. Wang et al., 2015).

Concerning beneficial effects, online platforms were found to bolster sufficiency in the form of second-hand consumption (Behrendt et al., 2019). Further, an international study could not find a direct relationship between internet penetration and sustainable consumption, yet it found that the higher the internet penetration in a country, the stronger the correlation between pro-environmental attitudes and sustainable behaviour (Y. Wang & Hao, 2018), supporting the moderating effect of online environments.

2.1.3 Research question 1

The empirical studies that examine the relationship between behavioural costs of online shopping and environmentally relevant consumption behaviour, as summarised in the previous chapter and Publication A, have produced mixed results. Also, they did not empirically assess and compare the individual perception of online shopping's behavioural costs to those of in-store shopping or the relation to sufficiency-oriented consumption. Yet as online shopping has gained increasing relevance, research interest has grown on the link between perceived behavioural efficiency gains of online shopping and sufficiency-oriented consumption. In this context, sufficiency-oriented consumption can be operationalised by low consumption levels of new goods and services or by an increased consumption level of sufficiency-oriented goods and services, such as second-hand purchase. In both cases, perceived behavioural efficiency gains of online shopping may enable an increased consumption of conventional or sufficiency-oriented products. The first research question thus is as follows:

***RQ1:** Are perceived behavioural efficiency gains of online shopping correlated with higher consumption levels of sufficiency-oriented and conventional goods or services?*

To approach this question in an empirical study, it can further be broken down into three

hypotheses that are derived from the theoretical and empirical state of research presented above (aligning with 1a, 1b and 1c in Figure 1) and will be addressed consecutively in Publication A:

***H1a:** Perceived behavioural costs for online-shopping are lower than those of in-store shopping.*

***H1b:** Perceived behavioural efficiency gains from in-store to online shopping are positively correlated with consumption levels (direct effect).*

***H1c:** Perceived behavioural efficiency gains positively moderate the relationship between purchase intention and consumption levels (moderated effect).*

2.2 Part II: Online environments changing motives for consumption behaviour

In the first part, online environments were considered as a technology or tool that decreases behavioural costs, enabling individuals to pursue their goals. This second part focuses on online environments' influence on motivational factors that may foster or hinder sufficiency-oriented consumption. In online environments, individuals most often search for information and communicate and interact with other users ([Initiative D21, 2021](#)). When presented in an effective way, the information that individuals encounter online is expected to influence their attitudes, motives, perceived social norms, and behaviour ([Abrahamse & Matthies, 2012](#)). Marketing literature particularly emphasises the informational influence of online advertisement and social media on consumption behaviour ([Stephen, 2016](#)). These aspects of online environments are therefore studied in this part.

2.2.1 Theoretical considerations on motivational factors

Both online marketing ([Gossen et al., 2019](#)) and social media ([Ballew et al., 2015](#)) have been described as potential tools to promote sufficiency-oriented consumption. Yet to a larger extent, the potential of online advertisement and social media to increase purchase intentions has been the center of attention, especially in marketing research (e.g., [Stephen, 2016](#)). Conceptualised as informational strategies ([Abrahamse & Matthies, 2012](#)), online advertisement or social media content may influence behaviour in multiple ways. In the context of sufficiency-oriented consumption, conventional online advertisement may target purchase intentions and thus foster the increase of consumption levels, whereas environmentally conscious influencers, for example, may speak out for curtailment and thus influence consumption behaviour towards sufficiency.

The influence of (online) communication and information on motivational factors and thereby behaviour is assumed implicitly in most studies. For a theoretical understanding of these influences, I turned to the field of media psychology, which has a long tradition in

studying media effects on motives and behaviour (Giles, 2003). Within the field of media psychology, and more generally in the communication sciences, cultivation theory proposes that long-term, repeated exposure to certain media (primarily television) encourages recipients to attain "social realities", and thus social norms of consumption are transmitted through the media content (Gerbner, 1969; Morgan & Shanahan, 2010). This effect was also discussed in the context of online media (Morgan, Shanahan, & Signorielli, 2015). Applied to online environments, cultivation theory predicts an increasing influence on attitudes, motives and behaviour the longer people spend online. This long-term influence is reinforced in social psychology: E. B. Goldsmith and Goldsmith (2011), for example, write that "over time, consumers' cognitive structures are established through consumer socialisation, observation or exposure, and social and personal experiences" (p. 120). Sanne (2002) and Thøgersen (2014) also describe mechanisms where cultural consumption norms are formed, among other factors, by media and advertisement.

Turning to the effect mechanisms of online media, media psychologists applied the social cognitive theory; Bandura (2001) conceptualised mass media communications systems as influencing behaviour directly and indirectly. According to his conceptualisation, online media affect behaviour by informing and influencing motives of recipients. Indirectly, media influences are socially mediated through social networks that transport social norms. This theory corresponds well with action determination models in environmental psychology that emphasise the central role of personal norms (S. H. Schwartz, 1977) and social norms (Cialdini et al., 1991) in predicting behaviour. Bandura (2001) further emphasised that interactive communication systems, as is the internet, can intensify their influence through tailored information. Tailored information is especially effective as far as influencing attitudes and behaviour goes (Abrahamse & Matthies, 2012; Pelletier & Sharp, 2008), and personalisation in social media or targeted advertisement is thus expected to be especially effective in influencing motives and behaviour.

Of special interest in psychological research is understanding the motivational factors by which online advertisement or social media content change consumption behaviour. As described above, I identified normative motives as central mediators between online content and sufficiency-oriented consumption. Normative motives can be driven by moral obligations, such as the personal norm. The personal norm was shown to be a stable predictor of pro-environmental behaviour (Bamberg & Möser, 2007; S. H. Schwartz, 1977). Supporting this finding for the sufficiency domain, Verfuërth et al. (2019) found that sufficiency orientation predicted consumption reduction. Normative motives can additionally include an orientation towards conformity, as in the case of the social norm (Cialdini et al., 1991), which was also found to be a robust predictor of pro-environmental behaviour (Abrahamse & Steg, 2013; Bamberg & Möser, 2007).

Notably, the major part of social media platforms or providers of websites including advertisement primarily makes its profits from consumption-promoting advertisement (Frick,

Gossen, et al., 2021). I, thus, also researched theories that include consumption-promoting contextual factors and consumption-oriented motives. Matthies (2005), Richetin et al. (2012), and Thøgersen (2014) argued that not only pro-environmental and normative motives (e.g., pro-environmental personal or social norms), but also conflicting motives play a central role in determining environmentally relevant behaviour. Thøgersen (2014) therefore proposed an interdisciplinary model that predicts unsustainable (over-)consumption instead of pro-environmental behaviour. Additionally, the goal-framing theory complements normative motives (what one is supposed to do, e.g., personal and social norms) with gain motives and hedonic motives to predict behaviour (Lindenberg & Steg, 2007). Gain motives are guided by what brings a person personal benefit, and hedonic motives are driven by what feels good to them. In terms of sufficiency-oriented consumption, these theories help identify not only predictors of intentional consumption reduction, but also distinct motivational predictors of increased consumption (Richetin et al., 2012).

In interdisciplinary literature, consumption needs and desires described as influencing overconsumption, which is opposed to sufficiency-oriented consumption (P. M. Brown & Cameron, 2000; Sanne, 2002; Thøgersen, 2014). These needs and desires would fall under the category of gain and hedonic motives (Lindenberg & Steg, 2007). The consideration of perceived desires and actual needs is at the heart of the sufficiency debate. Discussions include what amount of material consumption individuals need for a 'good life' from both a philosophical (Di Giulio & Fuchs, 2014) and a psychological point of view (Jenny, 2016). Max-Neef, Elizalde, and Hopenhayn (1992)'s fundamental human needs theory states that human needs are finite, yet need satisfiers (e.g., consumption goods) vary in material intensity and are potentially infinite. In the context of consumption of goods and services, material aspiration level have been applied to measure consumption desires (e.g., Lohmann, 2015). Aspiration levels can be operationalised as a "minimum amount" of consumption that individuals think they need to consume without decreasing their well-being. A psychological approach to this concept is the 'perceived sufficient amount of consumption' (Jenny, 2016). Aspiration levels can also be operationalised as the consumption level that individuals would ideally desire (Karlsson et al., 2004; Lohmann, 2015). Summing up, consumption desires as aspiration levels, but also social norms for consumption, have been conceptualised as barriers to sufficiency-oriented consumption (Ahlström, Gärling, & Thøgersen, 2020; Thøgersen, 2014). As a consequence, I included in my empirical studies not only sufficiency-oriented normative motives, but also consumption-oriented motives and consumption norms.

2.2.2 Empirical findings

In this section, I sum up research on the two central aspects of online advertisement and social media; a more detailed state of research can be found in Publication B. The research on online advertisement's influence on consumption behaviour is mainly situated

in the discipline of marketing, where often not sufficiency-oriented consumption but rather an increase in purchase of certain products is the target behaviour (Stephen, 2016). As an example, online advertisement was found to be more effective in inciting purchase than traditional “offline” advertisement (Dinner et al., 2014). Yet research has not yet determined, whether online advertisement’s effectiveness results in a shift in product choice or in an increase of consumption levels. There is also no clear evidence as to whether social media content may affect consumption levels. Yet, as one example in a different behavioural field, social media content including descriptive social norms could influence voter behaviour (Bond et al., 2012).

Research on the extent to which online environments influence sufficiency-oriented consumption through motivational factors is at an early stage. Bauer, Wilkie, Kim, and Bodenhausen (2012) found that exposing participants to advertisement-like content increased materialism. Their study measured short-term effects that can be attributed to priming or cuing, i.e., making participants’ pre-existing motives salient in the situation (Lindenberg and Steg (2007)). (Bauer et al., 2012)’s results indicate that, but do not test whether online content also changes motives in the long term. Media psychology (e.g., cultivation theory) implies that long-term effects on consumption-oriented motives, such as materialism, can also be expected from frequent media exposure. In one such study, internet penetration was correlated with aspiration levels (Lohmann, 2015). In further studies, social media use correlated with conspicuous consumption or materialism (Taylor & Strutton, 2016). Research that finds such long-term interrelations is mostly based on correlational data and thus not free from possible self-selection or personalisation bias. From a methodological perspective, long-term effects are thus difficult to prove, as random assignment is often not practicable. More long-term research is needed to gain further insights into long-term effects of online media, but interdisciplinary research has shown that also cross-sectional survey methods can help gain valuable insights.

2.2.3 Research question 2

Based on the theoretical and empirical state of research, it can be expected that online marketing and social media content that is directed towards increased purchase decreases sufficiency-oriented consumption. At the same time, content that promotes consumption reduction is hypothesised to strengthen sufficiency-oriented consumption.

***RQ2:** How does the perception of sufficiency-promoting and consumption-promoting online content influence sufficiency-oriented consumption?*

For the empirical study, the research question can be narrowed down to specific hypotheses derived from the theoretical and empirical state of research: the sufficiency-oriented motives (personal norm for sufficiency) and norms (social norm for sufficiency) are positive mediators between sufficiency-promoting content and sufficiency-oriented consumption, but

negative mediators for consumption-promoting content. In effect, consumption-promoting content is expected to decrease sufficiency-oriented motives and, thus, respective behaviour. The reverse pattern should be found for consumption-oriented motives (aspiration levels) and norms (social norm for consumption). Sufficiency-promoting content is expected to decrease consumption-oriented motives and thereby increase sufficiency-oriented behaviour. Consumption-promoting content may then increase consumption-oriented motives, which decrease sufficiency-oriented consumption. The hypotheses (aligning with paths 2a and 2b in Fig. 1) will first be addressed in mediation models in a correlational manner in Publication B and then tested in experimental designs in Publication C:

***H2a:** The perception of sufficiency-promoting online content positively, and consumption-promoting online content negatively, influences sufficiency-oriented consumption.*

***H2b:** The personal norm and social norms for sufficiency mediate the influence of online content in the manner of strengthening sufficiency-oriented consumption, whereas aspiration levels and social norms for consumption mediate this relationship in a manner that weakens sufficiency-oriented consumption.*

3 Research design and methods

Three main challenges arose when setting up the empirical concept for the thesis. First, the thesis was embedded in an overarching project of a transdisciplinary research group, and thus research questions had to be formed based on an interdisciplinary and a practice-oriented perspective. Second, as a study subject, online environments pose challenges both in operationalisation, empirical measurement, and manipulation. Third, the research questions had to be tested in several consumption domains to determine whether the empirical results are generalisable across different consumption domains.

3.1 Development of research questions in a transdisciplinary setting

In sustainability research, the research objective is not only the creation of knowledge; it also follows the normative goal of social-ecological change (Scholz, 2017). Further, sustainability researchers engage in interdisciplinary research and collaborate with actors from practice, as sustainability goals can only be reached through cooperation on a societal level (Brandt et al., 2013). Transdisciplinary research methods help rise to these challenges. Transdisciplinarity is defined as a research approach that includes multiple scientific disciplines (interdisciplinarity) focusing on shared problems and the active input of practitioners from outside academia (Brandt et al., 2013). The aim of transdisciplinary research is to produce knowledge to cope with real-world problems (Lang et al., 2012).

This research approach is based on co-production of knowledge that includes the research question relevant in solving a societal problem (such as the climate crisis), integrating research methods from different disciplines, and diffusing research results to various societal actors in order to implement changes (Lang et al., 2012). Also, researchers critically reflect the normative component of their research, as well as their own role and subjectivity in the research process (C. Pohl, Krütli, & Stauffacher, 2017). Both the biggest challenge and the biggest benefit of transdisciplinary work is mutual learning and the integration of epistemics (knowledge systems) between different disciplines and between science and practice (Scholz, 2017). In this thesis, insights from transdisciplinary workshops with practice partners in e-commerce and consumer protection organisations, as well as collaboration with fellow researchers in several disciplines, helped form the research questions. Collaboration with macro-economics, social sciences and ICT life cycle assessment informed *RQ1* in the context of ICT rebound-effects and induction effects (J. Pohl et al., 2019; Santarius & Soland, 2018). *RQ2* on online advertisement and social media influences evolved in collaboration

with a marketing (Gossen et al., 2019) and practical e-commerce perspective of an online shopping platform.

From a transdisciplinary point of view, three kinds of knowledge production can be distinguished (Hadorn et al., 2008): System knowledge concerns the knowledge on the current situation, target knowledge concerns the aspired target situation, and transformation knowledge informs shaping the transition from the current to the target situation. Environmental psychology research depends on interdisciplinary collaboration with environmental and natural sciences, as these usually provide sustainability-oriented target knowledge, for example, to determine which consumption behaviours are environmentally harmful and thus need to be targeted to protect the environment. Environmental psychologists produce system knowledge through testing behavioural determinant models (e.g., Klöckner & Blöbaum, 2010). They further produce transformation knowledge through experiments that test behaviour change interventions (Osbaldiston & Schott, 2012).

In my thesis, I first conducted three representative surveys to gain system knowledge on relationships between online environments and sufficiency-oriented consumption (Publications A and B). Then, I elaborated the second research question towards transformation knowledge through intervention studies on how to foster sufficiency-oriented consumption in online environments (Publication C).

3.2 Selection of research design

As described in Chapter 1.2, online environments are more dynamic than built or natural environments. Environments such as social media, search engines, or websites with advertisement placement are responsive to their users' online behaviour and preferences, providing the users with matching content. As a consequence, online environments and individuals have a reciprocal relationship of online environments with individual behaviour and motives. This positive feedback loop between the appearance of online environments and individual behaviour can be termed an "echo chamber", which can intensify existing motives (Luzsa & Mayr, 2019). Yet, predominant action determination models in environmental psychology presume a unidirectional causality from situational or contextual factors to intentions and behaviour (e.g., Ajzen, 1991; Bamberg & Möser, 2007; Klöckner & Blöbaum, 2010; Steg & Vlek, 2009). Accordingly, psychological methods aiming to examine causal relationships are based on the condition that independent variables need to be, as the name implies, independent of the outcome or intermediate variables. Strictly speaking, the exposure to online content such as advertisement cannot be measured independent of the user's consumption motives and behaviour, as these partly determine which content the user is exposed to. Online environments are actively chosen by users and personalized by algorithms. They are, thus, inherently confounded with users' existing motives and attitudes. In other words, any field experiment in online environments was

going to be confounded by self-selection bias. Hence, online environments' responsiveness posed additional challenges and restrictions of interpretability to the empirical assessment of their influence on consumption behaviour.

Further methodological challenges arise when researchers attempt to measure a causal relationship on existing societal phenomena in the field, as for example advertisement's effect on consumption levels or materialistic values. Research on media and marketing influences on consumption applies several methods, which each have their advantages and disadvantages. Cross-sectional studies using data on a macro-level (e.g., [Molinari & Turino, 2018](#)) or cross-sectional self-report surveys on a micro-level (e.g., [Liu-Thompkins, 2019](#)) can only establish correlational relationships that cannot determine directional causality. Laboratory experiments are more seldom, and can only test short-term effects, as for example the priming effect of a consumption-promoting manipulation on subsequent behaviour ([Bauer et al., 2012](#)).

My methodological approach to address these challenges of measuring effects in online environments and of a transformation at the societal level was to combine several quantitative methods (Table 3). As outlined in method literature, for more robust hypothesis testing, it is advisable to combine a variety of research methods (e.g. interviews, surveys and experiments) that can complement each other's strength and weaknesses ([Gifford, 2016](#)). I first conceptualised relevant relationships between three central aspects of online environments (online shopping, advertisement, social media), motivational factors, and sufficiency-oriented consumption. I did so by analysing interdisciplinary literature and interpreting it through an environmental psychology perspective (see also [Frick & Gossen, 2019](#); [Frick & Santarius, 2019](#)). On this basis, I designed a cross-sectional survey to test the identified research hypotheses on a correlational level. For these findings to be more generalisable, I applied the survey in three consumption domains, each in a sample representative of the German population. After establishing these links in moderation models (Publication A) and structural equation modelling (Publication B), I then turned to experimental research methods to explore causality in these relationships.

Experimental research design is more labour-intensive and limited in the number of constructs that can be addressed. Therefore, I focused on *RQ2* and the clothing consumption domain going forward. I followed up on correlations of consumption-related online content with sufficiency-oriented consumption in two experiments. This choice was based both on research interests derived from the surveys and for practicability. From a research interest perspective, the research described in Publication A had shown that enabling effects of online shopping have mixed effects and that consumption motives play a pivotal role in the consumption process. Research in Publication B had added insights on the strong relationship of online content in marketing and social media with consumption motives. From a practical perspective, the practice partner in our project mostly offered clothing and was more flexible in adapting its communication and marketing than adapting its

online shop design for the purpose of a field experiment. In the experiments, online content could be manipulated instead of measured by self-report only, as applied in surveys. Both a quasi-experimental field experiment and a laboratory experiment were conducted, as they could complement one another: The quasi-experimental field experiment could strengthen external validity and a long-term perspective on online content's influences. In a transdisciplinary research approach, the intervention was conducted in co-creation with an online marketplace. It consisted of a theme week promoting sufficiency-oriented consumption on the marketplace's website, social media accounts and newsletters. Thus, the experimental and control group assignment could not be randomised, but rather customers reported in an online survey whether they had seen the intervention. The laboratory experiment complemented the field experiment by providing internal validity, full randomisation and better causal interpretability for short-term effects. Table 3) summarises the advantages and disadvantages of the different methods.

Table 3: Combining and comparing research methods in the thesis

Method	Advantages	Disadvantages
Cross-sectional representative surveys in three consumption domains and three aspects of online environments (Publication A & B)	<ul style="list-style-type: none"> • Sample representativeness • Replication in several consumption domains • Addressing several online environments 	<ul style="list-style-type: none"> • Correlational relationships, no causality • Self-reported perception of online content exposure
Transdisciplinary, longitudinal quasi-experimental field intervention study (Publication C)	<ul style="list-style-type: none"> • External validity • Assessment of long-term effects • Real-world impacts, practical learnings and implications 	<ul style="list-style-type: none"> • Self-selection bias and non-representativeness due to convenience sampling • Quasi-experimental setting due to self-reported exposure to manipulation • Low control over manipulation design due to practice collaboration
Online laboratory experiment with a 3×2 design (Publication C)	<ul style="list-style-type: none"> • Internal validity, controlled manipulation • Full randomization, representative and controlled sampling • Behavioural measure • Causal implications 	<ul style="list-style-type: none"> • Short-term effects • Low external validity

3.3 Choice of consumption domains

Examining relationships between online environments and sufficiency-oriented consumption, the surveys assessed consumption in several domains in order for the results to be replicable across the consumption domains that play a central role in online environments. Criteria for consumption domains were, first, that they had a relevant environmental impact, second, the necessity of the consumption domain for human well-being, and third, the prevalence of the consumption domain in online environments.

To determine the relevance of environmental impact, each of the planetary boundaries is relevant, but most studies concentrate on the CO₂-footprint and climate change. In this respect, [Ivanova et al. \(2020\)](#) have identified the following consumption changes as most environmentally friendly:

1. Mobility: car travel reduction (living car-free, shifting to electric vehicles and public transport), air travel reduction
2. Housing: use of renewable electricity, more sustainable heating (renewable-based heating and heat pump), refurbishment and renovation
3. Nutrition: shift to a plant-based diet

Projections of future electricity usage and greenhouse gas emissions also include digital infrastructure and devices, which may contribute up to 23% of global greenhouse gas emissions in 2030 ([Andrae & Edler, 2015](#)). For other planetary boundaries, different consumption domains can have more detrimental impacts. For land use and biodiversity loss, for example, the main driver is agriculture and food production ([Wilting, Schipper, Bakkenes, Meijer, & Huijbregts, 2017](#)). For freshwater use and chemical pollution, the food sector and the clothing industry are key consumption domains ([Choudhury, 2014](#)). Further, social inequality, threats to human rights and poor labour conditions are mostly caused in the Global South in agriculture and manufacturing (e.g., food, manufactured devices, textiles), the results of which are, to a substantial part exported to the Global North ([Simas, Golsteijn, Huijbregts, Wood, & Hertwich, 2014](#)).

Second, I considered which consumption is superfluous to fulfilling objective human needs ([Defila & Di Giulio, 2020](#)). This consideration follows the rationale that consumption reduction should primarily be applied in domains that are the most dispensable in regards to human well-being ([O'Neill et al., 2018](#)). Especially the clothing domain is subject to such overconsumption: Due to the fast fashion industry, the amount of clothing purchased has been increasing constantly, and the use time of clothing has been declining ([Niinimäki et al., 2020](#)). Fashion and newness are guiding principles for conspicuous consumption, which does not satisfy basic needs, but rather helps individuals socially distinguish themselves through luxury ([O'Cass & McEwen, 2004](#)). Similarly, digital devices are subject to

superfluous consumption, as their lifetime is often shortened by the desire to own the newest technology (Jaeger-Erben, Frick, & Hipp, 2021). Finally, a substantial driver of environmental impact is leisure air travel, which is strongly connected to affluence and often considered superfluous (Gössling, Hanna, Higham, Cohen, & Hopkins, 2019), as well as socially unjust, as its environmental impact is caused by the most privileged and wealthy parts of society (Gössling & Humpe, 2020).

Third, I assessed which consumption domains are most prevalent in the aspects of the online environments examined. For online shopping, fashion and electronics were the products most sold online in 2020 (Statista, 2021c). Also Eurostat (2018) identifies these product categories, along with books, food deliveries, furniture and beauty products, as the most frequently purchased products in e-commerce in the year 2020 and also identifies that, in 2019, before travel bans due to the COVID-19 pandemic, travel was amongst the most popular products. In online marketing, clothing, travel, and technological innovations such as digital devices or cars are among the most advertised products (Statista, 2019b). In online marketing, especially the role of social media, of mobile devices and video formats is growing (Statista, 2021b). Finally, in social media content, the main topics discussed are fashion and beauty, technology, or holiday trips (Statista, 2019a). Considering these three parameters, I chose the consumption domains of clothing, digital devices, and leisure travel for the empirical studies.

4 Publications

Additional information on Publications

Publication A

Frick, V., & Matthies, E. (2020). Everything is just a click away. Online shopping efficiency and consumption levels in three consumption domains. *Sustainable Production and Consumption*, 23, 212-223. <https://doi.org/10.1016/j.spc.2020.05.002>

CRedit authorship contribution statement

Vivian Frick: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Visualization.

Ellen Matthies: Conceptualization, Writing – review and editing, Supervision.

Orientation of the Journal „Sustainable Production and Consumption“

„Sustainable production and consumption can be defined as production and use of products and services in a manner that is socially beneficial, economically viable and environmentally benign over their whole life cycle. The journal aims to provide a leading platform for publishing high-quality interdisciplinary papers on research and practice in this emerging field. It looks uniquely at the interactions between technology, consumption and policy to help identify more-sustainable solutions for both production and consumption systems.“ (Elsevier, 2020)

Impact Factor 5.03 (2021)

Publication Process

Manuscript received: 12 February 2020

Manuscript revised: 1 May 2020

Manuscript accepted: 2 May 2020

Version of Record online: 18 May 2020

Publication B

Frick, V., Matthies, E., Thøgersen, J., & Santarius, T. (2021). Do online environments promote sufficiency or overconsumption? Online advertisement and social media effects on clothing, digital devices, and air travel consumption. *Journal of Consumer Behavior*, 20(2), 288-308. <https://doi.org/10.1002/cb.1855>

CRedit authorship contribution statement

Vivian Frick: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Visualization.
Ellen Matthies: Conceptualization, Writing - review and editing.
John Thøgersen: Conceptualization, Methodology, Writing – review and editing, Supervision.
Tilman Santarius: Conceptualization, Writing - review and editing.

Orientation of the Journal „Journal of Consumer Behavior“

„The Journal of Consumer Behaviour aims to promote the understanding of consumer behaviour, consumer research and consumption through the publication of double-blind peer-reviewed, top quality theoretical and empirical research. An international academic journal with a foundation in the social sciences, the JCB has a diverse and multidisciplinary outlook which seeks to showcase innovative, alternative and contested representations of consumer behaviour alongside the latest developments in established traditions of consumer research.“ (Wiley, 2020)

Impact Factor 3.28 (2021)

Publication Process

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Version of Record online: 25 August 2020
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Publication C

Frick, V., Gossen, M., Santarius, T., & Geiger, S. (2021). When your shop says #lessismore. A field and laboratory intervention on online communication for clothing sufficiency. *Journal of Environmental Psychology*, 75, 101595. <https://doi.org/10.1016/j.jenvp.2021.101595>

CRedit authorship contribution statement

Vivian Frick: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Visualization.
Maike Gossen: Conceptualization, Methodology, Investigation, Resources, Writing – original draft.
Tilman Santarius: Conceptualization, Resources, Writing – review and editing, Project administration.
Sonja Geiger: Conceptualization, Methodology, Investigation, Resources, Writing – review and editing, Supervision.

Orientation of the Journal „Journal of Environmental Psychology“

„The Journal of Environmental Psychology is the premier journal in the field, serving individuals in a wide range of disciplines who have an interest in the scientific study of the transactions and interrelationships between people and their surroundings (including built, social, natural and virtual environments, the use and abuse of nature and natural resources, and sustainability-related behavior). The journal publishes internationally contributed empirical studies and systematic reviews and meta-analyses of research on these topics that advance new insights.“ (Wiley, 2020)

Impact Factor 5.19 (2021)

Publication Process

Manuscript received: 2 September 2020
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4.1 Publication A: Everything is just a click away. Online shopping efficiency and consumption levels in three consumption domains.

Vivian Frick & Ellen Matthies¹

Abstract

Online shopping makes consumption increasingly easy. It may lead to more sufficiency-oriented goods and services being bought (e.g. second-hand clothing), but also comes with the risk of overconsumption due to rebound- and induction effects. This study examines whether perceived behavioural efficiency gains of online shopping are associated with higher consumption levels of new, as well as sufficiency-oriented goods or services.

In a cross-sectional three-study design, self-reported consumption levels of clothing ($N = 883$), digital devices ($N = 860$) and leisure travel ($N = 976$), purchase intentions and perceived behavioural efficiency gains of online-shopping were measured. Moderation analyses tested whether purchase intentions and efficiency gains predicted higher consumption levels.

Online shopping was perceived to have lower behavioural costs than in-store purchase, except for alternative transport booking (e.g. bus, train). Perceived behavioural efficiency gains of online shopping were not linked to higher clothing consumption levels, but they were linked to higher consumption levels in case of digital devices and travels.

Depending on the consumption domain, online shopping efficiency fosters both consumption levels of sufficiency-oriented and new products. Heterogeneous findings suggest that context and motivation are essential factors for the influence of online environments.

Keywords: Sustainable consumption, Sufficiency, Behavioural cost, Online shopping, Rebound-effect, Induction effect.

Introduction

Every-day consumption is increasingly influenced by online environments: Two thirds of a German survey sample stated that they had shopped online in the last three months; Over 90 % had searched for consumption-related information online (Statista, 2018). Information and communication technology (ICT) makes information and consumption available anywhere, anytime. The ease of online shopping changes consumption patterns

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and poses new challenges for sustainable consumption: Already, consumption in the industrialised countries is exceeding planetary boundaries, which has detrimental effects on human lives (Raworth, 2012; Steffen et al., 2015). In order to keep human activities within these planetary boundaries, the need for an absolute reduction of individual consumption levels in industrialised countries was thus expressed (Lorek & Spangenberg, 2014; O'Neill et al., 2018). Limiting individual consumption levels to what is needed to fulfil objective needs is defined as sufficiency (e.g., Di Giulio & Fuchs, 2014; Lorek & Spangenberg, 2014). Sufficiency-oriented consumption is the 'quantitative' aspect of sustainable consumption. In other words, individuals consume a reduced amount of new products or services, or substitute a resource- and energy-intensive service with a more frugal one (Jenny, 2016). For example, travelling by train instead of plane or purchasing 'second-hand' instead of new goods (Speck & Hasselkuss, 2015).

On one hand, the internet offers increased access to information on sustainability and to more sustainable goods and services (Börjesson Rivera et al., 2014; Chatzidakis & Mitussis, 2007; Reisch, 2001). Better access to sufficiency-oriented consumption alternatives can help substitute the purchase of new goods and services (e.g. second-hand acquisition, Behrendt et al., 2019; Reisch, 2001). On the other hand, the internet's "endless shopping opportunities" are "always open", and so online-shopping was seen as a gateway to over-consumption since the early stages of the internet (Reisch, 2001, p. 274). Consumption levels were expected to rise due to "the ease of pointing and clicking" (Sui & Rejeski, 2002, p. 157) in a "frictionless market" with close-to-zero transaction costs (Plepys, 2002, p. 519). More recently, this expected increase of individual consumption levels has been addressed as rebound- and induction effects (Börjesson Rivera et al., 2014; Hilty, 2008). Needless to say, such consumption level increases would imperil societal goals of living within planetary boundaries and social justice (Raworth, 2012; Steffen et al., 2015).

As a result of the relative ease of online shopping, there are anticipated chances and risks due to an increase in purchases. Either goods and services in general are purchased in higher quantity, or sustainable consumption options in particular. Based on these considerations, two research questions were examined in three separate surveys in the consumption domains of (i) clothing, (ii) digital devices, and (iii) leisure travel. The first aim was to inquire whether the ease of online shopping is associated with higher individual consumption levels of new, resource-intense goods and services, or whether online-shopping is rather substituting in-store purchases. The second question covered beneficiary effects of online-shopping, testing whether the ease of shopping sufficiency-oriented goods and services online is linked to individuals' respective consumption levels.

Literature and theory

Studies comparing online and in-store purchase mostly focus on the energy-intensity of individual purchases, and find that for a single item purchase, various factors such as consumer's travel behaviour, routing of deliveries, packaging or basket sizes are critical to decide whether online or in-store purchase is less energy- and resource-intensive (e.g., [Hischier, 2018](#); [Rosqvist & Hiselius, 2016](#); [Van Loon, Deketele, Dewaele, McKinnon, & Rutherford, 2015](#)). This study, however, focuses not on single item purchases, but on the influence of the ease of online-shopping on the individual consumption level within three consumption domains (e.g. clothing).

It was argued that shopping becomes easier due to (especially mobile) internet use, as one can buy more products or services investing less time, effort and money, which is described as shopping efficiency or productivity ([Voropanova, 2015](#)). Online product information, assessment and comparison portals further reduce the search and transaction costs ([Reisch, Büchel, Joost, & Zander-Hayat, 2016](#)). As [Friedrichsmeier and Matthies \(2015\)](#) argue, for consumption decisions, an individual's mental representations of costs are decisive as opposed to actual costs. These perceived costs are not only financial. We therefore define efficiency gains of online shopping in psychological terms: a reduction of individually perceived behavioural costs. Behavioural costs are defined as the behavioural price relative to the behavioural budget, wherein behavioural price includes time, psychic and physical task demand and the behavioural budget is a function of the goal importance ([Verhallen & Pieters, 1984](#)). Perceived behavioural efficiency gains may alter consumption behaviour by increasing perceived behavioural control, defined as the perceived ease or difficulty for an individual to perform a behaviour ([Ajzen, 2002](#)), and by reducing perceived behavioural barriers ([Tanner, 1999](#)).

Such efficiency gains may lead to a substitution effect, if individuals consume the same amount of goods and services given online shopping possibilities as they did previously, saving behavioural costs thanks to the efficiency of online shopping (i.e. minimising input). Yet the other possibility to use efficiency is instead to maximise output, remaining at the same input level but instead increasing their consumption levels. This second possibility is the focus of this study and is further discussed in the next chapters on rebound-effects, induction and beneficiary effects of online shopping.

Rebound- and induction effects of online shopping efficiency

If a substitution of in-store shopping for online-shopping took place, individual consumption levels would remain steady. Yet repeatedly, researchers found that online shopping has a complementary relationship with in-store shopping: Rather than reducing shopping trips, online shopping is not or even positively associated with in-store purchases ([Cao, 2012](#); [Lachapelle & Jean-Germain, 2019](#); [R. J. Lee et al., 2017](#); [Zhou & Wang, 2014](#)).

These studies focused on travel behaviour change, rather than indicating how consumption levels of products or services might change. To fill this research gap and examine the relationship between online-shopping efficiency gain and consumption levels, we address this link empirically on an individual level.

The anticipated relationship of perceived behavioural efficiency gains of online shopping and higher consumption levels corresponds to both the direct rebound-effect and the induction effect (Røpke, 2012). The direct rebound-effect is typically described as a phenomenon in which energy efficiency gains from technological innovations do not fully lead to expected energy-savings but rather, because of a decrease of costs and thus monetary gain, motivate additional consumption which offsets part of the savings (Berkhout et al., 2000; Gillingham, Jenn, & Azevedo, 2015; Khazzoom, 1980). This definition differs from the consumption increase described here, as behavioural efficiency gains of shopping online are not a monetary gain, and as seen above, there is no certainty that energy efficiency per item purchase increases when moving purchases online. However, some authors broadened the concept of rebound-effect to include consumption increases due to efficiency gains to those that are not related to energy-efficiency or based on monetary gains, but for example effort and time savings (Santarius, 2015; Santarius, Walnum, & Aall, 2016). The induction effect on the other hand is broadly defined as the implementation of new technologies such as ICT products and services leading to an increased demand for other products or services (Hilty, 2008; Mickoleit, 2010; Røpke, 2012). As an example for the induction effect, (Hilty, 2008, p. 38) describes that the convenience of printers leads to an increase of print-outs. Hence according to the existing literature, the consumption increase examined in this study can be subsumed both under rebound- or induction effects.

Prior research on a possible increase of consumption levels due to online-shopping is scarce. LaRose and Eastin (2002) found a relationship between online-shopping and impulsive buying, which they explained by deficient self-regulation and the removal of time and resource barriers in online-shops. In a marketing survey (Beauchamp & Ponder, 2010), shopping 'convenience' was perceived to be higher by online than in-store shoppers, which indicates perceived behavioural efficiency gains. Additionally, there is a variety of marketing studies that apply the Technology Acceptance Model (TAM) and structural equation modelling to cross-sectional survey data, finding correlations between the perceived ease of use and/or perceived ease of online shop use with purchase intentions, online shopping frequency and expenditures of online shopping (e.g., Shang et al., 2005). One paper could be identified that used a quasi-experimental approach and actual purchase amounts: Analysing individual purchase levels in an online food shop study, researchers found that the amount and frequency of shopping increased, when customers switched from ordering at the computer to ordering over a smartphone with mobile internet (R. J.-H. Wang et al., 2015). As mobile versus stationary internet use would reduce perceived behavioural cost, this result indicates increases in consumption levels due to efficiency gains. Yet the

research gap remains, whether there is any relationship between perceived efficiency gains of online shopping and not just online, but overall the consumption level of individuals.

Beneficiary effects of online shopping

By the same line of argument, perceived behavioural efficiency gains of online shopping may also facilitate consumption of sufficiency-oriented goods and services. Accordingly, it was argued that the ease of online-shopping fosters green consumption (Reisch, 2001). After Midden et al. (2007) this effect addresses the promoter role of online-shopping. Santarius and Soland (2016) define this as a beneficiary effect, ‘improved control over frugal use’ (p. 417), in which equally, better behavioural control fosters sufficiency-oriented consumption. In past research, beneficiary effects were shown for sustainable product choice in online-shops (Demarque, Charalambides, Hilton, & Waroquier, 2015). In a cross-national analysis, no direct relationship between sustainable consumption and internet penetration was found, yet internet penetration was found to strengthen the link between pro-environmental attitudes and sustainable behaviour (Y. Wang & Hao, 2018). Apart from that, we found no empirical field research on sufficiency-oriented consumption and online shopping.

A psychological perspective

In psychological theory, the link between perceived behavioral efficiency gains of online shopping and higher consumption levels corresponds with technology’s role as an amplifier for individual behaviour (Midden et al., 2007, p. 156), where technology “clearly enhances, extends, or amplifies the user’s goal attainment” and may thereby lead to an increase in resource consumption, if in line with the consumer’s consumption goals. It classifies the efficiency gain of using technology as a moderator between existing motivations and goal attainment. Also Bandura (2002) describes how digitalisation increases the primacy of human agency, generally enabling individuals to pursue their goals in various behavioural fields, e.g. shifting from in-store to online shopping or even shifting from conventional to easily accessible sufficiency-oriented options available online. Thus, whereas the definitions of rebound- and induction effect (Hilty, 2008; Mickoleit, 2010; Röpke, 2012) propose a direct relationship between technological efficiency gains and consumption levels, environmental psychology also adds the dependency on motivational factors to this debate. For example, a study found that energy saving is not directly brought about by the application of smart meters, but rather that its effectivity depends on personal motivation (Henn, Taube, & Kaiser, 2019). Personal motivations are often measured as intentions (Ajzen, 2002; Klöckner & Blöbaum, 2010). Intentions may lead to more sufficiency-oriented consumption (sufficiency intention), but other motives may also strengthen intentions to consume new products (Di Giulio & Fuchs, 2014; Gwozdz, Steensen Nielsen, & Müller, 2017; Midden

et al., 2007; Steg & Vlek, 2009). From a psychological perspective, a direct effect of perceived behavioural costs (i.e., perceived constraints and facilitation of behaviour access or constraints) on consumption behaviour as well as a reinforcing moderator effect on the intention-behaviour relationship are expected as outlined conceptually by Midden et al. (2007) and (Steg & Vlek, 2009) and shown empirically by Klöckner and Blöbaum (2010).

Model and hypotheses

The present study investigates the relationship between perceived behavioural efficiency gains of online shopping with consumption levels of new (research question, *RQ1*) and sufficiency-oriented (*RQ2*) goods and services in three consumption domains. Regarding both questions, if efficiency gains of online shopping hold relevance for consumption levels, then (a) online shopping is perceived as less behaviourally costly than in-store shopping and (b) individuals who find online shopping less behaviourally costly have higher online purchase levels. A person's expectation of lower behavioural costs of online-shopping (as opposed to in-store shopping) represents the perceived behavioural efficiency gain of online-shopping which is examined as an antecedent of the consumption behaviour (main effect) and of the intention-behaviour relationship (moderator effect, *c*).

H1a, H2a: *Perceived behavioural costs for online-shopping are lower than those of in-store shopping.*

H1b, H2b: *Perceived behavioural efficiency gains from in-store to online shopping are positively related to online purchase levels (main effect).*

H1c, H2c: *Perceived behavioural efficiency gains positively moderate the relationship between purchase intention and online purchase levels (moderator effect).*

If higher online consumption substitutes in-store shopping (*H0*), then the overall purchase level should be independent of perceived behavioural efficiency gains. If a rebound- or induction effect is occurring, then consumption levels of conventional, new products increase with online shopping efficiency (*RQ1*). Equally, if a beneficiary effect of more sufficiency-oriented consumption (*RQ2*) is occurring, then overall purchase levels of sufficiency-oriented products should be higher for participants who experience higher behavioural efficiency gains of online shopping (*d*), more so if they have sufficiency-oriented consumption intentions (*e*).

H1d, H2d: *Perceived behavioural efficiency gains correlate with an overall higher consumption of the product (main effect).*

H1e, H2e: *The relationship between purchase intention and behaviour is stronger when perceived behavioural efficiency gains are higher (moderator effect).*

Moderation analyses both for *RQ1* and *RQ2* were conducted as seen in Figure 2.

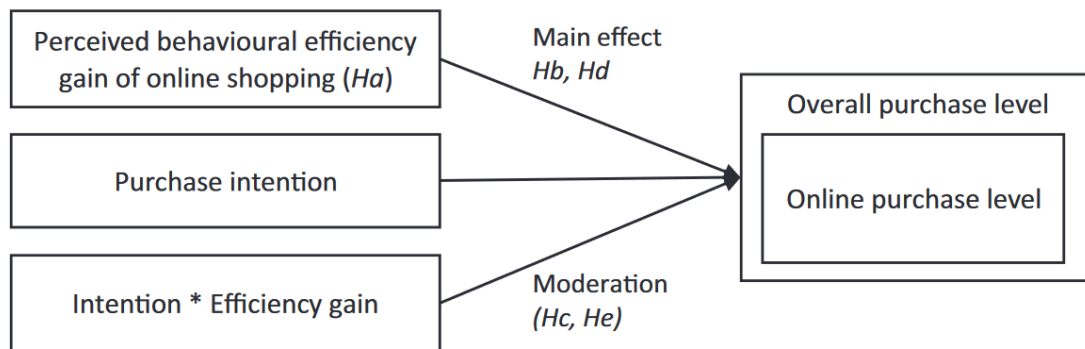


Figure 2: Hypotheses for purchase levels of conventional, new (*H1b-e*) and sufficiency-oriented (*H2b-e*) products.

Material and methods

We conducted three representative online-surveys on consumption of clothing, digital devices and leisure travel. The product categories were chosen due to the environmental impact relevance and the prevalence in online environments. First, both the production and disposal of clothing (Choudhury, 2014) and of digital devices (Arushanyan, Ekener-Petersen, & Finnveden, 2014) is responsible for the release of harmful chemicals and wastes, high consumption of water, energy and fuel for transportation, and for the use of non-biodegradable packaging materials. Electricity usage of digital devices may contribute up to 23 % of global greenhouse gas emissions in 2030 (Andrae & Edler, 2015). Tourism already accounts for 8 % of global greenhouse gas emissions, mainly caused by air travel (Lenzen et al., 2018). Second, clothing and digital devices are among the products and travel bookings among the services most purchased online (Eurostat, 2018).

Sample

The three studies had separate samples, recruited in the German population by a panel organisation, which included screen-out criteria based on socio-demographic representativeness. The initial samples ($N_{Clothing} = 1224$, $N_{Devices} = 1233$, $N_{Travel} = 1348$) were refined to ensure a minimum standard of data quality for online surveys: An instructed response item was applied, as proposed by Meade and Craig (2012), leading to exclusion of participants ($N_{Clothing} = 157$, $N_{Devices} = 156$, $N_{Travel} = 269$). Meade and Craig (2012) further advise to control for response time, which was done by a conservative estimation of minimum processing time per item is 2 s (Huang, Curran, Keeney, Poposki, & DeShon, 2012), excluding 96 participants in the clothing survey (170 items; < 340 s, 84 participants in the digital devices survey (195 items; < 380 s), and 98 participants in the travel survey

(195 items; < 380 s). Inconsistent answers also excluded participants ($N_{Clothing} = 88$, $N_{Devices} = 133$, $N_{Travel} = 5$), e.g. if the number of self-reported sustainable purchases exceeded total purchase level. A priori power analysis showed that a sample size of $N = 322$ is required in order to observe small effect sizes of 0.05 with 80 % power in a regression analysis including 9 predictors. In the study at hand, this was surpassed, in order to provide a representative sample, depicted in Table 4.

Table 4: The three samples compared to German population.

	Clothing $N = 883$	Digital devices $N = 860$	Leisure Travel $N = 976$	German Population ^a
Age				
$M (SD)$	46.0 (14.0)	46.6 (14.4)	46.1 (14.1)	44.3
Education level	24 % primary 37% second. 38% tertiary 1%other	23 % primary 37% second. 38% tertiary 2%other	23 % primary 37% second. 39% tertiary 1%other	30.4 % primary 23.1 % second. 31.9 % tertiary
Income (€, Median)	1'500 - 2'000	1'500 - 2'000	2'000 - 2'500	1'957 € (in 2013)
Gender	51 % female 48% male 1% other	51 % female 48% male 1% other	51 % female 48% male 1% other	50.7 % female 49,3 % male
Environmental concern \star	3.18 (0.72)	3.11 (0.64)	3.02 (0.67)	3.26 (0.73)
Time spent online ^b	2–4 h	2–4 h	2–4 h	3.27 h

Notes. \star Range: 1 = very low; 4 = very high; population mean adapted from the German Survey on Environmental Concern ([Umweltbundesamt, 2017](#))

$\star \star$ Range: 1 = 0–1 h, 2 = 1–2 h, 3 = 2–3 h, etc.

^a ([Statistisches Bundesamt - Destatis, 2018](#)); ^b Median; population value from [Statista \(2018\)](#)

Design and procedure

In a cross-sectional design, separate online surveys on the consumption domains of clothing, digital devices and leisure travel were disseminated. In each survey, first consumption levels of new goods or services and sufficiency-oriented goods and services (second-hand clothing and devices, alternative transport modes) were assessed. Then the time spent online and perceived behavioural costs of online and in-store purchase were measured, followed by other questions used for other analyses, environmental concern and socio-demographic variables.

As predictors and criterion variables are measured in the same survey, common method bias may occur. To avoid such bias, [Podsakoff, MacKenzie, Lee, and Podsakoff \(2003\)](#); [Podsakoff, MacKenzie, and Podsakoff \(2012\)](#) recommend to separate the measurement

of criterion and predictor proximally and methodologically. We measured, criterion and each predictor variables with different scale formats. As seen in more detail in the next section and in Appendix A , consumption levels were measured as the sum of products bought, whereas intention and behavioural costs were measured by Likert scales. Perceived behavioural efficiency gain was obtained including reversed items, and by subtracting costs of online and from in-store shopping, a calculation which would also partial out possible common method bias. To avoid proximity, the variables were dispersed in the surveys, which contained more questions in-between the used measures.

Measures

In all questionnaires, consumption level, perceived behavioural efficiency gains, and control variables were measured as self-reports for both acquiring new products and acquiring the sufficiency-oriented consumption alternative products. All scales can be found in the appendix.

Consumption level. For each consumption domain, consumption level refers to different retrospective time periods. Periods were defined so that purchases were both still memorable and the time period was long enough to be representative of individual consumption levels, as consumption domains differ in purchase frequency. For clothing purchase, this period consisted of the last three months (suggested by [Gwozdz et al., 2017](#)). Clothing purchase was measured on a 7-item scale from ‘0 pieces of clothing’ to ‘5 or more items’, each in the four categories of brick-and-mortar store, online-shop or marketplace, brick-and-mortar second-hand store, and online second-hand shop or marketplace. For digital devices, participants were asked to indicate which digital devices they had bought in the last two years, in a list of 15 devices. The period of two years was chosen as devices are used consecutively (e.g. buying a new smartphone after the old one breaks) rather than parallel (e.g. clothing). A time span of two years is both representative and more memorable because most guarantees for these devices are set to two years. For each selected device, participants then indicated which of the store categories (online vs. in-store; new vs. second-hand) they had purchased the device from. Summing them up, consumption levels were calculated. To assess booked leisure travels, participants chose which transport mode they had taken for leisure travels into foreign countries in the last 12 months, with the options of train and bus (referred to as alternative transport modes), short-distance plane (< 3.5 h, after [Mensen, 2003](#)) and long-distance plane (> 3.5 h) for air travel, car, ride-sharing or bike, or participants could chose ‘I have not been on any leisure travels to foreign countries’. The number of travels with either booking possibility (in-store / travel agency vs. direct booking / online booking portals) was assessed, each for train, bus, short-distance and long-distance plane trips, ranging from ‘0 travels’ to ‘5 or more travels’. The period of 12 months was chosen following the example of public census surveys typically assess a yearly period, and also because individuals

organise their leisure travel within the time-frame of a year, so travels could at the same time be remembered correctly and be representative.

Perceived behavioural efficiency gains. The perceived behavioural efficiency gain of online shopping was operationalised as perceived behavioural costs of online shopping minus those of in-store purchase (as a baseline). Perceived behavioural costs were operationalised based on psychological, physical and temporal costs (Verhallen & Pieters, 1984), the convenience scale by (L. G. Brown, 1990) and ‘online shopping convenience’, which includes time and effort saving (L. A. Jiang et al., 2013). They were assessed separately for online and in-store purchase in each of the three consumption domain studies. For the purchase of clothing, $\alpha_{\text{online}} = .77$, $\alpha_{\text{in-store}} = .78$, digital devices, $\alpha_{\text{online}} = .76$, $\alpha_{\text{in-store}} = .78$, and the booking of leisure travels, $\alpha_{\text{online}} = .76$, $\alpha_{\text{in-store}} = .77$, in each case, seven items were assessed on a 7-point Likert scale, with the option ‘does not apply to me / I don’t know’, defined as a missing variable. Exemplary items of this scale are ‘shopping for clothing is convenient’ or ‘finding the right digital device is time-consuming.’ (appendix A). For the perceived behavioural costs of second-hand purchase of clothing, $\alpha_{\text{online}} = .53$, $\alpha_{\text{in-store}} = .43$, or digital devices, $\alpha_{\text{online}} = .47$, $\alpha_{\text{in-store}} = .45$ as well as for booking travels with alternative transport modes, $\alpha_{\text{online}} = .63$, $\alpha_{\text{in-store}} = .58$, a 3-item short version of the previous scale was applied, including psychological, physical and temporal costs (appendix A). Perceived efficiency gains of online shopping compared to in-store purchase were then calculated as the perceived behavioural costs of purchase online minus the perceived behavioural cost of purchasing in-store as the baseline, resulting in the range from -6 for in-store shopping having lower costs than online-shopping, to $+6$ for online-shopping being easier. The variable was constructed in all three consumption domains each for purchase of new and second-hand clothing and digital devices, as well as booking leisure travels.

Purchase intention. Items measuring intention were on a 7-point Likert scale and introduced by ‘In my future decisions on clothing purchase I intend to...’ following Klöckner and Blöbaum (2010). Purchase intention for new products included three self-constructed items that capture the motivation to buy new products and services regularly (e.g., Gwozdz et al., 2017), for clothing ($\alpha = .81$), e.g. ‘buy new clothing regularly’, digital devices ($\alpha = .82$), ‘always be able to use digital devices that are the newest available technology.’ and air travel ($\alpha = .76$), e.g. ‘be able to travel by plane regularly.’ Purchase intention of sufficiency-oriented products was measured by 3 self-constructed items each, for second-hand clothing ($\alpha = .69$), second-hand digital devices ($\alpha = .68$), e.g. ‘buy used clothing instead of buying new.’ and alternative transport travels ($\alpha = .62$), e.g. ‘if possible travel with public transport, train or bus instead of the plane.’ These items were constructed based on literature on sufficiency-oriented consumption (Gwozdz et al., 2017; Jenny, 2016; Speck & Hasselkuss, 2015).

Control variables. We assessed the socio-demographic variables age, education level, income level and gender. Time spent online was assessed by the estimated time participants

spent online per day, adding up two items assessing the hours on a fixed device (e.g. desktop computer) and on mobile internet (e.g. smartphone). Environmental concern ($\alpha_{\text{Clothing}} = .83$, $\alpha_{\text{Devices}} = .85$, $\alpha_{\text{Travel}} = .85$) was measured by 5 items from the environmental concern study Germany on a 4-point Likert scale, e.g. ‘For the conservation of nature, we all have to be ready to cut back on our living standard.’ (Umweltbundesamt, 2017).

Data analysis

To test the difference in perceived behavioural costs of online and in-store shopping (perceived behavioural efficiency gain, *H1a*, *H2a*), paired t-tests were applied. Cohen’s *D* for repeated measures served as effect size, including the correlation between online and in-store behavioural costs (Lenhard & Lenhard, 2016). Subsequently, moderation analyses were conducted separately for the three consumption domains, and separately for the purchase of new products (*H1b-e*) and sufficiency-oriented purchases (*H2b-e*; second-hand products, alternative modes of travel transport), using SPSS PROCESS v 3.3 (Hayes, 2017). In the analyses with interval-scaled dependent variables, values scoring higher than 3.29 standard deviations above the sample mean (outliers) were truncated, i.e. recoded to scores one unit above the highest value within the valid range, as proposed by (Tabachnick & Fidell, 2007). Missing data resulted in a decrease of the sample.

Results

Descriptive variables are subsumed in Table 5. In the last 3 months, 84 % of the participants stated they had bought clothing, 66 % in stores and 60 % online. Only 17 % had bought second-hand clothing, 8 % in-store and 13 % online. In total, participants had purchased on average $M(SD) = 4.44(3.67)$ pieces of clothing, with 12 % of all clothing purchased second-hand. 86 % of the digital devices sample stated they had bought new digital devices in the last two years, 59 % in-store and 63 % online. 15 % had bought second-hand digital devices, 4 % in-store and 12 % online. Overall, participants had purchased $M(SD) = 2.98(2.50)$ digital devices, with a share of 7 % second-hand devices. In the last year, 36 % of the travel survey participants had taken short-distance flights (under 3,5 h), 29 % had taken long-distance flights (over 3,5 h), 21 % had travelled by train, 14 % by bus, 47 % with their own car, 6 % by bicycle, 4 % by car lift. 50 % of participants had taken the plane, 25 % the bus or train (alternative transport modes) and 42 % had not travelled by either bus, train or plane for leisure travel. Participants had travelled by plane $M(SD) = 1.22(2.01)$ times, $M(SD) = 0.61(1.58)$ times by train and $M(SD) = 0.31(1.03)$ times by bus in the last year.

Behavioural efficiency gains and online shopping

Behavioural costs were perceived to be lower for online shopping than for in-store shopping for new clothing (*H1a*), $t(852) = 19.30$, $p < .001$, $d_{\text{Repeated Measures}} = 0.68$ [CI 0.58 - 0.77], new digital devices, $t(822) = 19.39$, $p < .001$, $d_{RM} = 0.65$ [CI 0.55 - 0.75], and air travels, $t(817) = 9.97$, $p < .001$, $d_{RM} = 0.35$ [CI 0.25 - 0.45]. For sufficiency-oriented consumption alternatives (*H2a*), results were mixed. Second-hand purchase of clothing, $t(648) = 9.32$, $p < .001$, $d_{RM} = 0.35$, CI [0.24 - 0.46], and digital devices, $t(630) = 12.10$, $p < .001$, $d_{RM} = 0.47$, CI [0.36 - 0.58], were perceived to have less behavioural costs online than in-store. Yet, booking alternative transport modes (bus, train) online was perceived less behaviourally costly than in-store booking, $t(784) = -23.97$, $p < .001$, $d_{RM} = 0.80$, CI [0.70 - 0.90] (descriptives in Table 5).

Next, the direct effect of perceived efficiency gains of online shopping (*H1b*) and its interaction effect with purchase intention on the amount of new products purchased online (*H1c*) was tested (Table 6). Efficiency gains had both a direct effect on online clothing purchase, and an interaction effect (with an effect size of R_2 change = 0.007, $p < .01$): when efficiency gains of online shopping were low ($M - 1 SD$), the link between purchase intention and online purchase was weaker, $b = 0.29$, 95 % CI [0.18–0.40], $p < .01$, at the mean value $b = 0.37$, 95 % CI [0.29–0.46], $p < .01$, and when purchase intention was high, the link was strongest ($M + 1 SD$), $b = 0.49$, 95 % CI [0.36–0.59], $p < .01$. For online digital devices purchase, there was a direct effect, $b = 0.31$, 95 % CI [0.24–0.39], $p < .01$ and no interaction effect. Behavioural efficiency gains had a direct effect on air travels booked online, $b = 0.13$, 95 % CI [0.06–0.19], $p < .01$, and the interaction (R_2 change = 0.015, $p < .01$), with the relationship between purchase intention and behaviour being weaker when behavioural efficiency gains of online booking were low ($M - 1 SD$), $b = 0.16$, 95 % CI [0.07–0.25], $p < .01$, at the mean value $b = 0.26$, 95 % CI [0.19–0.33], $p < .01$, and when the efficiency gain was high ($M + 1 SD$), the relationship was stronger, $b = 0.40$, 95 % CI [0.30–0.50], $p < .01$.

In all consumption domains, the purchase intention for new products or services predicted more items purchased online. A higher age was associated with lower purchase levels for online-shopping, whereas income positively predicted the amount of products purchased online, this effect being stronger for digital devices and air travel than clothing. Online purchase of air travel was the only consumption domain associated (positively) with the level of education. Gender was only associated with online purchase of new digital devices in the sense that men purchased more devices. Environmental concern was not associated, and the time spent online positively predicted for online purchase of digital devices and air travel.

Table 5: Descriptive statistics of outcome and predictor variables.

	Clothing		Digital devices		Leisure travel	
	<i>(N = 883)</i>		<i>(N = 860)</i>		<i>(N = 976)</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>Consumption level</i>						
Purchases*:	3.92	2.99	2.77	2.41	1.22	2.01
in-store	2.00	1.97	1.26	1.55	0.32	0.91
online	1.92	2.06	1.51	1.84	0.87	1.55
Sufficiency-oriented purchases*:	0.52	1.52	0.21	0.62	0.92	2.22
in-store	0.19	0.81	0.05	0.32	0.24	0.89
online	0.33	1.03	0.16	0.50	0.63	1.65
<i>Perceived behavioural cost (PBC)</i> <i>of purchasing new products</i>						
PBC in-store purchase <i>(N = 872/834/826) **</i>	3.91	1.10	3.97	1.09	4.32	1.16
PBC online purchase <i>(N = 696/694/799) **</i>	4.94	1.08	4.91	1.05	4.89	1.08
Perceived behavioural efficiency gain <i>(N = 853/823/818) ***</i>	1.04	1.57	0.96	1.41	0.55	1.57
<i>Perceived behavioural cost (PBC)</i> <i>of purchasing sufficiency-oriented products</i>						
PBC in-store purchase <i>(N = 673/652/841) **</i>	4.06	1.3	3.69	1.20	4.79	1.15
PBC online purchase <i>(N = 696/694/799) **</i>	4.49	1.38	4.30	1.21	3.39	1.43
<i>Purchase intentions</i>						
of new products <i>(N = 872/844/931) ***</i>	4.29	1.49	3.83	1.61	4.86	1.46
of sufficiency-oriented products <i>(N = 876/842/938) ***</i>	2.70	1.44	3.31	1.46	4.47	1.40

Notes. Differences in *N* due to missing values when stated ‘I don’t know’.

* Clothing: in the last 3 months; Digital devices: in the last 2 years; Travel: in the last year

** Range: 1 = high behavioural cost; 7 = low behavioural cost.

*** Range: -6 = in-store is easier than online; 0 = both are equally easy;

6 = online is easier than in-store.

**** Range: 1 = not at all, 4 = indifferent, 7 = fully agree.

Table 6: Moderation analyses for online purchase of new products (*H1b, c*).

	New clothing purchased online						New digital devices purchased online						Air travel booked online					
	<i>coeff</i>	<i>se</i>	<i>t</i>	<i>p</i>	<i>lower CI</i>	<i>upper CI</i>	<i>coeff</i>	<i>se</i>	<i>t</i>	<i>p</i>	<i>lower CI</i>	<i>upper CI</i>	<i>coeff</i>	<i>se</i>	<i>t</i>	<i>p</i>	<i>lower CI</i>	<i>upper CI</i>
Constant	2.93	.52	5.63	<0.01	1.91	3.96	0.59	.48	1.22	.22	-0.36	1.54	0.06	.39	0.15	.88	-0.70	0.81
Purchase intention	0.38	.05	8.26	<0.01	0.29	0.47	0.19	.04	5.14	<0.01	0.12	0.27	0.27	.04	7.74	<0.01	0.20	0.34
Behavioural efficiency gains	0.31	.04	7.36	<0.01	0.22	0.39	0.31	.04	7.82	<0.01	0.24	0.39	0.13	.03	4.03	<0.01	0.06	0.19
Intention <i>X</i> efficiency gains	0.06	.03	2.59	.01	0.02	0.11	0.04	.02	1.78	.08	0.00	0.09	0.08	.02	3.67	<0.01	0.04	0.12
Age	-0.02	.01	-4.77	<0.01	-0.03	-0.01	-0.02	.00	-4.64	<0.01	-0.03	-0.01	-0.01	.00	-3.42	<0.01	-0.02	-0.01
Income	0.06	.03	2.09	.04	0.00	0.11	0.09	.02	3.68	<0.01	0.04	0.14	0.09	.02	4.65	<0.01	0.05	0.13
Education	-0.04	.06	-0.72	.47	-0.16	0.08	0.02	.06	0.33	.74	-0.09	0.13	0.16	.05	3.32	<0.01	0.07	0.26
Gender	-0.09	.13	-0.65	.52	-0.35	0.18	0.46	.12	3.98	<0.01	0.24	0.69	0.02	.10	0.24	.81	-0.17	0.22
Environmental concern	-0.05	.10	-0.57	.57	-0.24	0.13	0.08	.09	0.84	.40	-0.1	0.26	0.00	.07	-0.05	.96	-0.15	0.14
Time spent online	0.05	.03	1.80	.07	0.00	0.11	0.08	.03	2.77	.01	0.02	0.13	0.06	.02	2.80	.01	0.02	0.11
Notes.	<i>N</i> = 792; <i>R</i> ₂ = .21						<i>N</i> = 737; <i>R</i> ₂ = .22						<i>N</i> = 745; <i>R</i> ₂ = .20.					

Table 7: Moderation analyses for online purchase of sufficiency-oriented products (*H2b, c*).

	Second-hand clothing purchased online						Second-hand digital devices purchased online						Alternative transport modes booked online					
	<i>coeff</i>	<i>se</i>	<i>t</i>	<i>p</i>	<i>lower CI</i>	<i>upper CI</i>	<i>coeff</i>	<i>se</i>	<i>t</i>	<i>p</i>	<i>lower CI</i>	<i>upper CI</i>	<i>coeff</i>	<i>se</i>	<i>t</i>	<i>p</i>	<i>lower CI</i>	<i>upper CI</i>
Constant	-1.26	1.03	-1.22	.22	-3.27	0.76	-2.09	1.10	-1.91	.06	-4.24	0.06	-2.19	.79	-2.77	.01	-3.74	-0.64
Purchase intention	0.56	0.09	6.55	<0.01	0.39	0.72	0.32	0.09	3.45	<0.01	0.14	0.50	0.19	.08	2.31	.02	0.03	0.35
Behavioural efficiency gains	0.21	0.10	2.09	.04	0.01	0.41	0.26	0.10	2.70	.01	0.07	0.45	0.26	.07	4.00	<0.01	0.14	0.39
Intention <i>x</i> efficiency	-0.09	0.06	-1.51	.13	-0.21	0.03	0.03	0.06	0.44	.66	-0.10	0.15	0.05	.04	1.04	.30	-0.04	0.13
Age	-0.01	0.01	-1.14	.25	-0.03	0.01	-0.02	0.01	-2.01	.04	-0.04	0.00	-0.03	.01	-4.65	<0.01	-0.05	-0.02
Income	0.04	0.05	0.84	.40	-0.06	0.14	0.05	0.05	0.94	.35	-0.05	0.15	0.06	.04	1.52	.13	-0.02	0.13
Education	-0.07	0.11	-0.60	.55	-0.29	0.16	-0.31	0.13	-2.30	.02	-0.57	-0.05	0.22	.09	2.41	.02	0.04	0.40
Gender	-0.34	0.25	-1.39	.17	-0.82	0.14	0.53	0.26	2.02	.04	0.02	1.04	0.19	.19	1.01	.31	-0.18	0.56
Environmental concern	-0.21	0.21	-1.04	.30	-0.62	0.19	0.17	0.23	0.76	.45	-0.27	0.62	0.09	.16	0.55	.58	-0.23	0.41
Time spent online	0.19	0.05	3.83	<0.01	0.09	0.29	0.07	0.05	1.24	.22	-0.04	0.17	0.16	.04	4.10	<0.01	0.08	0.24
Notes.	<i>N</i> = 605; <i>R</i> ₂ McFadden = .15, CoxSnell = .12, Nagelkrk = .21						<i>N</i> = 585; <i>R</i> ₂ McFadden = .15, CoxSnell = .14, Nagelkrk = .22						<i>N</i> = 731; <i>R</i> ₂ McFadden = .12, CoxSnell = .12, Nagelkrk = .18.					

The analyses for second-hand products or alternative transport modes tested whether efficiency gains could predict whether participants had bought these sufficiency-oriented alternatives online or not. The analysis (Table 7) included $N = 605$ (69 % of the sample) for the online purchase of second-hand clothing, $N = 585$ (68 % of the total sample) for second-hand devices and $N = 731$ (75 % of the sample) for alternative transport booking due to missing data in perceived behavioural costs of these consumption alternatives. In all consumption domains, a main effect was found for behavioural efficiency gains of purchasing sufficiency-oriented products online on sufficiency-oriented product online shopping ($H2b$), but no interaction effects ($H2c$). Purchase intention consistently predicted second-hand online purchases. Age negatively predicted online purchase of second-hand digital devices and alternative transport modes. Education level negatively predicted online second-hand devices purchase and positively predicted alternative transport booking. Being male was associated with higher digital devices online purchase and the time spent online was positively linked to online-shopping of second-hand clothing and alternative transport modes.

Increasing or substituting consumption?

Last, moderation analyses tested whether perceived efficiency gains predicted overall higher consumption of new and sufficiency-oriented products. For new products, results differed in the three domains (Table 8): Neither the main effect of behavioural efficiency gains, nor their interaction with purchase intention predicted new clothing purchase. A main effect of a behavioural efficiency gains on the number new digital devices purchased was found for overall digital devices purchased, but no interaction effect. In contrast, behavioural efficiency gains had no main effect on the number of flights booked in total, but a significant interaction (R_2 change = 0.008, $p < .01$). The relationship between purchase intention and behaviour was weaker at low perceived efficiency gains ($M -1 SD$), $b = 0.25$, 95 % CI [0.14–0.36], $p < .01$, at the mean ($M +1 SD$) = 0.34, 95 % CI [0.26–0.43], ($M +1 SD$) $< .01$, and when perceived efficiency gains were high ($M +1 SD$), the relationship was stronger, ($M +1 SD$) = 0.46, 95 % CI [0.35–0.58], ($M +1 SD$) $< .01$ (Fig. 3). Again, the purchase intention for new products consistently predicted more items purchased, higher age predicted lower purchase levels for online-shopping and higher income predicted higher amounts of products purchased. Education level positively predicted purchase of air travel, men purchased more digital devices and women more clothing. Environmental concern was weakly associated with lower clothing consumption, but not with the purchase of digital devices or flights. The time spent online positively predicted consumption levels in all domains.

In the case of sufficiency-oriented products, the sample was again reduced due to missing data in perceived behavioural costs (Table 9). For overall second-hand clothing consumption, perceived behavioural efficiency gains of online second-hand shopping were

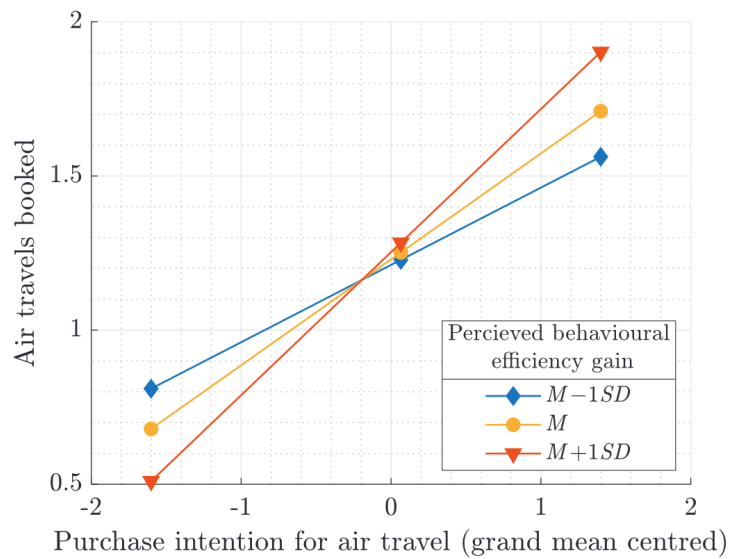


Figure 3: Relation of purchase intention and air travels booked moderated by the behavioural efficiency gain of online purchase.

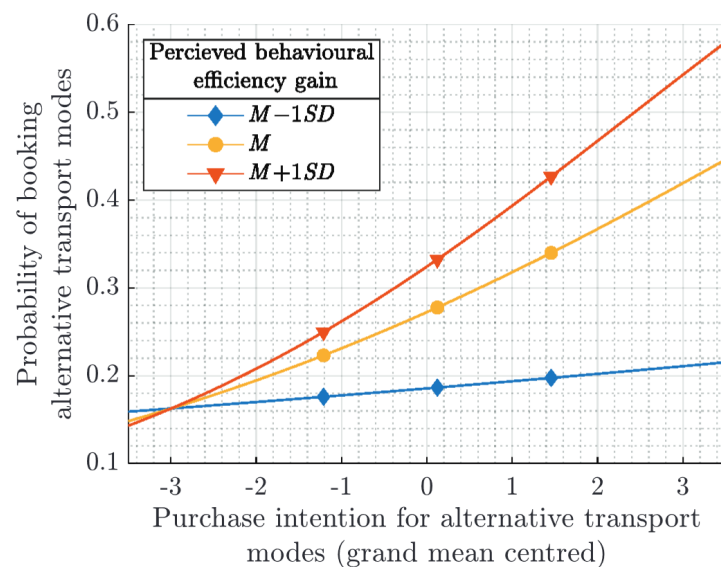


Figure 4: Relation of sufficiency-oriented purchase intention and alternative transport booking probability moderated by the behavioral efficiency gain of online purchase.

not linked to the probability of participants having bought second-hand clothing (*H2d*, *e* not confirmed). A direct effect (*H2d* confirmed), but no interaction effect (*H2e* not confirmed) was found for digital devices. The probability of booking alternative transport modes was higher both for higher efficiency gains of online booking (*H2d* confirmed), and a stronger link between purchase intention and behaviour when said efficiency gains were higher (*H2e* confirmed, likelihood ratio test $\chi^2 = 4.09$, $p < .05$) (Fig. 4). Second-hand purchase intention predicted respective purchase, age negatively predicted second-hand clothing and alternative transport mode purchase, female participants bought more second-hand clothing, and those who spent more time online bought more second-hand clothing and alternative transport mode travels.

Discussion

All in all, perceived behavioural costs of online shopping were lower than those of in-store shopping (a), with the exception of alternative transport modes booking, which was perceived to have higher behavioural costs than booking them at the counter. In all consumption domains, perceived behavioural efficiency gains of online shopping were positively correlated with the amount of new products bought online, or the probability of sufficiency-oriented online purchase (b). The relationship between purchase intention and online consumption level was moderated by these efficiency gains in the case of new clothing and air travel, but not in the case of new digital devices or sufficiency-oriented products (c). Perceived behavioural efficiency gains predicted consumption levels of new and second-hand digital devices and alternative transport modes (d). A moderator effect of perceived behavioural efficiency gains on the relationship between purchase intention and behaviour was found for both travel options, air travel and alternative transport modes, and second-hand clothing showing a tendency in the same direction, $p = .05$ (e). Results show that possible rebound-, induction or beneficiary effects of online shopping depend on the context of both the consumption domain and the individual's motivational background. We found a substitution effect for new clothing purchase, whereas for new digital devices, there was a direct consumption-increasing effect on purchase level (main effect), irrespective of purchase intentions (interaction effect), and for leisure air travel, only when individuals had purchase intentions, did a consumption-increasing effect occur (interaction effect). Comparing these domains, we further draw mixed conclusions: in the digital devices domain, the economic interpretation of consumer behaviour, that a reduction in transaction cost automatically leads to higher consumption (as seen in the mentioned literature on rebound-effects and induction) is supported. Yet, with the assessment being correlational, third variables might explain this relationship, such as technology affinity: a personal interest in new technology would explain both a higher purchase level of digital devices as well as perceived efficiency gains of online shopping.

Table 8: Moderation analyses for overall purchase of new products (*H1d, e*).

	New clothing purchased overall						New digital devices purchased overall						Air travels booked overall					
	coeff	se	t	p	lower CI	upper CI	coeff	se	t	p	lower CI	upper CI	coeff	se	t	p	lower CI	upper CI
Constant	6.73	.17	9.37	<0.01	5.32	8.14	2.00	.65	3.08	<0.01	0.73	3.27	0.15	.46	0.34	.73	-0.74	1.05
Purchase intention	0.60	.06	9.56	<0.01	0.48	0.73	0.32	.05	6.30	<0.01	0.22	0.42	0.35	.04	8.49	<0.01	0.27	0.44
Behavioural efficiency gains	0.00	.06	-0.07	.94	-0.12	0.11	0.20	.05	3.75	<0.01	0.10	0.31	0.01	.04	0.38	.71	-0.06	0.09
Intention <i>x</i> efficiency	0.05	.03	1.45	.15	-0.02	0.12	0.04	.03	1.31	.19	-0.02	0.10	0.07	.03	2.75	.01	0.02	0.12
Age	-0.04	.01	-5.24	<0.01	-0.05	-0.02	-0.03	.01	-5.98	<0.01	-0.05	-0.02	-0.01	.00	-3.12	<0.01	-0.02	-0.01
Income	0.09	.04	2.25	.02	0.01	0.16	0.13	.03	4.00	<0.01	0.07	0.19	0.12	.02	5.22	<0.01	0.08	0.17
Education	-0.07	.08	-0.88	.38	-0.24	0.09	0.01	.08	0.19	.85	-0.14	0.17	0.17	.06	3.00	<0.01	0.06	0.29
Gender	-0.80	.19	-4.30	<0.01	-1.16	-0.43	0.43	.16	2.74	.01	0.12	0.73	0.08	.12	0.70	.48	-0.15	0.31
Environmental concern	-0.26	.13	-1.97	<0.05	-0.52	0.00	0.11	.12	0.86	.39	-0.14	0.35	-0.03	.09	-0.39	.70	-0.21	0.14
Time spent online	0.13	.04	3.35	<0.01	0.05	0.21	0.14	.04	3.86	<0.01	0.07	0.21	0.08	.03	3.03	<0.01	0.03	0.13
Notes.	<i>N</i> = 792; <i>R</i> ₂ = .22						<i>N</i> = 738; <i>R</i> ₂ = .21						<i>N</i> = 745; <i>R</i> ₂ = .18					

Table 9: Moderation analyses for overall purchase of sufficiency-oriented products (*H2d, e*).

	Second-hand clothing purchased overall						Second-hand digital devices purchased overall						Alternative transport modes booked overall					
	coeff	se	t	p	lower CI	upper CI	coeff	se	t	p	lower CI	upper CI	coeff	se	t	p	lower CI	upper CI
Constant	0.31	.96	0.32	.75	-1.57	2.19	-1.88	.99	-1.90	.06	-3.83	0.06	-1.91	.75	-2.54	.01	-3.38	-0.44
Purchase intention	0.57	.08	6.87	<0.01	0.41	0.73	0.35	.09	4.04	<0.01	0.18	0.52	0.19	.08	2.43	.02	0.04	0.34
Behavioural efficiency gains	0.18	.09	1.92	.05	0.00	0.37	0.34	.09	3.81	<0.01	0.16	0.51	0.25	.06	4.01	<0.01	0.13	0.37
Intention <i>x</i> efficiency	-0.09	.06	-1.47	.14	0.20	0.03	-0.03	.06	-0.55	.58	-0.15	0.08	0.08	.04	2.04	.04	0.00	0.16
Age	-0.02	.01	-2.13	.03	-0.04	0.00	-0.01	.01	-1.14	.25	-0.03	0.01	-0.03	.01	-4.16	<0.01	-0.04	-0.02
Income	0.02	.05	0.39	.70	-0.08	0.12	0.00	.05	-0.10	.92	-0.10	0.09	0.04	.03	1.19	.23	-0.03	0.11
Education	-0.05	.11	-0.49	.62	-0.27	0.16	-0.13	.12	-1.09	.28	-0.36	0.10	0.17	.09	1.91	.06	0.00	0.33
Gender	-0.48	.23	-2.06	.04	-0.94	-0.02	0.44	.24	1.86	.06	-0.02	0.91	0.18	.18	1.03	.30	-0.17	0.53
Environmental concern	-0.37	.19	-1.90	.06	-0.74	0.01	-0.04	.20	-0.18	.86	-0.43	0.36	0.13	.15	0.82	.41	-0.18	0.43
Time spent online	0.15	.05	3.27	<0.01	0.06	0.25	0.09	.05	1.88	.06	0.00	0.19	0.14	.04	3.63	<0.01	0.06	0.21
Notes.	<i>N</i> = 598; <i>R</i> ₂ McFadden = .15, CoxSnell = .14, Nagelkrk = .22						<i>N</i> = 585; <i>R</i> ₂ McFadden = .08, CoxSnell = .06, Nagelkrk = .11						<i>N</i> = 731; <i>R</i> ₂ McFadden = .10, CoxSnell = .11, Nagelkrk = .168					

For more clarity on the direction of causality, long-term studies or experimental study designs are needed –which of course goes for all results of this study. Results of the air travel domain on the other hand indicated a consumption increase for people with a high purchase intention (interaction effect), supporting the psychological approach to consumption-increasing effects that includes motivational factors. Here, a moderator effect of technology on motivational factors or individual goal attainment was shown (as proposed by [Midden et al., 2007](#); [Steg & Vlek, 2009](#)). What may also play a role in flight consumption, is that whereas in the other consumption domains, online and offline consumption are at about the same level, here online booking predominates. Further, whereas in the travel domain, information is presented in written form online and over the counter, whereas clothing and digital devices can only be physically experienced in-store. It is possible but not testable in retrospective that when direct online booking emerged as a new possibility, this may have incentivised additional air travels: travel agencies and counters are often not in convenient reach of individuals highly interested in regular travel activities, in which case online booking opened a new gateway to (resource-intensive) consumption. A direct beneficiary effect of perceived behavioural efficiency gains for sufficiency-oriented product purchase (main effect) was found in all consumption domains, albeit for clothing this was only found as a tendency ($p = .05$). In the case of leisure travel with alternative transport modes, a stronger link between intention and behaviour was found (interaction effect). Yet this last finding has to be interpreted in the context of higher perceived behavioural costs of online booking on the aggregate level. It seems that sufficiency-oriented niches may profit substantially in the case of alternative transport online booking, yet for this to materialise, online booking of alternative travel modes would have to be perceived as more easy to use. Practical implications may include improving online booking possibilities for alternative transport modes. Some insights on control variables are worth noting: Age was associated with lower purchase rates (except for second-hand digital devices). Future studies may examine whether this is a general age effect of consuming less, or rather a cohort effect of increasing consumption. Income was associated with higher consumption levels, which is coherent with prior findings (e.g., [S. Moser & Kleinhüchelkotten, 2018](#)), but not with the purchase of sufficiency-oriented products, and education level was only associated with the probability of booking alternative transport. Environmental concern was only weakly associated with lower clothing consumption, and not with the other consumption forms: sufficiency-oriented behaviour might either not be linked to sustainability for many individuals, as a lack of awareness of consequences ([S. Schwartz, 1975](#)), or there is an attitude-behaviour gap in these consumption domains (as shown for air travel by [S. Moser & Kleinhüchelkotten, 2018](#)). This missing link merits further investigation, as sufficiency-oriented lifestyles are a cornerstone of reaching sustainability goals (e.g., [Raworth, 2012](#)). Finally, the time spent online was a considerable predictor for all consumption forms except second-hand

digital devices. Future research should find out more on the relationship between spending time in online environments and sustainable consumption. Accordingly, a link between internet use and material aspiration levels was found (Lohmann, 2015) and other research shows how media influences consumption (e.g., Richins, 1987). By changing individuals' normative and hedonic motives, online environment exposure might have long-term effects on consumption levels, as social media content or online marketing (Steg & Vlek, 2009; Stephen, 2016).

Strengths and weaknesses

This study offers a valid individual measurement of self-reported behaviour in individually fitting, memorable time spans and the replication in three samples with different consumption domains. Whereas most empirical evidence concerning effects of ICT application on consumption levels (such as induction and rebound-effects) is based on macro-level data or modelling, the study at hand offers micro-level data on individual purchase behaviour. Also the definition and measurement of efficiency gains was extended in a psychological framework of perceived behavioural efficiency gains, including not only financial costs but also effort and time, theoretically founded on behavioural costs (Verhallen & Pieters, 1984). Further, as previously described, the product-specific analyses allowed for a more nuanced picture of the relationships between efficiency of online shopping and consumption domains, showing that oftentimes effects are product-specific and context-dependent.

As for the study's weaknesses, as a cross-sectional online-survey, it does not allow causal interpretations of the results. Found relationships are indicators that should be followed by long-term and experimental studies. Also, reliability of behavioural costs for second-hand purchases was low. Due to theory-driven content validity and low item number this was accepted, yet for future studies this measurement should be redesigned. Another limitation is that second-hand and alternative transport modes consumption only contribute to sufficiency, if they substitute rather than complement the purchase of new products. Due to the low prevalence of sufficiency-oriented purchases however, this substitution was not tested and no definite conclusions were drawn. Also due to this low prevalence, the possibility of a biased result due to missing data in behavioural efficiency for sufficiency-oriented product purchase remains, as many participants stated not knowing how behaviourally costly second-hand or alternative transport consumption online or in-store was.

Future research

The field of online environments' impact on sustainable consumption is relatively new. This study was an early attempt on examining these influences in terms of sufficiency, offering first insights for further exploration. Further research may include behavioural data, long-

term measurement and experimental design to examine causality and effective direction. In the future, other behavioural determinants of overconsumption such as perceived gains from online shopping could also be researched from a psychological perspective. Consumer culture and marketing studies find that entertainment and social interaction are such gains that deserve further attention, as they may be more prevalent in-store than online. To test if and how this study's results translate to overall consumption levels, examining further consumption domains is advised, e.g. mobility, food consumption, or the 'qualitative' side of sustainable consumption, e.g. organic product choice. Notably, the link between the time spent online and consumption levels deserves further attention. Repeated exposure to consumption-related cues on the internet, such as online advertisement or social media, may alter consumption patterns.

Conclusion

Online shopping does make consumption more efficient and easy, with the exception of booking buses and trains online. However, it depends on the consumption domain how online shopping efficiency links to individual consumption levels. It also depends on individuals' motivations: Having the ability to consume everything that is just a click away does not necessarily make people do so. As behavioural agency increases thanks to the enabling role of online environments, individuals' consumption-related motivations play an increasing role in determining consumption levels that affect environmental outcomes. Looking at the pressing sustainability challenge of providing a good life for all that respects planetary boundaries, people's pro-environmental and pro-social motivations and values now matter more than ever.

Statement of research ethics: Participants were informed on the type and use of the data collected and on voluntary participation, they were debriefed and financially reimbursed for their efforts.

Declarations of Competing Interest: The authors declare no conflict of interest.

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4.2 Publication B: Do online environments promote sufficiency or overconsumption? Online advertisement and social media effects on clothing, digital devices, and air travel consumption.

Vivian Frick, Ellen Matthies, John Thøgersen & Tilman Santarius²

Abstract

Sustainable consumption is increasingly shaped by online environments. Everyday exposure to online advertisement and social media content by peers may influence individual consumption decisions. By representative online surveys ($N = 2,694$), we examined how perception of online environments influences individual consumption levels of clothing, digital devices and leisure air travel, mediated by individual aspiration levels, personal and social norms. Structural equation modelling confirms relationships between perceived consumption-promoting online content and consumption levels, fully mediated through aspiration levels. Sufficiency-promoting online content is associated with higher social and personal norms for sufficiency, but neither of the latter are linked to aspiration or consumption levels. These findings are consistent with the hypothesis that aspiration levels and consumption decisions are influenced by consumption-promoting online content. Due to the use of cross-sectional data, it cannot be ruled out that these results reflect that more consumption-oriented individuals pay more attention to consumption-promoting online content. Hence, the dominant causal direction needs to be determined by experimental or longitudinal methods.

Introduction

Consumption patterns, especially in the Global North, threaten planetary boundaries and human welfare (Steffen et al., 2015). In light of resource use levels exceeding critical planetary boundaries, negative environmental impacts, such as greenhouse gas emissions (IPCC, 2014), and natural resource extraction (IPBES, 2019) have to be reduced. An increasingly voiced strategy to secure people's need satisfaction within planetary boundaries is "sufficiency" in resource consumption, which is assumed to imply a decrease of consumption levels (O'Neill et al., 2018). Sufficiency entails the vision of a good quality of life for all without ever-increasing material consumption and with lower total resource

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consumption and waste (IPBES, 2019, pp. 9-10). Proponents of this vision argue that a reduction of resource consumption levels in industrialised countries is possible through the implementation of sufficiency goals and principles without negatively affecting social well-being or increasing social inequality.

Due to digitalisation, the challenge to remain within planetary boundaries while meeting human needs is faced within a rapidly changing context. Worldwide, Internet users spend on average over 2.5 hr online daily, of which 2 hr on mobile Internet (Statista, 2021a). Online environments increasingly penetrate most everyday activities, a trend that may pose both chances and risks for sustainable consumption (Börjesson Rivera et al., 2014). As daily exposure to online environments increases, they may affect sustainability-related consumption behaviour in several ways. Exposure may facilitate (un-)sustainable consumption, for example, as access to (online-)shopping improves (Bandura, 2002; Frick & Matthies, 2020; Midden et al., 2007). At the same time, online content may influence consumption motives by way, for example, of commercial advertisement (Dinner et al., 2014) or peer communication in social media (Bauer et al., 2012). As consumption levels, especially in the Global North, are far from a sufficiency-oriented lifestyle, research needs to examine determinants of unsustainably high consumption levels. There is a lack of systematic research on how and how much online content influences consumption motives, consumption aspirations and consumption levels. However, it has been argued that advertising, in general, boosts consumption through increased aspiration levels and consumption norms (Kasser & Kanner, 2004; Thøgersen, 2014; Uzzell & Rätzzel, 2009), whereas sustainability marketing may evoke moral considerations promoting sufficiency (Gossen et al., 2019).

Therefore, sustainable consumption research needs to take the influence of Internet use into account (Chatzidakis & Mitussis, 2007; Reisch, 2001). Yet to our knowledge, the relationship between online content and individual consumption levels, including possible motivational mediators, still remains to be empirically investigated. The present study contributes to filling this gap by means of online surveys investigating the relationship between users' perception of online content and consumption levels with regard to three product categories that are increasingly advertised, traded and discussed online: clothing, digital devices and leisure air travel. In the following, key constructs are defined, followed by a review of extant research, based on which a theoretical model of the relationship between online content and consumption levels is proposed. Next, the methods are introduced, followed by a presentation and then a discussion of the results.

Individual consumption and sufficiency — how much is enough?

While it is well established that global fossil energy and resource use levels need to drop quickly, it is less clear how this is translated into individual consumption behaviour. Connecting the individual consumption of products and services to primary energy and

resource use and greenhouse gas emissions is challenging. Researchers have suggested both a minimum and a maximum for a sustainable individual consumption levels (Di Giulio & Fuchs, 2014; O'Neill et al., 2018; Raworth, 2012; Spengler, 2016), the upper limit being defined by an equal distribution of limited resources within planetary boundaries and the lower limit by basic human needs. (Di Giulio & Fuchs, 2014) differentiate between objective needs and subjective wants based on Max-Neef et al. (1992)'s definition of basic needs as universal, finite in number and satiable. Need satisfaction varies culturally and individually, resulting in an infinite number of possible "need satisfiers". For example, if a person's aspiration for clothing possession is only determined by the need for protection of the body, then a smaller number of need satisfiers (clothes fulfilling objective needs) is probably aspired than if their aspiration level is also determined by the need for affection, identity and leisure (clothes fulfilling subjective wants). From this point of view, primarily the consumption of need satisfiers with high resource-intensity that are not indispensable for the fulfilment of objective needs should be curbed (P. M. Brown & Cameron, 2000; Di Giulio & Fuchs, 2014; Thøgersen, 2014). An individual consumption level that exceeds planetary boundaries has been defined as over-consumption (P. M. Brown & Cameron, 2000; Thøgersen, 2014), whereas sufficiency-oriented consumption has been defined as the voluntary restraint or reduction with regard to product and service purchase, including the choice of smaller dimensions of acquired products and services, and energy-saving use patterns (Jenny, 2016; Verfuërth et al., 2019). This reduction in product purchase often implies alternative consumption behaviour, such as acquiring second-hand products, repair and sharing practices (N. M. Bocken & Short, 2016).

The second challenge of breaking planetary boundaries down to individual consumption levels is that the resource-intensity of consumption domains varies greatly (e.g., a holiday flight emits far more CO₂ than attending a gym class, also per monetary unit spent). Thus, environmental impacts of consumption rely not only on the overall consumption level, but also on the structure of consumption (e.g. Chitnis, Sorrell, Druckman, Firth, & Jackson, 2014). Hence, in efforts to curb the environmental impacts of consumption, it is important to focus on goods and services that have a high resource- and greenhouse gas intensity (Dietz, Gardner, Gilligan, Stern, & Vandenberg, 2009), such as cars or air travel (Lenzen et al., 2018; Røpke, 1999). It is also important to take into account that consumer goods and services in general are main drivers of the increasing energy and resource use in industrialised countries (e.g., embodied energy in household electronics; European Environment Agency, 2018, November 29; Lenzen et al., 2018).

Although on a macro-level, overconsumption and sufficiency are two sides of the same coin (namely, the consumption level), individuals' motives for consuming goods and services and motives for not consuming them are distinct (Ajzen & Sheikh, 2013; Richetin et al., 2012). Individuals' pro-environmental intentions are not always accompanied by a sustainable lifestyle (S. Moser & Kleinhüchelkotten, 2018), as intentions and impact

often diverge (Fischer, Michelsen, Blättel-Mink, & Di Giulio, 2012). Whereas a voluntary sufficiency goal, like other types of pro-environmental behaviour, is mostly predicted by moral motives such as personal norms (S. Schwartz, 1975; Stern et al., 1999) or social norms for targeted behaviours (Ajzen, 1991), the consumption of products is typically explained by needs and wants (Thøgersen, 2014) or material aspiration levels (Karlsson et al., 2004). Social norms are also identified as a cause of material consumption, when material consumption functions as a status or group membership signal (Ajzen & Sheikh, 2013; Aro & Wilska, 2014; Thøgersen, 2014; Witt, 2001).

Sufficiency is an emerging research field in social sciences, including environmental psychology (where determinants of sustainable consumption have had a more central role than determinants of unsustainable consumption, for example; Thøgersen, 2014; Uzzell & Rätzhel, 2009). As online environments are rendering increasing agency to individuals (Bandura, 2002), in terms of both influencing and fulfilling their material aspiration levels and finding ways to fulfil their needs with less material intensity, it is becoming imperative to study how the increasing use and perception of online content affects consumption aspirations and behaviour.

Online environments

The Internet is in many ways different from and more versatile than “traditional” media such as print, radio or TV. First, it increases information access, and as a marketplace it also gives access to purchase. Second, its inherent connectivity and networks allow peer-to-peer interaction for active participants co-creating the online environment, with online peer-to-peer interaction in online forums or social media potentially influencing attitudes toward (sustainable) consumption (e.g., Cooper, Green, Burningham, Evans, & Jackson, 2012). Third, the Internet also makes it possible to adapt online content presentation according to users’ interests through personalisation. By blurring the lines between cause and effect of consumption actions, this adds challenges to research: Do individuals consume a product due to online advertisement, or was it advertised to them because of their past consumption patterns being traced online?

Research on the relationship between online exposure and consumption behaviour is in an early phase. Lohmann (2015) found a positive correlation between Internet use and material aspiration levels. However, Y. Wang and Hao (2018) found no relationship between Internet penetration and sustainable consumption indicators on a macro-level. Prior research distinguishes between two types of online content that may impact consumption motives and behaviour (Reisch, 2001; Stephen, 2016): online advertisement and social media peer content, defined as the content users produce on social media (e.g., posts, likes, comments). The following two sections review research on these two types of content.

Online advertisement

Regular exposure to traditional media is correlated with product sales (e.g., [Rubinson, 2009](#)) and material aspiration levels ([Richins, 1987](#); [Shrum, Burroughs, & Rindfleisch, 2005](#)). The reason for this relationship is often attributed to advertising exposure ([Chia, 2010](#); [R. Jiang & Chia, 2009](#); [Thøgersen, 2014](#); [Vandana & Lenka, 2014](#)). At the macro level, advertisement spending is related to economic growth and increased consumption ([Brulle & Young, 2007](#); [Hoch, Handrich, & Pavel, 2016](#); [Molinari & Turino, 2018](#)). Expenditures on online advertisement are growing steadily, with a current growth rate of 8 % per year in Germany ([PwC, 2018](#)). For example, not only online sales but also over-the-counter retail sales of clothing are positively linked to online advertisement expenditures, with larger returns than traditional advertising ([Dinner et al., 2014](#)). One reason is personalisation: banner ads personalised by retargeting (advertising products or shops people recently visited online) receive more clicks than non-personalised banner ads ([Bleier & Eisenbeiss, 2015](#)). It has also been proposed that online-advertisement can foster sufficiency-oriented consumption, when it avoids aggressive marketing strategies and especially, when it promotes consumer sufficiency (e.g., promoting the reduction of new product purchase, [N. M. Bocken & Short, 2016](#); [Gossen et al., 2019](#)). Therefore, depending on advertisement content, it can arguably foster either increased consumption or sufficiency.

Social media peer content

Perceiving social media peer content may influence individual consumption levels in the same way as perceiving online advertising. Social media use was found to be positively related to materialism and purchase intentions ([Kamal, Chu, & Pedram, 2013](#)). Also, survey respondents reported they had an increased desire to buy clothes after browsing fashion blogs or seeing social media posts ([Wahnbaeck & Roloff, 2017](#)). In another study, an experimental manipulation of social media peer content increased purchase intentions for sportswear ([Seng & Keat, 2014](#)). Apart from such increases in aspiration levels ([Kasser & Kanner, 2004](#)), social media peer content is also assumed to change behaviour through social influence ([E. B. Goldsmith & Goldsmith, 2011](#)). [Taylor and Strutton \(2016\)](#) found that Facebook use predicts conspicuous consumption, mediated by emotions such as envy, narcissism and self-expression. Another study found that experimentally manipulated social information about peers' consumption led to increased consumption levels ([Carbone & Duffy, 2014](#)). Accordingly, the approval of products on social media (giving "likes") has been found to increase their purchase ([K. Lee, Lee, & Oh, 2015](#)), and so has joining brand communities on social media ([Goh, Heng, & Lin, 2013](#)). But social media can also positively influence environmental behaviour: For example, information shared on social media has been found to increase individual voting behaviour through social norms ([Bond et al., 2012](#)). [Oakley and Salam \(2014\)](#) found a positive relationship between receiving

Facebook posts about energy-saving and environmental responsibility and Foster, Lawson, Blythe, and Cairns (2010) found that social comparison on Facebook can lead to reduced energy use.

A model of exposure to online content and consumption levels

Summing up the state of research, various links appear to exist between online advertisement, social media peer content and consumption levels. Yet, there is little empirical research aiming at understanding this relationship at the individual level, including which motivation factors mediate the relationship. Also, theoretical approaches to online content's influence on consumption levels are sparse. Therefore, the theoretical framework of this study builds on several theoretical models. The basic foundation is environmental psychology behaviour models (e.g., Ajzen & Sheikh, 2013; Klöckner & Blöbaum, 2010; Steg & Vlek, 2009; Stern, 2000). These models include normative motives such as personal and social norms, yet they do not make clear predictions on online content's influence on behaviour, simply categorising online content as "contextual factors" (Steg & Vlek, 2009; Stern, 2000). Media effects are examined in more detail in marketing research (e.g., Taylor & Strutton, 2016), which has identified materialism and aspiration levels as relevant mediators. Hence, despite environmental psychology models lacking these potential determinants of unsustainable overconsumption (Osaldiston & Schott, 2012; Uzzell & Räthzel, 2009), aspiration levels (Thøgersen, 2014) are added to our theoretical framework. As a step toward integrating these approaches, our theoretical framework, outlined in Figure 5, suggests a causal relationship of exposure to online content (the time spent online) and perception of online content with the consumption level of various products, which is at least partly mediated through the motivational constructs social norm for sufficiency, social norm for consumption, personal norm for sufficiency and the aspiration level.

Due to the moral character of sufficiency, we hypothesize that a personal norm of sufficiency influences consumption levels (Norm-Activation Model; S. H. Schwartz, 1977; S. H. Schwartz & Howard, 1981; Stern et al., 1999, : Value-Belief-Norm Theory). We further predict an influence of multiple and contrarian social norms, some promoting higher consumption levels, others promoting constraint (i.e., norms for sufficiency). These two types of social norm effects are inspired by Ajzen and Sheikh (2013), who included both intentions for and against a behaviour in a two-sided theory of planned behaviour. Especially for products consumed in public, such as clothing, many digital devices, and travels, social influence plays a major role for individual choices, which we assume can be direct, but also indirect, mediated through personal norms (Cialdini et al., 1991; Klöckner & Blöbaum, 2010). The proposed determinants of overconsumption are operationalised as aspiration levels (e.g., Karlsson et al., 2004).

The assumed effect hierarchy of the model is based on the following rationale. Contextual

factors, such as online environments (e.g., social media peer content, advertisement), can work as cues or primes and thus, activate values or motives that influence behaviour (Thøgersen & Alfinito, 2020; Verplanken & Holland, 2002). Experiments have found that advertisement-like cues can prime self-enhancing motives as consumerism, and that advertisement cuing self-transcendent values can increase pro-social behaviour (Bauer et al., 2012; Defever, Pandelaere, & Roe, 2011). Similarly, Ballew et al. (2015) argue that the exchange with peers on social media influences psychological factors (e.g., personal norms, social norms or status) which can foster pro-environmental behaviour. Based on these findings, we hypothesise that exposure to online content can increase the situational salience of moral, hedonic or gain motives (e.g., attitudes, values, norms, aspirations; Steg & Vlek, 2009), reinforcing the long-term strength of these motives. These altered or reinforced motives may affect individual consumption levels.

Consequentially, consumption-promoting online content may boost new product purchase, whereas sufficiency-promoting content may foster restraint and sufficiency-oriented consumption behaviour. Priming moral motives have been found to inhibit self-enhancing motives and vice versa (Maio, Pakizeh, Cheung, & Rees, 2009). Therefore, we expect sufficiency-promoting content to reinforce sufficiency-oriented motives and inhibit consumption-oriented motives, and vice versa. Since we are aware of only one study on how time spent online is related to consumption levels (Lohmann, 2015), we control for all possible direct effects of antecedent variables on behaviour, according to our theoretically assumed effect hierarchy, in addition to the theoretically predicted mediation paths.

Taking a transactional perspective, individuals and their environment are linked in complex and reciprocal ways (Altman & Rogoff, 1987; Uzzell & Rätzhel, 2009). Hence, the non-recursive model in Figure 5 is a simplification, reflecting theoretical assumptions about the main direction of influence. As mentioned earlier, we acknowledge that a mutual and dynamic relationship between content perception and consumption level is likely (similar to Thøgersen & Ölander, 2006), as for example searching for goods online may result in increased as well as in personalised advertisement individuals are exposed to. However, our empirical study is based on cross-sectional surveys, which means that we are not able to test assumptions about causal directions. This study is only a first step toward obtaining a better understanding of individuals' interaction with online environments.

Method

The proposed model was tested with online-surveys in the consumption domains of clothing, digital devices and leisure travel. The three domains were chosen based on the criteria of environmental impact, for digital devices, see Arushanyan et al. (2014); for clothing, see Choudhury (2014); for air travel, see Lenzen et al. (2018), and the prevalence of online advertisement (clothing and electronics; Statista, 2019b) and social media peer content

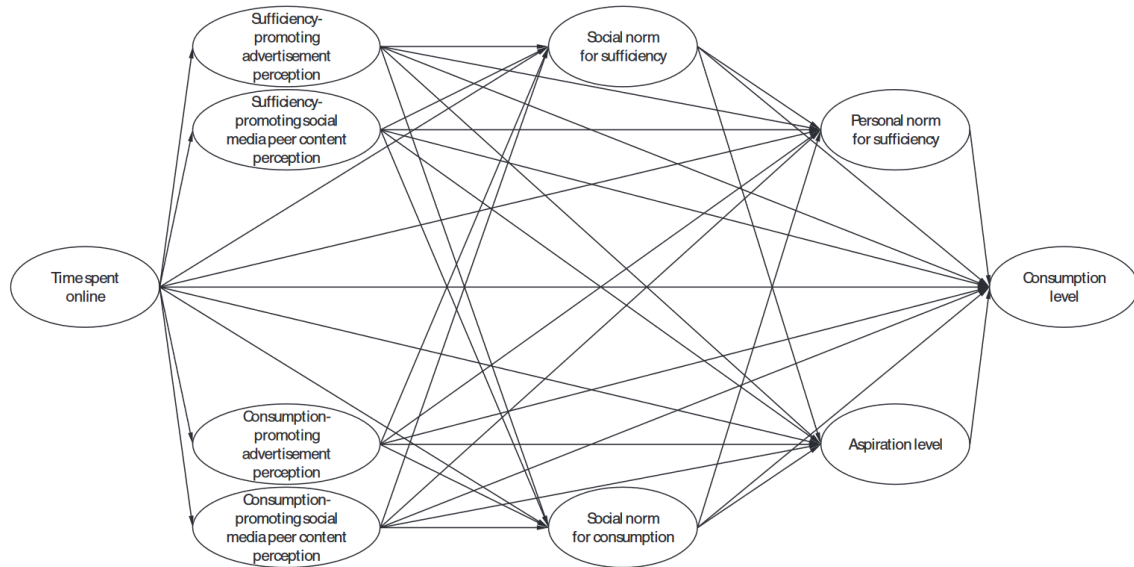


Figure 5: Model of the relationship between exposure to online content and consumption level

(e.g., traveling in social media peer content; [Statista, 2019a](#)).

Design and procedure

We conducted representative cross-sectional online surveys for each of the three domains. Each survey first asked about the amount of products bought in a specific time period, then aspiration levels, time spent online, perception of product-related online advertisement and social media peer information on product consumption. The perception of shopping online as well as social and personal norm about respective products (clothing, digital devices and travels) were also measured, along with additional measures used for other study purposes. All items that might prime for sufficiency or sustainability were placed toward the end of the survey to reduce the risk of socially desirable answers and biases. Environmental concern and socio-demographic variables were measured last.

Sample

The initial sample sizes were: clothing $N_C = 1,224$, digital devices $N_D = 1,233$, and leisure air travel $N_T = 1,348$. To control the response quality ([Meade & Craig, 2012](#)), an instructed response item lead to the exclusion of $N_C = 157$, $N_D = 156$, and $N_T = 269$ participants. Participants with too short response times were also excluded ($N_C = 111$, 170 items; less than 340 s; $N_D = 105$, 195 items; less than 380 s; $N_T = 98$, 190 items; less than 380 s), applying a minimum of 2 s of processing time per item ([Huang et al., 2012](#)). Lastly, participants reporting the acquisition of a higher number of sustainable products than products in total were also excluded ($N_C = 73$; $N_D = 112$, and $N_T = 5$). The final

samples are presented in Table 10.

Table 10: Sample and comparison to German population.

	Clothing <i>N</i> = 883	Digital devices <i>N</i> = 860	Travel <i>N</i> = 976	Group comparison	German population*
Age					
M (SD)	46.0 (14.0)	46.6 (14.4)	46.1 (14.1)	$F(2) = 0.31,$ $p = .73$	44.3
Education level	24 % primary 37% second. 38% tertiary 1%other	23 % primary 37% second. 38% tertiary 2%other	23 % primary 37% second. 39% tertiary 1%other	$\chi^2(8) = 13.79$ $p = .09$	30.4 % primary 23.1 % second. 31.9 % tertiary
Income (€, Median)	1'500- 2'000	1'500- 2'000	2'000- 2'500	$F(2) = 4.84,$ $p < .01$	1'957 €
Gender	51 % female 48% male 1% other	51 % female 48% male 1% other	51 % female 48% male 1% other	$\chi^2(2) = .01$ $p > .99$	50.7 % female 49.3 % male

Notes. For group comparison of gender and education level, χ^2 -tests were used.

For age and income, we used one factor ANOVA. * [Statistisches Bundesamt - Destatis \(2018\)](#)

Measures

All measures described in the following section, except for the time spent online and socio-demographic data, were assessed specifically related to the consumption domain of the survey, that is, clothing, dig-ital devices, or leisure air travel. The complete lists of items can be found in Tables A1, A2, and A3 in Appendix A. The reliability of latent constructs (Table 2) was estimated as Composite Reliability (CR; [Raykov, 2004](#)) and average variance extracted (AVE).

Consumption levels for new clothing, new digital devices and leisure air travels were measured both as amount of products purchased and monetary expenditures in a specified time period. These two measures served as indicators for the latent factor of consumption level. For the amount of clothing purchased, participants reported the number of new pieces of clothing (“new” meaning, not second-hand) acquired in the last 3 months and for digital devices, the number of new devices from a checklist of 14 devices purchased in the last 2 years. Leisure air travel was measured as the number of return flights taken in the last year, assessing both short-distance (<3.5 hr, after [Mensen, 2003](#)) and long-distance flights (>3.5 hr). In the confirmatory factor analyses (CFA) and structural equation model (SEM) analyses, the sum of flights was weighed, with long-distance flights being double-weighted. In each consumption domain, the expenditure for the respective product category was measured as the amount of money they spent on it in Euros per year, in intervals (clothing:0–100, 101–200, [...], more than 2000€; digital devices: 0–100,101–200, [...], more than 1,500 €.; leisure travel: 0–200, 201–400,[...], more than 3,000 €).

The personal norm for sufficiency was assessed with two items on a 7-point Likert scale with the option of choosing “I don’t know”, which was categorised as missing data, for example, “Due to values that are important to me, I feel obliged to keep my clothing consumption low.” In the case of air travel, the measure included four items.

The social norm for sufficiency was measured by three items including injunctive and descriptive norms regarding “people who are important to you, e.g., friends, partner, family members and other people in your direct surroundings”. For example, “People who are important to me try to buy less of the product”, measured on a 7-point Likert scale, with a “do not know” option. The social norm for consumption was also measured with a Likert scale corresponding to the social norm for sufficiency, including three items, for example, “People who are important to me approve of me buying new digital devices regularly.”

The aspiration level in each consumption domain was measured by two items. (1) The subjectively sufficient level of consumption, representing the minimum consumption level individuals deemed necessary for a good life (Aro & Wilska, 2014; Jenny, 2016; Karlsson et al., 2004), was measured with an instrument developed by Jenny (2016): “How many pieces of clothing would you need to purchase as a minimum / which digital devices would you need to own as a minimum / how many air travels would you have to go on as a minimum per year, so that your personal well-being is not restricted?”. For digital devices, this was assessed by ticking the list of 14 digital devices used in the measurement of products purchased. In addition to the number of products or services, the answer options included: “I would rather not purchase any at all” and “clothing / digital devices / air travels are not relevant to my well-being”, which were coded as zero. (2) The subjectively ideal level of consumption the respondent is striving for (“levels of consumption at which no substantial further improvement in well-being is to be expected”, Di Giulio & Fuchs, 2014, p. 188) was measured by items adapted from a “want” or “desire” concept (Campbell, 1998). It assessed “how many pieces of clothing / digital devices / how many travels would you ideally like to purchase within a year, if money and time were no issue?”. The ideal level of device consumption was again assessed by ticking the check-list of 14 digital devices.

Perceptions of product-related, sufficiency-promoting and consumption-promoting online advertisement and social media peer content were measured by items capturing the self-reported frequency of seeing the respective online content on a 7-point scale from 0 (never) to 6 (several times a day). In each survey, one item measured sufficiency-promoting advertisement for the respective products, and one item sufficiency-promoting social media peer content (the travels survey included two items each). Perceptions of consumption-promoting online advertisement and social media peer content were each measured with three items, for example, “I see holiday pictures and posts of my friends on social media.” Social media peer content items were only presented to participants who in a prior question stated they use social media; else they were coded

as zero. As these items were constructed for this study, the structures of social media peer content and online advertisement perceptions were analysed with exploratory factor analysis (Appendix B, Tables B1, B2, and B3), which revealed a two-factor-structure: perception of consumption-promoting online content and perception of sufficiency-promoting online content.

The time spent online was assessed to measure the exposure to online environments. This was calculated from self-reported daily hours of Internet usage as a sum of the “number of hours that you actively spend online for private purposes (not that your internet is turned on)” on fixed and mobile devices, each measured in hour intervals (0 = 0 hr, 1 = up to 1 hr, 2 = more than 1, up to 2 hr [...], 6 = more than 6 hr).

The questionnaire further assessed the socio-demographic data age, education level, income level and gender.

Statistical analysis

In each consumption domain, our analysis followed the two-step procedure suggested by [McDonald and Ho \(2002\)](#). We first fitted a confirmatory factor analysis (CFA) model to the data and analysed correlations between latent variables. Next, we tested the hypothesised model by means of structural equation modeling (SEM). The analyses were done with the lavaan package of R. Due to skewed distribution of some variables, we used robust maximum likelihood (MLR) with Yuan-Bentler Correction and Huber-White estimation of standard errors ([Rhemtulla, Brosseau-Liard, & Savalei, 2012](#); [Steinmetz, 2015](#)). To handle missing data, we used full information maximum likelihood (FIML, [Graham, 2009](#); [Steinmetz, 2015](#)).

The same measurement model and structural model were assumed in the three consumption domains, meaning that the three domains served as cross-validation studies for the hypothesised model. We started with the standard assumptions of a simple structure factor pattern and uncorrelated error terms. However, it appeared that four measurement error term correlations within the latent factor “consumption-promoting online content” were highly significant in all three models. Since these error correlations could be attributed to differences in measurement within the same latent factor, they were allowed ([Bagozzi & Yi, 2012](#)). In the factor “sufficiency-promoting online content” of the leisure air travel model, two error terms were allowed to correlate for the same reason (see Figure 6).

Time spent online, as well as the sufficient and ideal level of consumption in the leisure air travel model were assessed by single items. For these factors, error variance could not be estimated and was therefore fixed to 10 % of the indicator variance (as suggested by [Steinmetz, 2015](#), p. 102). Finally, in the digital devices models, the loadings of the two variables measuring personal norm for sufficiency were fixed to be equal, to avoid a Heywood case ([Chen, Bollen, Paxton, Curran, & Kirby, 2001](#), p. 504).

Results

Table 11 reports descriptive measures of the included predictors, mediators and the outcome variable for each of the consumption domain samples. Psychological motives differ between the domains. The personal norm for sufficiency is overall rather low, but highest for digital devices, lower for clothing consumption, and lowest in the leisure air travel domain (Bonferroni-corrected contrasts $F(2) = 105.9, p < .01$). Social norms for sufficiency follow the same pattern ($F(2) = 121.9, p < .01$), but are stronger.

Social norms for consumption are higher than the scale midpoint in the clothing and air travel domains, suggesting a perceived social pressure to consume. The social norm for sufficiency is higher than the social norm for consumption in the domain of digital devices, $t(722) = 8.03, p < .01$, whereas no difference is found in the clothing domain, $t(735) = -1.69, p = .09$, and the inverse relationship for leisure air travel, where the social norm to travel is stronger than the social norm to travel less, $t(836) = -14.48, p < .01$. Social norms overall show missing value rates between 11 % (social norm for air travel consumption) and 16 % (social norm for clothing sufficiency), suggesting that some have not thought about social expectations in these domains. Turning to aspiration levels, the subjectively sufficient level of consumption was lower than the ideal level in all domains, for clothing $t(885) = 26.22, p < .01$, digital devices, $F(859) = 28.62, p < .01$, and air travel, $t(975) = 30.84, p < .01$. The perception of online content was generally low, and consumption-promoting online content was perceived more often than sufficiency-promoting digital contents in the domains of clothing, $F(882) = 22.22, p < .01$, digital devices, $F(859) = 21.63, p < .01$, and leisure air travel, $t(975) = 23.97, p < .01$.

Confirmatory factor analyses

The confirmatory factor analysis models are equivalent in all three consumption domains (see Figure 6), including detailed model specifications). A confirmatory approach was chosen to test the hypothesised model, yet one data-driven alteration to the proposed model in Figure 5 is applied: the merger of perceptions regarding advertisement and social media peer content due to the finding that these perceptions are too strongly correlated to be distinguished (i.e., the items load on a common factor, Section 2.3). However, perceptions regarding “consumption-promoting online content” and “sufficiency-promoting online content” clearly form two different latent constructs. The leisure air travel model differed from the clothing and digital devices models in two ways: First, we had included four instead of two items to measure the latent factors “personal norm for sufficiency” “sufficiency-promoting content perception”. Second, the aspiration level was operationalised as two constructs rather than just one latent construct, due to low reliability of the joint “aspiration level” construct in this case ($CR = 0.49$ and $AVE = 0.34$). Hence, in the leisure air travel model only, we distinguished between “sufficient level of consumption” and

Table 11: Descriptive statistics of predictors, mediators and the outcome variables.

	Clothing			Digital devices			Leisure air travel		
	<i>N</i> *	<i>M</i>	<i>SD</i>	<i>N</i> *	<i>M</i>	<i>SD</i>	<i>N</i> *	<i>M</i>	<i>SD</i>
<i>Outcome variables:</i>									
<i>Consumption level</i>		<i>in the last 3 months:</i>			<i>in the last 2 years:</i>			<i>in the last year:</i>	
Number of products purchased		3.92	2.99		2.77	2.41		1.22	2.01
Expenditure ^a	849	151	185	823	370	381	907	707	925
<i>Mediators: psychological motives</i>									
Personal norm for sufficiency ^b	840	3.50	1.85	811	4.30	1.91	902	2.99	1.83
Social norm for sufficiency ^b	740	4.10	1.45	733	4.73	1.40	846	3.58	1.50
Social norm for consumption ^b	770	4.25	1.43	741	4.08	1.51	872	4.64	1.44
Subjectively sufficient level of consumption		10.05	9.22		2.72 ^c	2.11		2.37	2.34
Subjectively ideal level of consumption		19.31	12.76		6.20 ^c	4.04		6.25	4.03
<i>Predictors: Online content</i>									
Consumption-promoting content _d		1.48	1.44		1.46	1.29		1.41	1.27
Online advertisement		1.94	1.53		1.85	1.46		1.61	1.37
– at least one perception			94.0 %			86.2 %			79.6 %
Social media peer content		1.09	1.44		1.08	1.36		1.32	1.41
– at least one perception			53.2 %			56.3 %			66.5 %
Sufficiency-promoting content ^d		0.52	0.96		0.72	1.06		0.54	0.88
Online advertisement		0.57	0.99		0.71	1.12		0.59	0.93
– at least one perception			38.8 %			44.9 %			43.2 %
Social media peer content		0.64	1.07		0.74	1.16		0.50	0.94
– at least one perception			39.4 %			42.1 %			34.3 %
Time spent online ^e		4.94	2.39		4.78	2.27		4.82	2.31

Notes. *Number of participants who answered; full sample if left blank: $N_{\text{Clothing}} = 886$; $N_{\text{Devices}} = 860$; $N_{\text{Travel}} = 976$

a in Euro; *b* Range: 1 = not at all; 4 = indifferent; 7 = absolutely agree

c Number of digital devices individuals want to own at least (ownership instead of purchase);

d Range: 0 = never, 1 = several times a year, 2 = monthly, 3 = weekly, 4 = several times a week, 5 = daily, 6 = several times a day

e Range: 0 = 0 hours, 1 = up to 1 hour, 2 = between 1 and 2 hours, 3 = between 2 and 3 hours, [...], 12 = more than 11 hours.

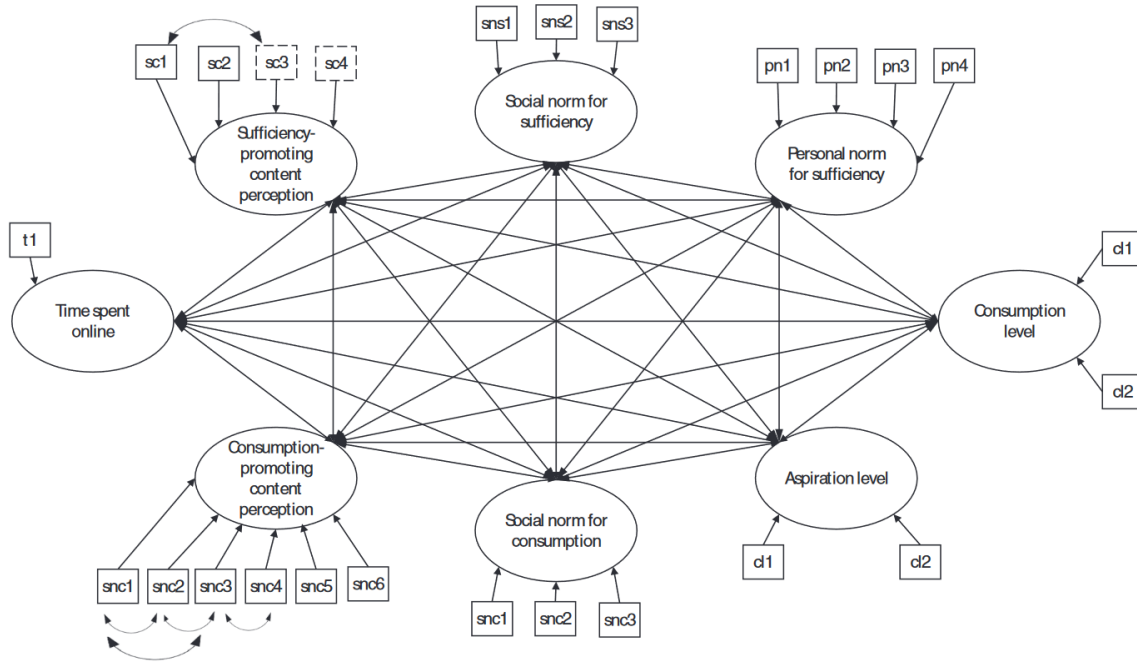


Figure 6: Confirmatory factor analysis model

Notes. Clothing survey - Model fit: $\chi^2(N = 883, df = 158) = 489.4, p < .001$; RMSEA = 0.052; 90%CI = [0.047, 0.057]; CFI = 0.953, TLI = 0.937; SRMR = 0.042.

Digital devices survey—Model fit: $\chi^2(N = 860, df = 159) = 476.1, p < .001$; RMSEA = 0.051; 90%CI = [0.046, 0.056]; CFI = 0.956, TLI = 0.942; SRMR = 0.038. The factor loadings of the two personal norm items were set to be equal to solve a Heywood case (following [Chen et al., 2001](#)).

Leisure air travel survey - Model fit: $\chi^2(N = 976, df = 237) = 624.2, p < .001$; RMSEA = 0.044; 90%CI = [.039, .048]; CFI = .964, TLI = .955; SRMR = .038. The items in dashed boxes were only measured in the leisure air travel survey (sc3, sc4, pn3, and pn4). In the leisure air travel survey, aspiration level was separated in two latent factors: sufficient and ideal level of consumption. Model specification - Four error terms were allowed to correlate within the factor “consumption-promoting content perception” due to common unique content that was not shared with all measures (snc1-snc2: 0.45, 0.55, 0.40; snc1-snc3: 0.25, 0.24, 0.18; snc2-snc3: 0.21, 0.28, 0.17; error terms of items measuring advertisement perceptions; snc3-snc4: 0.21, 0.28, 0.11; error terms measuring “social media” perceptions). In addition, the error terms of the two items measuring sufficiency-oriented advertisement perception were correlated (.33) in the leisure air travel model. For correlations between factors, see Table 3. For factor loadings, see Tables A1-A3 in the Appendix A.

“ideal level of consumption”. This suggests that participants distinguish between their minimum and ideal level of air travel consumption, but not with regard to clothing and digital devices.

The reliability of latent constructs was assessed by Construct Reliability (CR) and Average Variance Extracted (AVE). No generally accepted minimum thresholds for these indicators exist, but the usually desired levels are > 0.70 for the CR and > 0.50 for the AVE, although slightly lower levels are often accepted ([Bagozzi & Yi, 2012](#); [Malhotra, Hall, Shaw, & Oppenheim, 2006](#)). The reliability of the aspiration level for digital devices (CR = 0.65, AVE = 0.51), the digital devices consumption level (CR = 0.68, AVE = 0.53) and the air travel consumption level (CR = 0.67; AVE = 0.47) are low, but deemed acceptable. All reliability measures are shown in Table 73. As listed in more detail in Figure 6, all CFA models had an acceptable fit, with RMSEA (root mean square error of approximation) ≤ 0.06 , the CFI (comparative fit index) ≥ 0.95 , and the SRMR (standardized root mean square residual) ≤ 0.08 ([Hu & Bentler, 1998](#)).

Table 12: Correlations and reliability of latent factors.

		<i>CR</i>	<i>AVE</i>	2	3	4	5	6	7	8
1	Consumption level									
	Clothing	.79	.69	-.01	.62	-.07	.37	.36	.51	.19
	Digital devices	.68	.53	-.11	.80	-.13	.40	.43	.53	.30
2	Personal norm for sufficiency									
	Clothing	.85	.74		-.16	.45	.03	.28	.02	-.04
	Digital devices	.86	.76		-.10	.42	-.05	.15	-.04	-.05
3	Aspiration level									
	Clothing	.76	.62			-.15	.39	.23	.50	.19
	Digital devices	.65	.51			-.02	.39	.34	.48	.32
4	Social norm for sufficiency									
	Clothing	.77	.53				.07	.19	-.01	.02
	Digital devices	.74	.50				-.11	.12	.04	.06
5	Social norm for consumption									
	Clothing	.76	.52					.28	.30	.07
	Digital devices	.75	.50					.35	.35	.20
6	Sufficiency-promoting digital content									
	Clothing	.80	.67						.62	.22
	Digital devices	.85	.61						.75	.28
7	Consumption-promoting digital content									
	Clothing	.86	.60							.30
	Digital devices	.78	.64							.32
8	Time spent online									
	Clothing	.88	.62							.29
	Digital devices	.88	.62							.29

Notes. The correlation between (a) sufficient level and (b) ideal level of leisure air travel consumption is .37.

The Tucker and Lewis index was slightly below the benchmark for a good fit in the clothing and digital devices models, $TLI \geq 0.95$ (Hu & Bentler, 1998), yet CFI and TLI > 0.90 are commonly accepted in practice if fit indices are acceptable overall (McDonald & Ho, 2002).

Table 12 reveals a strong correlation (.80) between consumption and aspiration levels for digital devices, yet not so high as to question their discriminant validity. The two constructs are also relatively strongly correlated in the clothing domain, whereas for leisure air travel, the number of flights that participants deem necessary for their well-being and that they ideally would like to take are less strongly linked to actual consumption levels. The construct validity of actual consumption levels and aspiration levels is also supported by the facts that they are empirically clearly distinct in the two other domains and that they are theoretically clearly distinct.

Social norms for sufficiency and for consumption are not correlated, nor are the personal norm for sufficiency and the aspiration level. Yet perceptions of digital content in the category of sufficiency and in the category of consumption are highly correlated. Participants perceiving more consumption-promoting digital content related to a product are also more likely to perceive corresponding sufficiency-promoting content, suggesting that both reflect how much a person is exposed to, and pays attention to online content.

Structural equation modelling

SEM was employed to test hypothesized pathways, using the measurement model specifications that had been determined in the CFA analyses. Again, the SEM models show acceptable to good fit (Table 4). The clothing model accounts for 47 % of the variance in the consumption level, the digital devices model for 69 % of the variance, and the air travel model for 29 % of the variance in the consumption level (see Table 13).

Figure 7 gives an overview of the structural model in all three domains, emphasising the significant structural paths. In all domains, the aspiration level fully mediates the impacts on consumption levels of time spent online, consumption-promoting online content perceptions and motivational factors. However, in the clothing domain the amount of perceived consumption-promoting online content had an additional direct and positive impact on consumption. Despite that, in the leisure air travel domain, the aspiration level was split into two constructs (the subjectively sufficient and ideal level of air travel consumption), these two constructs together still had the strongest direct effect on air travel consumption. In addition, the social norm for consumption and perceived sufficiency-oriented content also had a direct effect on air travel consumption. Contrary to our hypotheses, the perception of sufficiency-oriented content actually was positively related to air travel consumption, and positively related to the subjectively sufficient amount of air travel.

Neither the perceived sufficiency-oriented content nor motives reflected in social and

personal norms for sufficiency had an effect on aspiration levels or consumption levels in any of the domains. However, the perception of consumption-promoting online content had a strong direct positive link to aspiration levels in the clothing and digital devices domain. In the case of air travel, the connection of content perception to the ideal level of consumption was stronger than to the sufficient level of consumption, indicating that online advertisement and peer-generated content is more strongly related to the wish to travel more than a perceived actual need to travel. The relationship between consumption-promoting content perception and aspiration levels was only partially mediated by social norms for consumption.

The perception of sufficiency-promoting content was consistently positively related to sufficiency-oriented motivational factors, whereas the perception of consumption-promoting content was positively related to consumption-oriented motivational factors. Further, the expectation that the perception of consumption-promoting content inhibits sufficiency-oriented motives was confirmed in the digital devices and clothing domains. Here, there was a negative relationship between consumption-promoting content perception and the personal norm for sufficiency. In the clothing and air travel domains, perception of consumption-promoting content was negatively related to the social norm for sufficiency. However, sufficiency-promoting content did not inhibit consumption-oriented motives. The pathways reflecting hypothesised inhibitory effects of personal and social norm for sufficiency on aspiration levels were insignificant in all domains. Finally, the time spent online showed an equally positive link to both consumption- and sufficiency-promoting online content perception. In addition, in the digital devices and air travel domains, the time spent online had a weak positive direct effect on aspiration levels. In the case of digital devices, it may be that people who spend more time online actually have a higher perceived need for owning digital devices, irrespective of online content perception. In the case of leisure air travel, however, there seems less reason to expect an impact from aspiration levels to time spent online. In a nutshell, all models were consistent with the assumption that aspiration levels play an important role as the missing link between sufficiency-oriented norms and consumption levels. On the other hand, some expected effects were only found in some domains, but not in others, such as the negative effect of consumption-promoting content on sufficiency-oriented norms.

Table 13: Estimated parameters of the hypothesised models ($N_{Clothing} = 886$, $N_{Devices} = 860$, $N_{Travel} = 976$)

	Clothing					Digital devices					Leisure air travel				
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>R</i> ₂	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>R</i> ₂	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>R</i> ₂
PN →CL	0.06	0.05	.242	.05		0.00	0.07	.980	.00		-0.06	0.05	0.207	-.06	
AL (SLC)→CL	0.51	0.06	<.001	.47		xx	0.19	<.001	.69		0.20	0.05	<.001	.18	
ILC → CL											0.15	0.05	.001	.14	
SNS →CL	-0.06	0.06	.353	-.04		-0.23	0.10	.017	-.13		-0.03	0.06	.668	-.02	
SNC →CL	0.14	0.06	.029	.11		0.08	0.09	.368	.05		0.18	0.06	.002	.16	
SOC →CL	0.15	0.08	.056	.11		0.22	0.14	.118	.13		0.30	0.09	<.001	.27	
COC →CL	0.22	0.08	.004	.17		0.14	0.15	.363	.08		0.09	0.07	.196	.08	
TO →CL	0.03	0.05	.605	.02		0.03	0.08	.707	.02		0.01	0.05	.894	.01	
Consumption level (CL)					.47					.69					.29
SNS →PN	0.44	0.07	<.001	.39		0.44	0.07	<.001	.39		0.61	0.07	<.001	.51	
SNC →PN	-0.04	0.06	.513	-.07		-0.02	0.06	.744	-.02		-0.20	0.05	<.001	-.16	
SOC →PN	0.37	0.07	<.001	.32		0.37	0.08	<.001	.34		0.30	0.06	<.001	.24	
COC →PN	-0.16	0.06	.007	-.28		-0.29	0.08	<.001	-.27		-0.07	0.05	.207	-.05	
TO →PN	-0.08	0.05	.071	-.07		-0.09	0.05	.054	-.08		-0.10	0.04	.015	-.08	
Personal norm for sufficiency (PN)					.27					.23					.39
PN →AL/SLC	-0.11	0.05	.036	-.21		-0.07	0.05	.233	-.06		-0.08	0.04	.080	-.09	
SNS →AL/SLC	-0.12	0.06	.062	-.10		0.01	0.06	.853	.01		0.06	0.06	.300	.06	
SNC →AL/SLC	0.34	0.06	<.001	.29		0.27	0.06	<.001	.24		0.14	0.05	.005	.14	
SOC →AL/SLC	-0.12	0.08	.138	-.10		-0.10	0.12	.398	-.09		0.19	0.07	.004	.18	
COC →AL/SLC	0.54	0.08	<.001	.46		0.46	0.10	<.001	.40		0.11	0.05	.026	.11	
TO →AL/SLC	0.06	0.05	.212	.05		0.20	0.06	.001	.17		0.12	0.04	.004	.11	
Aspiration level (AL) /					.36					.32					.14

	Clothing					Digital devices					Leisure air travel						
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>R₂</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>R₂</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>R₂</i>		
Sufficient level of consumption (SLC)																	
PN →ILC											-0.09	0.05	.053	-.10			
SNS →ILC											-0.04	0.06	.490	-.04			
SNC →ILC											0.10	0.05	.044	.09			
SOC →ILC											0.03	0.05	.580	.03			
COC →ILC											0.29	0.05	<.001	.28			
TO →ILC											0.15	0.04	<.001	.14			
Ideal level of consumption (ILC)															.17		
SOC →SNS	0.32	0.07	<.001	.32		0.19	0.07	.006	.19		0.46	0.07	<.001	.45			
COC →SNS	-0.21	0.07	.001	-.21		-0.12	0.07	.087	-.13		-0.21	0.06	<.001	-.20			
TO →SNS	0.01	0.05	.776	.01		0.05	0.05	.326	.05		-0.03	0.05	.587	-.02			
Social norm for sufficiency (SNS)					.06						.02						.13
SOC →SNC	0.17	0.07	.016	.16		0.17	0.08	.036	.16		0.06	0.05	.192	.06			
COC →SNC	0.21	0.07	.002	.21		0.20	0.08	.008	.20		0.22	0.06	<.001	.22			
TO →SNC	-0.03	0.05	.586	-.03		0.10	0.05	.056	.09		-0.01	0.05	.900	-.01			
Social norm for consumption (SNC)					.10						.14						.07
TO →SOC	0.22	0.04	<.001	.22		0.29	0.05	<.001	.28		0.31	0.05	<.001	.29			
Sufficiency-promoting content perception (SOC)					.05						.08						.09
TO →COC	0.31	0.04	<.001	.30		0.33	0.05	<.001	.32		0.31	0.04	<.001	.29			
Consumption-promoting content perception (COC)					0.09						.10						.09
Covariances:																	
SOC <->COC	0.59	0.04	<.001	.59		0.73	0.03	<.001	.73		0.54	0.04	<.001	.54			
SLC <->ILC											0.28	0.04	<.001	.28			

Notes. Abbreviations: CL = Consumption level. PN = Personal norm for sufficiency. SNS = Social norm for sufficiency. AL = Aspiration level. ILC = Ideal level of consumption.

SLC = Sufficient level of consumption. SNC = Social norm for consumption. SOC = Sufficiency-promoting content perception.

COC = Consumption-promoting content perception. TO = Time spent online.

Model fit: Clothing domain: $\chi^2(df = 159) = 488.3, \eta^2 p < .001$; RMSEA = .052; 90 % CI = [.046, .057]; CFI = .953, TLI=.938; SRMR = .042;

Digital devices domain: $\chi^2(df = 160) = 482.4, p < .001$; RMSEA = .051; 90 % CI = [.046, .057]; CFI = .955, TLI=.941; SRMR = .041 ;

Leisure air travel domain: $\chi^2(df = 238) = 630.5, p < .001$; RMSEA = .044; 90 % CI = [.040, .048]; CFI = .964, TLI = .954; SRMR = .040.

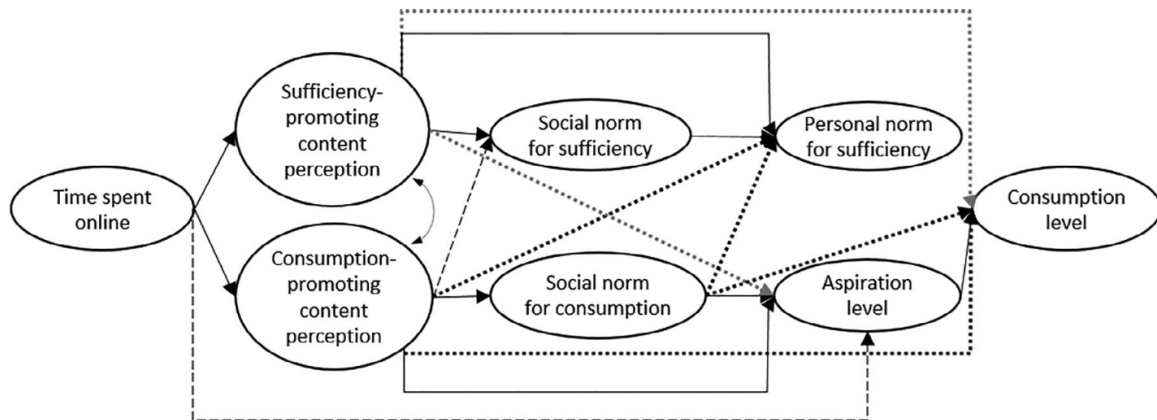


Figure 7: Structural equation models: summary of significant regression paths from online content exposure to consumption level.

Notes. Black: Relationship confirmed. Gray: relationship not as hypothesised (e.g., positive instead of negative). Full line: significant regression in all domains. Dashed line: significant in two domains. Dotted line: significant in one domain. Non-significant paths are omitted.

Discussion

The purpose of this study was to identify how exposure to online content may predict overconsumption and sufficiency, which might inform attempts to foster sufficiency-oriented lifestyles. First, the participants perceived more online content that promotes consumption than content that promotes sufficiency, suggesting that sufficiency marketing online is a niche phenomenon compared to conventional marketing (Gossen et al., 2019), and that also social media peer content is more often directed toward consumption than toward sufficiency. Also, the perception of consumption-promoting online content was connected to aspiration and consumption levels in the three studied domains, whereas the perception of sufficiency-promoting content was not. Further, perceptions of consumption-promoting content were consistently linked to the social norm for consumption, which were linked to the aspiration levels, whereas perceptions of sufficiency-promoting content were consistently linked to social and personal norms for sufficiency, but there were no links from sufficiency norms to aspiration and consumption levels.

Thus, our study revealed that the aspiration level plays a key role as the only predictor directly linked to consumption levels in all consumption domains. This strong link reflects that, at least in our sample and for the chosen consumption domains, most participants are able to purchase the amount of clothing and digital devices they desire. The link was weaker for leisure air travel, which is also reflected in the disparity between the number of leisure air travels participants had undertaken and the substantially higher level of air travel consumption they deemed necessary for their well-being. With aspiration levels clearly surpassing actual consumption levels, these results reflect that leisure air travel is

a growing consumption domain, resulting in increasing greenhouse gas emissions (Lenzen et al., 2018). A better understanding of the drivers of this consumption growth is key to reduce air travel and promote more sustainable lifestyles. Our study thus suggests that the most useful next step in an effort to reduce unsustainable consumption levels is to examine the predictors of aspiration levels as a key mediator.

We further found that social norms for consumption as well as exposure and attention to (i.e., perception of) consumption-promoting online content were directly linked to aspiration levels, and from there indirectly linked to higher consumption levels. However, we found no link between consumption levels or aspiration levels and the moral motives reflected in personal and social norms for sufficiency. This helps to explain Y. Wang and Hao (2018)'s findings that, on a macro-level, sustainable consumption and internet penetration are not linked. It is also consistent with a prior study finding that pro-environmental intentions do not reduce individual consumption levels (or are even positively related), and the important role of air travel in this relationship (S. Moser & Kleinhüchelkotten, 2018).

In addition, we found rather weak norms for sufficiency, both personal and social, in our samples. The social norm for sufficiency was stronger than the personal norm, suggesting that people generally feel a social pressure from others' expectations to show moderation, perhaps because they have adjusted their self-expectations for sufficiency downward to justify their consumption aspirations. The weak personal and social norm for sufficiency also suggest that sufficiency is not a salient moral motive, at least not in the examined domains of clothing, digital devices and air travel consumption, and compared to consumption-oriented motives. These results strongly support the inclusion of predictors of overconsumption in sufficiency research, at least in the consumption domains examined. For air travel, sufficiency-oriented factors were even positively linked with air travel consumption, as well as with the subjectively sufficient level of air travel. Further research should verify this positive link, but one possible explanation is the more complex concept of sufficiency-oriented travel. It includes less travel, but also sustainable modes of transport, or making shorter trips. Through online personalisation, searching for travel options in general may lead to more exposure to content that promotes all kinds of travel modes.

Overall, exposure to online content was reportedly rare in all samples, with an average of less than monthly. Especially sufficiency-promoting content was not perceived often. The low perception of consumption-promoting content is surprising and may be due to exposure to such content being underreported, perhaps due to limited attention and memory. Also, the perceived frequency of exposure may be influenced by the person's interests and motives: an environmentally conscious user may pay more attention to sufficiency-promoting social media posts, whereas a hedonically oriented user may pay more attention to advertisements for desired products. This implies that the relationship between online content perception and consumption levels may be due to both the exposure to online content causing a

change in a person's motives and behaviour, and the person's motives determining which online content is more consciously attended to and processed. In future research, these relationships should be examined in more detail, including experimental designs.

Limitations

It is a strength of this study that it covers three consumption domains, thus rendering results regarding the relationship between online content perception and consumption levels more generalisable. On the other hand, the differing relationships between mediating constructs in the domains of product purchases (clothing and digital devices) and purchase of services (travel) may also reflect that consumption decisions are made differently in these domains, and that not all relevant constraints and motives were covered by the survey.

It goes without saying that with cross-sectional survey data, no causal conclusions can be drawn. The presented regression analyses are a first, necessary, but not sufficient step to investigate the possible causal influence of digital environments on consumption behaviour. As mentioned earlier, the relationship between perceived content and behaviour is likely to be reciprocal: Online environments adapt to their users through personalisation, leading to positive feedback loops in which online environments shape motivations and behaviours of the users while the users' behaviours shape the way the Internet presents itself to them. So, while environmentally friendly users are more exposed and pay more attention to sustainable consumption options and information that are consistent with their values, more hedonistic or status-oriented consumers may receive and pay attention to exactly those posts and advertisement that trigger increased consumption. Causal relationships in societal developments are difficult to establish through existing methodologies, as they are difficult to reconstruct in an experimental setting, and to measure in surveys (e.g., [Aguilera et al., 2012](#)). Besides, digital environments are constantly changing making it uncertain whether online phenomena included in current research will still be relevant for future research.

Another limitation regards sample representativeness, which was approached, but not completely achieved. For example, the air travel sample had a slightly higher income than the other two samples. Further, individual consumption levels were measured with self-reports, but could in principle be measured in more valid ways, for example, using real-time purchasing documentation.

Research and practical implications

The important relationships identified in this study should be validated in longitudinal and experimental research to better understand the direction and causality between the factors. We provide a first step by identifying relationships that might serve as the point of departure for experimental research tackling overconsumption in a digitalised world.

As [Stephen \(2016\)](#) pointed out, to examine impacts of online environments on users, it is necessary to consider also long-term effects, as effects of online content perception may be subtle, but cumulatively important. We suggest that experimental studies looking into short-term changes in salience (e.g., [Bauer et al., 2012](#)) as well as long-term cohort surveys in the manner of the study at hand, integrated by a cross-lagged panel designs (for an example, see [Thøgersen & Ölander, 2006](#)), may be able to capture important long-term effects of exposure to online content.

It is particularly noteworthy that consumption-oriented motives and aspiration levels appear to be strongly connected to consumption levels, whereas sufficiency-oriented motives are not. It is possible that, for the domains in focus here, normative motives are less salient overall than in some other domains, such as energy saving behaviour, where moral motives were repeatedly shown to be central behavioural predictors (e.g., [Abrahamse et al., 2005](#); [Bamberg & Möser, 2007](#)). At least in the domains studied here, an important implication is to study not only interventions that foster pro-environmental behavior, but also examine in more detail the antecedents of unsustainable consumption ([Thøgersen, 2014](#)), calling into question the commercialisation of online environments that seem to boost consumption aspirations at the expense of ecological and social well-being ([Bauer et al., 2012](#); [Kasser & Kanner, 2004](#)). In the case of marketing practices, both sufficiency-promoting communication and avoidance of aggressive consumption promotion have been proposed ([N. M. Bocken & Short, 2016](#); [Gossen et al., 2019](#)). Yet our findings suggest that avoiding consumption promotion is more effective than promoting sufficiency. A possible explanation is that in the “consumerist culture” that is ubiquitous today (e.g., [Kasser & Kanner, 2004](#)), practising sufficiency would require stronger measures, including normative and cultural transformations, than the online sufficiency promotion perceived to be so rare by the participants in this study. As a practical implication, prescriptive knowledge might be needed on how to regulate online advertisement that boosts consumption levels. This should be combined with efforts to decrease data traffic from online advertisement, which has been shown in itself to have a negative environmental impact ([Pärssinen, Kotila, Cuevas, Phansalkar, & Manner, 2018](#)).

Conclusion

This study addressed several research gaps that opened for important contributions to sufficiency research. The main focus of behavioural environmental research is often to predict or foster sustainable consumption, and less on examining predictors or antecedents of unsustainable consumption ([Thøgersen, 2014](#); [Uzzell & Rätzl, 2009](#)). In this connection, the current study stands out by focusing on impediments to sustainable consumption, such as aspiration levels that exceed objective needs. Similarly, this study contributes to integrating contextual factors by examining links of sustainable consumption to two

central aspects of online environments. Also, contextual factors are underrepresented in current research on fostering pro-environmental behaviour (Osbaldiston & Schott, 2012; Steg & Vlek, 2009).

To summarise, we found that aspiration levels are boosted by consumption-promoting digital content and together with social norms for consumption they are important predictors of unsustainably high consumption levels. Sufficiency norms, as well as sufficiency-promoting online contents, are currently too rare to play a role for consumption levels. It seems that refraining from consumption pro-motion triggering material aspirations is more effective at fostering sufficiency than is the boosting of sufficiency-promoting online content. However, since digitalisation is an ongoing and fast-changing societal process, it is challenging to study. More and different types of empirical studies are needed to establish how strong and important the link is between exposure to online content and (un-)sustainable consumption. Future research should include more consumption domains as well as experimental and longitudinal research designs. It seems very likely that information technologies can be used for both sufficiency and increasing consumption. As (Bandura, 2002, p. 4) puts it, information technologies are “a tool, not a panacea.” In order to apply this tool in the service of a sustainable society, and not only in the service of corporate interests, further research is needed on how online environments can be designed to foster sufficiency-oriented consumption.

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Ethics statement: Participants were informed on the type and use of the data collected and on voluntary participation, and they were debriefed and financially reimbursed for their efforts.

4.3 Publication C: When your shop says #lessismore. Online communication interventions for clothing sufficiency.

Vivian Frick, Maike Gossen, Tilman Santarius, Sonja Geiger³

Abstract

To keep human resource consumption within planetary boundaries, individual consumption levels need to drop. We therefore investigated whether online communications interventions, especially on social media, can foster sufficiency in the clothing domain. In two experiments, consumption reduction and prolonging the lifetime of clothes were promoted. In Study 1, we conducted an online field intervention. All participants, both in the experimental and the control groups, reduced their clothing consumption. Hence, the intervention itself did not change clothing consumption levels. Study 2 was a laboratory experiment with sufficiency-promoting social media communication. Sufficiency-promoting communication led to more sufficiency behaviour compared to neutral and consumption-promoting communication. This effect was mediated by a lower desire to acquire new clothes (aspiration level). Peer endorsement of the communication by other social media users did not strengthen the communication's effect. However, the attitude towards the sender and the communication was more positive in the sufficiency-promoting communication than under the other two conditions. Although the field intervention was not effective, social media posts could increase sufficiency behaviour in the short-term. To test long-term effects, further experimental studies are needed.

Keywords: Sufficiency, Sustainable consumption, Behaviour change, Intervention, Social media, Online environment

Introduction

Climate change, biodiversity loss, environmental degradation and pollution are on the rise, and our society is facing the challenge of limiting their consumption's impacts to remain within planetary boundaries (Steffen et al., 2015). Three strategies are often proposed to face this challenge (Sachs, 2015). Following the efficiency strategy, production, use and disposal of consumed goods and services should require as little energy and few resources as possible, and following the consistency strategy, products should be biodegradable, reusable and environmentally friendly. These measures can only prove effective in combination with

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the sufficiency strategy, which requires behavioural changes of consuming less goods and services in absolute terms (Lorek & Fuchs, 2013; Spangenberg & Lorek, 2019). Sufficiency denotes a self-determined reduction of consumption levels in absolute terms while ensuring individual well-being (Princen, 2005). The affluent societies of the Global North could decrease resource use substantially without impairing well-being or the satisfaction of existential needs (O'Neill et al., 2018). At the level of individual consumption, sufficiency behaviour means reducing the purchase of new resource-intense goods, choosing goods that are smaller or of lower capacity, or using resource-intense goods and services less often (Jenny, 2016). The clothing domain is especially prone to overconsumption, and the vast majority of clothes are produced under socially and ecologically unsustainable conditions (Fundación, 2017). The fast-fashion system amplifies consumption habits such as buying more items and wearing them less frequently. Accordingly, Europe experienced a 40 % increase in clothing purchases between 1996 and 2012 (Reichel, Mortensen, Asquith, & Bogdanovic, 2014, October 20).

Decreasing clothing purchases and increasing garment lifetimes can help minimise and mitigate the environmental impacts of the clothing industry (Niinimäki et al., 2020). In line with the above characterisation, sufficiency behaviour in the clothing consumption domain means reducing the purchase of new clothing and prolonging product lifetime by engaging in behaviours such as care, repair, second-hand acquisition, and clothing exchange. While clothing sufficiency is currently a niche phenomenon in the Global North (Kleinhueckelkotten, Neitzke, et al., 2019), consumption-promoting communication predominates in online environments (Frick, Matthies, Thøgersen, & Santarius, 2021): Online marketing is ubiquitous, increasingly intrusive, and primarily targets increased consumption (Pappas, Kourouthanassis, Giannakos, & Lekakos, 2017). Clothing is among the goods most strongly advertised online (Statista, 2019b), and clothing-related communication in social media abounds. Social media use is also related to conspicuous consumption (Taylor & Strutton, 2016), and the majority of studies concerning social media's influence on consumption focus on the marketing perspective of increasing consumption. Nevertheless, online environments can also support consumption reduction. Currently, a growing interest in sufficiency can be observed through sustainability trends such as minimalism, slow fashion, or voluntary simplicity (e.g., Etzioni, 1999; Jung & Jin, 2016).

We report on two consecutive studies on sufficiency-promoting communication in online environments. In Study 1, we conducted a field experiment with customers of a sustainable online shop. We studied behavioural change towards clothing sufficiency by examining the impact of an online intervention applying sufficiency-promoting communication in social media. Study 2 was an online laboratory experiment with a representative sample of social media users. There, we investigated the impact of sufficiency-promoting communication on sufficiency behaviour and on attitudes towards the communication and its sender, and compared it with the impact of consumption-promoting communication and with a neutral

condition without any consumption-related content. Additionally, we tested whether peer endorsement through likes and comments from other social media users increased the effect of sufficiency-promoting or consumption-promoting communication.

Sufficiency interventions

From a theoretical standpoint, [Steg and Vlek \(2009\)](#) categorise behaviour change interventions for pro-environmental behaviour into structural strategies and informational strategies. Structural strategies consist of providing incentives to reduce behavioural costs and increase self-efficacy. Informational strategies induce motivational change, e.g., increasing knowledge or changing motives such as social or personal norms towards pro-environmental behaviour. According to the multiple goals theory ([Lindenberg & Steg, 2007](#)), these motivational changes can be induced for three motive categories, that are relevant for pro-environmental behaviour: Normative motives of what one should do to reflect personal or social norms, gain motives of what brings personal advantages, and hedonic motives of what feels good. Informational strategies can thus foster sufficiency behaviour by strengthening normative motives towards sufficiency, decreasing gain and hedonic motives opposed to consumption reduction, or aligning gain and hedonic motives with normative motives ([Steg, Bolderdijk, Keizer, & Perlaviciute, 2014](#); [Steg & Vlek, 2009](#)). The normative motive can be addressed by means of the personal norm. It describes a feeling of moral obligation and is a widely established determinant of pro-environmental behaviour ([S. H. Schwartz, 1977](#); [Steg & Vlek, 2009](#)). A recent study discovered personal norms to be especially relevant for sufficiency intentions in clothing ([Joanes et al., 2020](#)). Moreover, normative goal framing can increase sufficiency behaviour ([Thøgersen & Alfinito, 2020](#)). Normative motives also include what individuals perceive as a social norm in their community.

Descriptive social norms are especially effective in pro-environmental behaviour change by providing normative information about a peer group's behaviour ([Abrahamse & Steg, 2013](#); [Cialdini et al., 1991](#); [R. E. Goldsmith & Clark, 2008](#)). They also increase the effectiveness of informational strategies ([Abrahamse & Matthies, 2012](#)). Gain and hedonic motives may weaken sufficiency behaviour, for example when hedonic enjoyment or comfort through consumption are in conflict with consumption reduction ([Steg, Bolderdijk, et al., 2014](#)). Accordingly, some hedonic values negatively relate to sustainable fashion consumption ([Geiger & Keller, 2018](#)). To many, the experience of shopping is rewarding (hedonic shopping value, [Babin, Darden, & Griffin, 1994](#)). Status and conspicuous consumption both describe the desire to increase one's status or social prestige by acquiring consumer goods, including clothing and fashion ([O'Cass & McEwen, 2004](#)).

Conspicuous consumption is also an outcome of materialism, which describes the belief that well-being can be attained through acquiring goods ([R. E. Goldsmith & Clark, 2008](#)), and negatively correlates with pro-environmental behaviour ([Hurst, Dittmar, Bond, &](#)

Kasser, 2013; Kasser & Kanner, 2004). Additionally, the activation of self-enhancement values such as material aspirations has been shown to weaken self-transcendence values such as environmentalism and benevolence, and vice versa (Maio et al., 2009). The motive to pursue gain and hedonic motives by frequent consumption can be operationalised as the aspiration level. It has been examined in a consumption context by Easterlin (2001), who measured material aspirations as the importance of owning certain material goods (e.g., a car, a house, or clothes in the latest style). Similarly, (Karlsson et al., 2004, p. 755) define the aspiration level as “the degree to which households consider consumption of different goods and services to be necessary”. Finally, in a psychological setting, it was defined as the perceived need or desire to acquire goods and services (e.g., Frick, Matthies, et al., 2021; Jenny, 2016). As a result, we expect that framing communication on consumption reduction with intrinsic, non-materialistic benefits of sufficiency (e.g., lightness, freedom, autonomy, meaning in life) decreases the hedonic motive of aspiration levels and thus strengthens sufficiency behaviour (Pelletier & Sharp, 2008; Steg, Perlaviciute, van der Werff, & Lurvink, 2014). Such communication may allow materialistic motives to be replaced by non-materialistic ones: embedded in concepts such as voluntary simplicity or minimalism, sufficiency behaviour has personal advantages such as monetary savings and less pressure to earn money to spend (Etzioni, 1999).

Sufficiency communication on social media

To apply the described sufficiency interventions, online environments offer various new possibilities (Guadagno & Cialdini, 2005). Blogs, websites, smartphone applications, and social media offer new channels for providing sustainability-related information that is accessible to users at anytime and anywhere (Börjesson Rivera et al., 2014; Frick & Santarius, 2019). For example, in an online shop, communicating sustainability-oriented descriptive norms can increase sustainable product choice (Demarque et al., 2015). Communication interventions on social media are expected to be especially effective due to social influence, with some authors claiming they may be as influential as face-to-face interactions while having a wider reach (E. B. Goldsmith & Goldsmith, 2011). Arguably, social media can improve distribution of pro-environmental social norms (Ballew et al., 2015). A field experiment on social influence and political mobilisation showed, albeit with a small effect size, that social media posts influence individual decision-making on a large scale (Bond et al., 2012). The study found it was the descriptive social norm demonstrated by close peers that particularly influenced decision-making. Peer communication can lead to behavioural and motivational change through social influence such as social learning (Bandura, 2001), social norms, or persuasion (Guadagno & Cialdini, 2005). Accordingly, an online intervention including visible peer engagement on social media was effective in encouraging college students to save energy (Senbel, Ngo, & Blair, 2014). A social media field experiment aiming at reducing food waste, however, found no effects (Young, Russell,

Robinson, & Barkemeyer, 2017).

“Peer endorsement” is used to describe when peers visibly embrace social media communication (e.g., videos or pictures) with likes, shares, and supportive comments. It has been shown to influence behaviour and a communication’s popularity (Sherman, Payton, Hernandez, Greenfield, & Dapretto, 2016; Tofighi, Mazaheri, & Anderson, 2020). Similar concept used in informatics and marketing research are “social contagion”, describing peer influence through social media networks (e.g. to promote products, Aral & Walker, 2012; Langley, Bijmolt, Ortt, & Pals, 2012) or “word-of-mouth”, the impact of informal communications between social media users on consumption decisions (Chevalier & Mayzlin, 2006; Stephen, 2016). In this study, we therefore expect that peer endorsement of a company’s sufficiency communication strengthens the descriptive social norm for sufficiency and thereby, behaviour.

Companies as senders of sufficiency interventions

Marketing endeavours to promote consumption reduction for a social purpose mostly stem from political or civic actors (McKenzie-Mohr, 2011). Yet commercial actors can also play their part in fostering sufficiency (N. M. Bocken & Short, 2016; Heikkurinen, Young, & Morgan, 2019). They may foster sufficiency through their marketing activities since those activities create and maintain customer relationships and can effectively influence consumption decisions. Sufficiency-promoting marketing focuses on satisfying ‘needs’ rather than promoting ‘wants’ and aims at only selling the customer what she or he needs at the moment of purchase (N. Bocken, Smeke Morales, & Lehner, 2020; Gossen & Frick, 2018). This strategy is increasingly proving its relevance – both in practice, shown, for example, in Patagonia’s prominent campaign “Don’t buy this jacket” (Hwang, Lee, Diddi, & Karpova, 2016), and in scientific discourse (Gossen et al., 2019). There are other marketing concepts that seek to reduce consumption, such as demarketing (Cullwick, 1975; Kotler & Levy, 1971) or social marketing (Andreasen, 1994; Peattie & Peattie, 2009). What differentiates sufficiency-promoting marketing from those concepts is the clear focus on voluntary behaviour change, the contribution to sustainability through consumption reduction, and the fact that the sender is a commercial actor.

Companies might not implement sufficiency-promoting marketing if it appears unusual, controversial, or untrustworthy in the eyes of their customers and leads to image loss (Gossen et al., 2019). Empirical studies on sufficiency-promoting advertising show that customers perceive the company as more altruistic (i.e., socially and environmentally beneficial) and strategic (e.g., customer loyalty or profit), but exploitative motives in the sense of green-washing are often not assumed (Armstrong Soule & Reich, 2015; Gossen & Frick, 2018). Ramirez, Tajdini, and David (2017) further found companies applying sufficiency-promoting communication to be perceived more environmentally concerned and trustworthy.

Two-study outline

We combined a field experiment to maximise external validity (Study 1) with a laboratory experiment to maximise internal validity (Study 2) (Lusk, Pruitt, & Norwood, 2006). With Study 1, we tested whether online sufficiency-promoting communication can increase sufficiency behaviour and if so, which motives mediate this effect. The longitudinal design enabled us to measure consumption levels of clothing over two periods of four weeks. However, the transdisciplinary approach posed practical constraints that prevented all our hypotheses from being addressed.

Also, a substantial long-term effect of a single instance of sufficiency-promoting communication is somewhat unlikely, due to the sheer amount of competing in online environments, especially from marketing sources promoting consumption. Yet, as shown by (Bond et al., 2012), even very small interventions can have a significant impact on attitudes and behaviour when communication is broadcast to a big enough target group. Therefore, in an exploratory approach, we examined the hypothesis that sufficiency-promoting communication on social media can in fact change sufficiency behaviour, albeit with a small effect size. Further, the field experiment provided a conceptual and exploratory setting to determine whether there were small effects of the field intervention.

To gain additional insights on short-term effects of sufficiency-promoting communication in a controlled setting and to address further hypotheses that could not be examined in the field, we conducted a complementary laboratory experiment. Study 2 included best practice strategies that strengthen internal validity. Full randomisation was provided by the laboratory setting, and the experiment was assessed and approved by an ethical committee. In a cross-sectional design, sufficiency behaviour was assessed as an ad-hoc consumption decision. Study 2 included and manipulated further factors such as the comparison of sufficiency-promoting and consumption-promoting communication with a neutral communication condition. It also intended to deepen the understanding of social norms by investigating the effect of peer endorsement on social media. Additionally, we addressed the organisational perspective on practicability and appeal of sufficiency-promoting communication. For these purposes we tested how the attitude towards sufficiency communication and its sender differ between the sufficiency-promoting, consumption-promoting and neutral communication condition.

Study 1: Exploratory field experiment

Hypotheses

The main hypothesis addresses the effectiveness of an intervention in online environments via social media and newsletters that promote sufficiency behaviour, with a clothing company sending the communication. The communication's impact can be measured by

self-reported sufficiency behaviour. Notably, based on the literature, this online intervention is expected to yield only a small effect.

H1a. *Sufficiency-promoting communication increases sufficiency behaviour compared to a neutral communication condition.*

Past research ascribed effects of social media on behaviour change largely to the perception of social norms. As social norms play a major role in pro-environmental behaviour, we expect that the sufficiency-promoting communication strengthens social norms, which then supports sufficiency behaviour.

H2a. *The perceived descriptive social norm mediates the positive impact of sufficiency-promoting communication on sufficiency behaviour.*

At the same time, moral motives are established drivers for pro-environmental behaviour. We expect sufficiency-promoting communication to strengthen the personal norm for sufficiency. As a mediator, it promotes sufficiency behaviour.

H3a. *The personal norm for sufficiency mediates the positive impact of sufficiency-promoting communication on sufficiency behaviour.*

Sufficiency-promoting communication highlights non-materialistic values and decreases hedonic and gain motives for consumption. We expect a mediating effect for the aspiration level for clothing:

H4a. *A decrease in the aspiration level for clothing mediates the positive impact of sufficiency-promoting communication on sufficiency behaviour.*

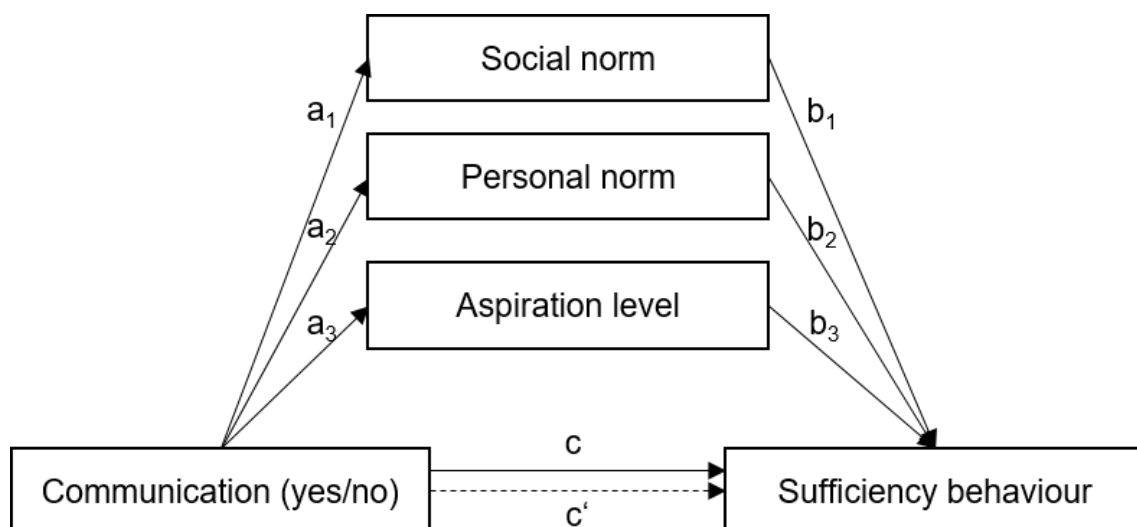


Figure 8: Hypotheses for study 1 ($H1a$: c ; $H2a$: a_1b_1 ; $H3a$: a_2b_2 ; $H4a$: a_3b_3).

Method

Study 1 was designed as a field experiment to measure the impact of a sustainable online shop's sufficiency-promoting communication on its customers. In a quasi-experimental design, the subjects were assigned to either the experimental or control group by self-report of intervention perception. In a longitudinal design, sufficiency behaviour, operationalised as clothing consumption levels, was assessed before (T1) and after the intervention (T2, T3).

Sample

The sample consisted of customers of the sustainable online shop. Prior to the intervention, participants were recruited by the online shop's newsletter (invitation newsletter). As described, only a small effect was expected from the field experiment. For a small effect size of $f = 0.05$, given $\alpha = .05$ and Power = 0.95, power analysis with G*Power indicated a sample size of 1302 participants. In fact, however, sample size was determined by the return rate on the online shop's invitation. In total, $N = 3308$ participants completed the T1 questionnaire, yet only $N = 3278$ gave their e-mail address. They received an invitation for the second questionnaire (T2), which was completed by $N = 2405$ participants (27 % drop-out rate). $N = 2113$ participants filled out the third questionnaire (T3), representing the final sample (36 % drop-out rate from T1). This convenience sample (Table 14) cannot be generalised for the German population, but was typical for the customers of the sustainable online shop, with a high rate of young, female participants, with low income and a high education level (as shown in a previous study by [Gossen & Frick, 2018](#)). Compared to the control group, the experimental group was younger, $t(2105) = 4.05$, $p < .001$, had a slightly lower education level, $\chi^2(2) = 12.46$, as shown in a previous study by $< .01$, and a lower income, $t(744.4) = 4.41$, $p < .001$ a higher percentage was female, $\chi^2(3) = 24.58$, $p < .001$, spent more time online, $t(2079) = -.16$, $p < .001$, $d_{Cohen} = 0.12$, and had slightly higher environmental awareness, $t(2110) = -2.75$, $p < .01$, $d_{Cohen} = 0.13$.

Material

The intervention was planned in a transdisciplinary process ([Lang et al., 2012](#)). This means that the online shop was involved in the formulation of the research question, the design of the study, and the interpretation of the results. The study design was co-produced during several workshops and meetings with representatives of the online shop.

As a result, a 'theme week' intervention was implemented, during which the online shop promoted clothing sufficiency through its social media accounts and in one of their weekly newsletters (intervention newsletter), along with the hashtag #lessismore. The intervention advertised the benefits of buying less and only owning 'favourite pieces'. The intervention newsletter, presented different styling options for a single clothing piece

Table 14: Sample description of the field experiment.

	Field experiment	
	Control group <i>N</i> = 1685	Experimental group <i>N</i> = 428
Age M (SD)	33.5 (10.5)	30.6 (9.9)
Education level*	7.2 % secondary	10.3 % secondary
	30.2 % undergraduate	35.3 % undergrad.
	59.2 % graduate	49.5 % graduate
Income M (SD)	1524 (1134) €	1282 (981) €
Gender*	79.6 % female	90.0 % female
	18.9 % male	9.1 % male
Online h/day	2.82 (1.67)	3.02 (1.67)
Environmental awareness	4.53 (0.38)	4.58 (0.34)

Notes. * Percentages not adding up to 100 % due to participants choosing “other” or “no indication”. Range environmental awareness: 1 = very low, 5 = very high.

(trousers). On Instagram and Facebook, a staff member of the online shop posted photos and stories on a daily basis, showing alternative outfits for her favourite trousers and presenting capsule wardrobe collections. In addition, polls for feedback were conducted, and discussions and interactions with the online shops’ followers about the benefits of sufficiency in their dealings with fashion were initiated in the comments section of the social media channels.

Procedure

The sustainable online shop recruited participants via their weekly newsletter, inviting its customers to take part in an online survey (invitation newsletter on week prior to the intervention newsletter), incentivised by a coupon raffle. The invitation gave no indication on the topic of the survey. In the first survey before the intervention (T1, Fig. 9), the self-reported amount of new and second-hand clothing purchased in the previous four weeks, as well as aspiration level, personal norm and social norm for sufficiency were assessed. Additionally, e-mail addresses were collected in order to send out the post-surveys.

The survey contained further scales on frugality, materialism, fashion consciousness and attitude towards the sender, which are, however, not included in this study. After the intervention week, participants were invited to take part in the second survey (T2). Here, participants completed a manipulation check by stating whether they had taken note of the #lessismore theme week. We assessed whether participants remembered the intervention newsletter, two exemplary posts from social media, and they could further indicate whether they had seen any comments on the posts from other social media users or whether they had commented on the posts themselves. If participants recalled at least one of the communication tools shown in screen-shots or reported to have seen comments or have commented, they were assigned to the experimental group. Participants who did

not agree with any of these statements were assigned to the control group. Cued recall revealed that 9 % of the sample had only seen the intervention newsletter, 4 % only social media posts and 7 % had seen both, whereas 80 % had not seen any of the intervention tools.

The post-intervention survey (T2) contained the same questions as T1 except for shopping behaviour and additional questions about environmental concern, time spent online and socio-demographic variables. Only subjects in the experimental group were asked about their attitude towards the theme week and sender. The third survey (T3) was conducted four weeks after the intervention to assess behavioural impacts. This time, participants were again questioned about the self-reported number of new products and second-hand clothing purchased in the last four weeks.

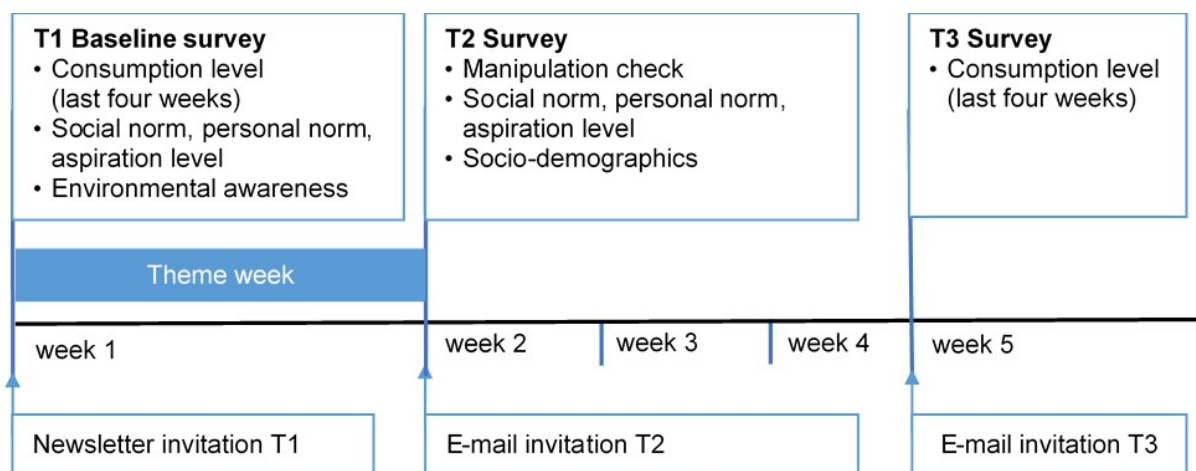


Figure 9: Procedure study 1.

Measures

All measures can be found in Appendix A. If not specified otherwise, items were assessed on a 5-point Likert scale, with the option ‘I don’t know’, which was defined as a missing variable in subsequent analyses.

Sufficiency behaviour was operationalised as a low consumption level of clothing. This was assessed at T1 and T3. We asked for the amount of clothes obtained in local or secondhand-shops, clothes swapped or gifted, clothes bought online, online-reselling or online exchange of clothing, and for the amount of self-made clothes, each on a scale from ‘0 pieces of clothing’ to ‘6 or more pieces’ during the last four weeks.

Personal norm for sufficiency consisted of three items ($\alpha_{T1} = .78$, $\alpha_{T2} = .78$) and were constructed following [S. H. Schwartz \(1977\)](#), e.g. ‘I feel obliged only to buy new clothes when I really need them’.

Social norm for sufficiency was assessed as the perceived descriptive social norms ([Cialdini et al., 1991](#)) of customers of the sustainable online shop as the peer group.

Five items assess whether participants think other customers show sufficiency behaviour, e.g. ‘customers of the online shop buy new clothes if they really need them’ $\alpha_{T1} = .78$, $\alpha_{T2} = .79$.

Aspiration level of clothing was assessed by the mean of the subjectively ideal level of clothing consumption (‘Given limitless availability of money and time, how many pieces of clothing (outerwear) would you ideally like to buy annually?’; Frick, Matthies, et al., 2021), and the subjectively sufficient level of clothing consumption (‘How many pieces of clothing would you need to buy annually for your well-being not to be restricted?’; Jenny, 2016) ($r_{T1} = .63$, $p < .001$, $r_{T2} = 0.62$, $p < .001$).

Environmental awareness was assessed by using a short version of the German environmental awareness scale (Geiger, 2019), including 9 items, $\alpha = .66$. The option ‘I don’t know’ was also included and later defined as missing value in subsequent analyses.

Socio-demographics were gender, age, education level, and income level.

Statistical analysis

To test hypothesis 1a, repeated-measure variance analysis was applied. The interval-scaled variables measuring the aspiration level were tested for outliers. Outliers were identified, as proposed by Tabachnick and Fidell (2007), as values scoring higher than 3.29 standard deviations above the sample mean. They were truncated, i.e. recoded to scores one unit above the highest value within the described range. Missing data resulted in a decrease of the sample through listwise deletion. Mediation analyses to test hypotheses 2a-4a and the pretest-posttest control group design from Valente and MacKinnon (2017) was applied (see Fig. 11). This method adjusts for pretest scores and thus controls for confounders invariant over time. Path analyses with manifest variables were executed with R lavaan (Rosseel, 2012), using robust maximum likelihood. In order to handle missing data, we used full information maximum likelihood (Graham, 2009; Steinmetz, 2015).

Results

All measured variables are listed in Table 15. To check whether randomisation led to comparable groups, we tested differences in all study variables before intervention (T1) via multiple variance analysis (MANOVA). We found no significant differences between experimental and control groups, except for social norm for sufficiency, which was higher in the experimental group, $F(1) = 23.63$, $p < .001$, partial $\epsilon^2 = .015$.

Repeated-measure variance analysis showed that consumption levels dropped in both the experimental and control groups from pre- to post-intervention measurement, $F(1, 2111) = 25.94$, $p < .001$, $\epsilon = .012$. There was no main effect of the group, $F(1) = 0.91$, $p = .34$. Yet the experimental group did not differ from the control group in their consumption reduction, $F(1, 2111) < 0.01$, $p = .98$. The intervention therefore did not

make a difference in participants' clothing consumption, but all participants reduced their clothing consumption.

Table 15: Descriptive statistics of predictors, mediators and the outcome variables.

	Control group (<i>N</i> = 1685)				Experimental group (<i>N</i> = 428)			
	T1		T2		T1		T2	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>Dependent variable</i>								
Consumption level	2.41	2.58	1.98	2.29	2.51	2.60	2.08	2.34
<i>Mediators</i>								
Aspiration level	13.16	7.90	13.00	7.82	13.22	7.43	13.34	7.86
Personal norm	3.70	0.82	3.84	0.79	3.79	0.78	3.94	0.76
Social norm	3.41	0.59	3.46	0.59	3.58	0.55	3.63	0.53

Notes. Social norm: CG T1 *n* = 1390, T2 *n* = 1319; EG T1 *n* = 390, T2 *n* = 386.

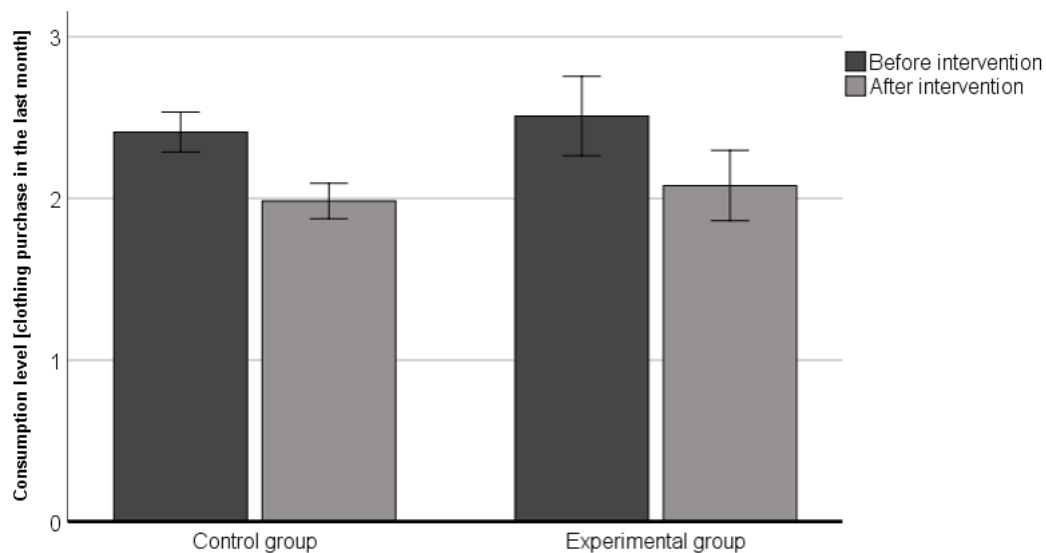


Figure 10: Clothing consumption level in the last month before (black) and a month after (grey) the theme week intervention. Error bars indicate 95 % confidence intervals.

Addressing *H2a-H4a*, we examined whether an influence of the intervention on the consumption level was mediated by motive changes. As Table 3 shows, the intervention had a small effect on the perceived descriptive social norm for sufficiency with regards to other customers (path a1), yet this social norm had no effect on the consumption level of clothing (path b1). The consumption level after the intervention was influenced by the aspiration level (path b3). Yet the intervention had no effects on personal norm or aspiration level, and mediation effects turned out to be non-significant. It is noteworthy

that although mediators were stable over time (stability sm_{1-3}), the consumption level of clothing before and after the intervention only showed a weak positive relationship (stability sy).

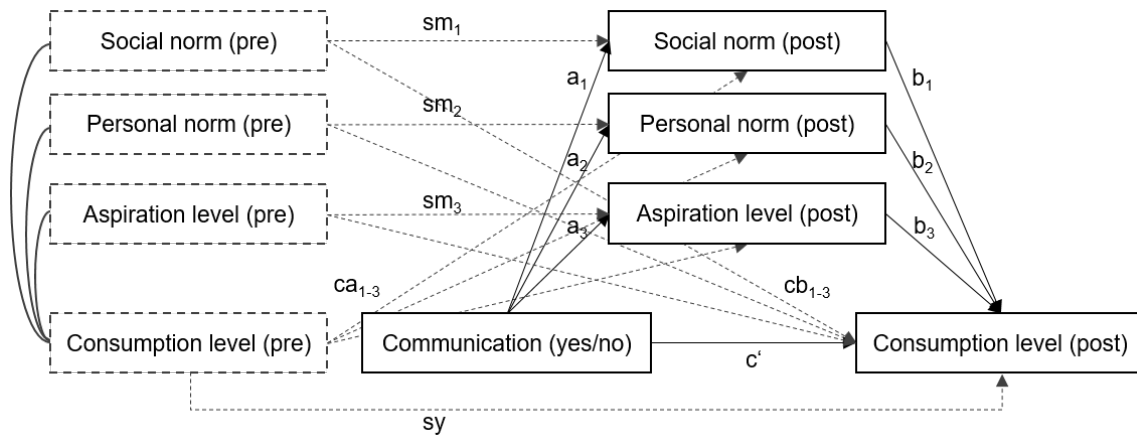


Figure 11: Mediation model of consumption reduction after [Valente and MacKinnon \(2017\)](#).

Notes. Model includes the effects of intervention on mediators (a), effects of mediators on outcome (b), effect of intervention on outcome (c'), stability of mediators (sm) and stability of dependent variable (sy), cross-lagged effects on mediators (ca), cross-lagged effects on outcome (cb), and the pretest correlations between mediators and outcome.

Discussion

All participants had reduced their clothing consumption and thus increased their sufficiency behaviour, whether they had perceived the intervention or not. Limitations of our study design are, of course, a prerequisite for interpreting these findings and are discussed below. However, our result replicates findings from a similar field experiment in the social media, which aimed at reducing food waste ([Young et al., 2017](#)) and showed that both social media and control groups significantly reduced their self-reported food waste. We conclude that the questionnaire may itself have had an effect as participants reflected on their clothing consumption during the pre-test questionnaire: It has been shown that assessing consumption intentions alone may alter subsequent behaviour, at least in the short term (mere-measurement effect, [Morwitz & Fitzsimons, 2004](#)). A second explanation for the overall consumption reduction may be the point of time in a clothing consumption cycle. When participants first completed the questionnaire, they may merely have been interacting with the online shop (irrespective of their perception of the intervention), and thus were more likely to have bought clothes whereas, a month later, they may not have been in a 'consumption phase'. Also, clothing consumption is undertaken infrequently, leading to a high error variance in the outcome variable and thus possibly weakening effects. The low stability of clothing consumption in the four weeks prior to intervention, compared to the four weeks after intervention, supports this explanatory approach. Third,

Table 16: Mediation model predicting consumption reduction

		<i>b</i>	<i>se</i>	<i>b</i>	<i>z</i>	<i>p</i>	
Path							
	a1	0.08	0.03	.06*	3.25	<.01	
	a2	0.05	0.03	.03	1.75	.08	
	a3	0.22	0.29	.01	0.76	.45	
	b1	-0.05	0.13	-.01	-0.37	.71	
	b2	-0.13	0.09	-.04	-1.34	.18	
	b3	0.03	0.01	.10*	2.64	.01	
	c'	0.09	0.12	.02	0.74	.46	
Stability							
	sm1	0.61	0.02	.61*	26.15	<.01	
	sm2	0.67	0.02	.70*	40.28	<.01	
	sm3	0.90	0.02	.79*	44.09	<.01	
	sy	0.13	0.02	.14*	5.43	<.01	
Cross-lagged effects							
	ca1	-0.01	0.00	-.03	-1.43	.15	
	ca2	-0.01	0.01	-.05*	-2.71	.01	
	cb3	0.10	0.05	.03	1.94	.05	
	cb1	0.15	0.11	.04	1.31	.19	
	cb2	-0.25	0.09	-.09*	-2.77	.01	
	cb3	0.01	0.01	.04	1.01	.31	
Covariates							
	Consumption – social norm (pre)	0.04	0.03	.03	1.08	.28	
	Consumption – pers. norm (pre)	-0.21	0.05	-.10*	-4.19	<.01	
	Consumption – aspiration l. (pre)	3.67	0.49	.18*	7.43	<.01	
Indirect mediation effects							
	Social norm	<i>H2</i>	0.00	0.01	.00	-0.37	.71
	Personal norm	<i>H3</i>	-0.01	0.01	.00	-1.05	.30
	Aspiration level	<i>H4</i>	0.01	0.01	.00	0.74	.46

Notes. SEM fit indices: $\chi^2(16) = 463.87$, $CFI = .90$, $RMSEA = .12$, $SMSR = .11$

participants from the control group could have been unconsciously exposed to the campaign and therefore, both groups would have been affected by the treatment. Yet this explanation seems unlikely, as informational strategies change motives or knowledge, which involves conscious reflection (as opposed to structural strategies which do not need reflection, e.g., [Steg & Vlek, 2009](#)).

Mediation analysis showed no mediation effects. The intervention had a small effect on the social norm of other customers' clothing sufficiency, but that did not affect consumption. From the mediators, only the aspiration level influenced the consumption level, yet the change of aspiration levels before and after the intervention could not predict the change in consumption levels. In any case, the non-significant results and low visibility of the theme week show that, in the way we implemented the intervention, single posts were not influential enough to have a measurable effect. The reason for this insignificance may be

found in deficiencies of our study design, as discussed below, but also in low attention levels on social media and the sheer amount of competing information available online (Maurer & Wiegmann, 2011). Therefore, social media communication might be too weak when it appears as singular posts in participants' newsfeeds.

The transdisciplinary approach and the field setting were additional challenges, which resulted in a dependency on the interests and technical availabilities of the cooperating online shop (e.g., they formulated the daily posts on their own), giving us less control regarding the intervention's topic and wording. Focusing on the hashtag #lessismore and on 'favourite pieces' within the theme week may not be explicit enough to foster sufficiency behaviour. Also, only 21 % of participants perceived the theme week communication activities. Another recent study showed that reminding individuals about the environmental consequences of their purchases can effectively increase voluntary simplicity (Peifer, Chugani, & Roos, 2020). Thus, it seems advisable to educate individuals on the link between overconsumption and the ecological harnesses of fast fashion before they indicate their purchase intentions.

Whereas the study's strength lies in its sample size and external validity, another methodological limitation is its quasi-experimental approach. Assigning participants post-hoc to experimental and control groups resulted in selection effects. The groups were inherently different in terms of their initial consumption level, social media use, and socio-demographic characteristics. Also, we could not completely rule out that drop-outs between T1 and T3 (36 %) were selective, even if there is no strong rationale for this. Finally, the sample was not representative of the German population. Participants were recruited among customers of a sustainable online shop, which attracted participants with higher-than-average education levels, environmental concern, and female gender, as was also found in other convenience sample studies on consumption reduction (Herziger et al., 2020; Joanes et al., 2020). Recruiting participants through a newsletter may have excluded potential participants who are irregular customers not as tied to the company or not interested in frequent information. As a practical research implication, the study demonstrates how effectiveness of interventions has to be interpreted with caution and within the limitations of the study design. Despite methodological weaknesses, the field experiment indicates positive effects of sufficiency-promoting communication on clothing sufficiency and provides valuable practical implications. To address these potentials, a laboratory experiment was conducted to follow up on open questions.

Study 2: Online laboratory experiment

Hypotheses

In Study 2, we tested further hypotheses we had derived from the literature, while we could also retest the hypotheses from Study 1. We compared sufficiency-promoting and

consumption-promoting communication with a neutral communication condition that does not suggest any change in the recipient's consumption levels, expecting inverse effects on sufficiency behaviour by consumption-promotion. Further, the aspiration level, personal norm and social norm for sufficiency were also expected to mediate this relationship analogous to *H2a-H4a* (Fig. 8).

H1b. *Consumption-promoting communication decreases sufficiency behaviour compared to a neutral communication condition.*

H2b, H3b, H4b. *The perceived descriptive social norm, personal norm and aspiration level mediate the negative impact of consumption-promoting communication on sufficiency behaviour.*

In the laboratory setting, the impact of peer endorsement of communication conditions through likes and comments could be controlled for and tested. Each communication condition was presented either with or without peer endorsement. We hypothesised that peer endorsement of social media communication increases its effectiveness, proposing a moderating effect on the impact of communication conditions on sufficiency behaviour (Fig. 12). Note that most above cited literature detected effects for peer groups that participants knew in person. In our research, we focus on social media communication from organisations and therefore test whether descriptive social norms shown by the more distal peer group of other social media users are equally effective.

H5a, H5b. *Peer endorsement moderates the positive impact of sufficiency-promoting communication on sufficiency behaviour (a) and the negative impact of consumption-promoting communication on sufficiency behaviour (b).*

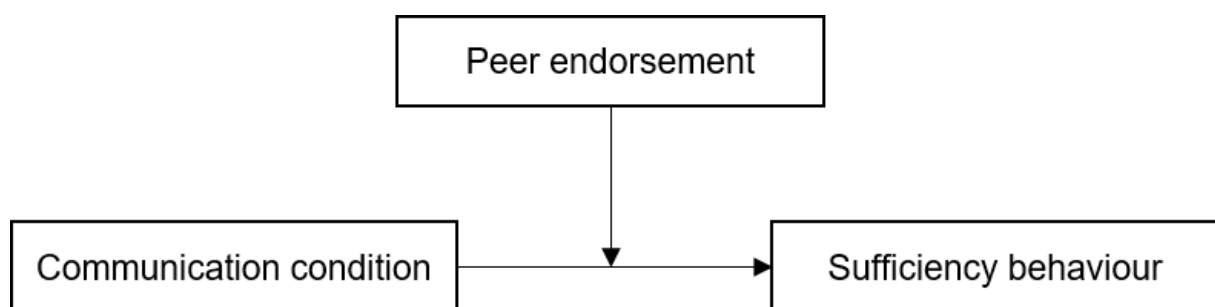


Figure 12: Moderation effect of peer endorsement by social media users.

Since in Study 1 we examined only customers of a sustainable online shop who reported high environmental awareness, in Study 2 we controlled for such values in a representative sample. Numerous studies established that pre-existing values of self-transcendence and self-enhancement influence pro-environmental behaviour and curtailment (Steg, Bolderdijk, et al., 2014; Steg, Perlaviciute, et al., 2014), for sustainable clothing consumption see Geiger and Keller (2018). We expected that participants with high self-transcendence

values (biospheric and altruistic values) would show more sufficiency behaviour, and the opposite for high self-enhancement values (hedonistic and egoistic values).

H6. *Individuals with high self-transcendence values show more sufficiency behaviour, whereas individuals with high self-enhancement values show less sufficiency behaviour.*

Due to the novelty of sufficiency-promoting communication, there is still little practical experience and empirical evidence on its effects on the image and value of the company. In past research, sufficiency-promoting communication itself was found to contribute to a positive attitude towards the company (Armstrong Soule & Reich, 2015; Gossen & Frick, 2018; Ramirez et al., 2017). Therefore, we expect that the attitude towards sufficiency-promoting communication and towards the sender are more positive than in the other conditions.

H7a, H7b. *Sufficiency-promoting communication leads to a more positive attitude towards the communication and sender than neutral communication (a) and consumption-promoting communication (b).*

Method

Study 2 was conducted as an online laboratory experiment, allowing for a representative sample and full randomisation. The participants were randomly assigned to one of six conditions in a 3×2 design, with the three communication conditions (neutral, sufficiency-promoting and consumption-promoting), each paired with only the fictional company's communication (Instagram posts) or the communication plus peer endorsement (Instagram posts with likes and comments).

Pre-study for the design of experimental material

In order to identify the most effective manipulation for the actual laboratory experiment, we conducted a pre-study. Initially, seven posts were designed (in each of the three versions neutral, sufficiency-promoting and consumption-promoting, but not including peer endorsement). In three surveys with mixed posts, $N = 105$ could rate the posts on two dimensions. First, participants' attitude towards the communication was assessed, and second, the participants rated the post on a consumption promotion scale from 1 = 'the post is intended to make me consume less', to 3 = 'neither', to 5 = 'the post is intended to make me consume more'. Based on these indicators, four posts were selected for the experiment. They were selected on the basis of the sufficiency-promoting version scoring as low as possible, the consumption-promoting version scoring as high as possible and the neutral version scoring in the middle range of the consumption promotion scale. At the same time, the posts with an overall positive attitude were chosen. The consumption promotion in the sufficiency-promoting condition was perceived as $M(SD) = 1.99(0.96)$, so

on the side of ‘intended to make me consume less’, the mean in the consumption-promoting condition was $M(SD) = 4.16(0.82)$, ‘intended to make me consume more’, and in the neutral condition it was $M(SD) = 3.40(0.76)$. The sufficiency-promoting communication included both messages directed towards normative motives (as proposed by Joanes et al., 2020) and hedonic motives (egoistic appeals, as proposed by Herziger et al., 2020) to engage in sufficiency behaviour. The messages thus included both ecological and personal advantages of sufficiency.

Sample

The data was collected by a market research institute within its online access panel, recruiting participants from Germany. As an inclusion criterion, participants were screened for social media use (Facebook, Instagram or Twitter). Only participants who used it at least once a week were included. To provide representativeness, a socio-demographic distribution was chosen that is representative for the part of the German population who actively participate on social media. Therefore, participants were screened on the criteria of age (three age groups between 16 and 69 years), gender (two groups), education level (three levels) and income (two levels).

Table 17: Online experiment sample description

	Laboratory experiment Full sample	German Population
	$N = 881$	(Statistisches Bundesamt - Destatis, 2018)
Age $M(SD)$	33.7 (13.4)	44.3
Education level*	52.2 % secondary 26.1 % undergrad. 18.9 % graduate	30.4 % secondary 23.1 % undergrad. 31.9 % graduate
Income $M(SD)$	1500 - 2000 €	1957 €(in 2013)
Gender*	51.2 % female 48.6 % male	50.7 % female 49.3 % male
Online h/day $M(SD)$	3.82 (2.08)	3.27

Notes. * Percentages not adding up to 100 % are due to participants choosing “other” or “no indication”.

The planned sample was $N = 1100$, as power analysis using G*Power proposes a sample size of 1093 participants for a medium effect size of 0.15, given $\alpha = 0.05$ and Power = 0.95. $N = 2286$ people accessed the survey, $N = 815$ were excluded as they did not use social media regularly, $N = 222$ because they did not pass a control question (‘please click 2 here’), $N = 13$ due to a break of more than 15 min within the questionnaire (as the priming effect of seeing the posts would fade over time), and $N = 259$ participants did not pass the manipulation check explained below. From the remaining $N = 977$ participants, $N = 96$ did not want to participate in the coupon raffle. The groups in the six conditions

did not differ significantly in age, $F(5) = 1.02$, $p = .41$, gender, $\chi^2(15) = 13.00$, $p = .60$, income, $F(5) = 0.76$, $p = .58$, education level, $\chi^2(10) = 10.44$, $p = .40$, or the time spent online, $F(5) = 1.36$, $p = .24$. The final sample of $N = 881$ is described in Table 17.

Material

The manipulation comprises six communication conditions, each consisting of four Instagram posts of a fictional online clothing shop. Over the conditions, each post had an identical design, using the same picture and text design, and in the peer endorsement condition, also the same number of likes and comments. For an example of a post in the three communication versions see Fig. 13. For full manipulation display, see supplementary material.

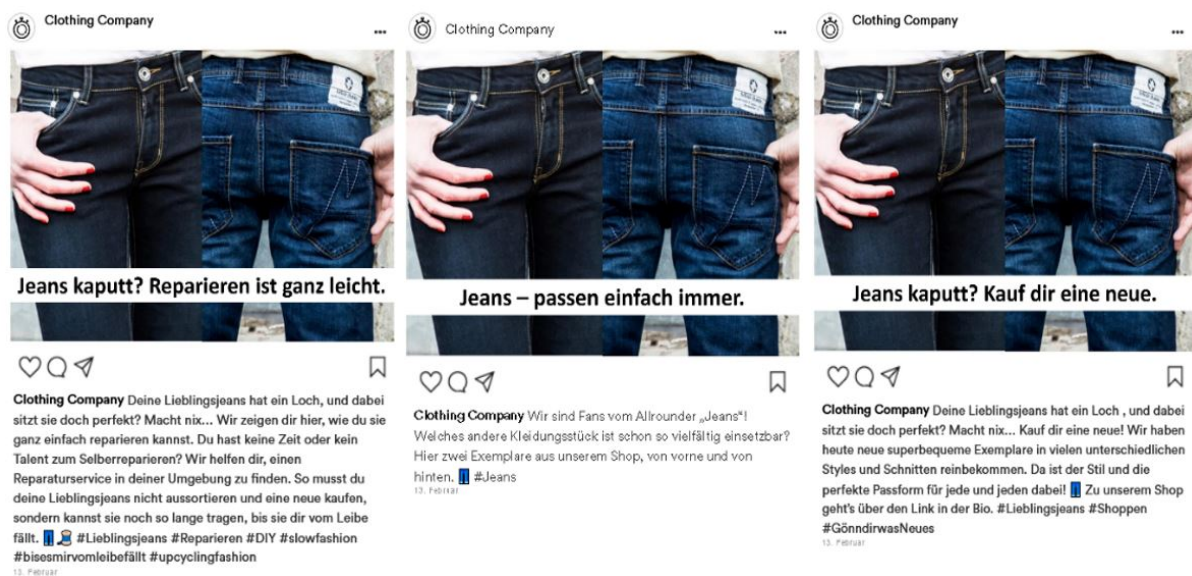


Figure 13: Manipulation from left to right: (1) Sufficiency-promoting communication: ‘Torn jeans? It’s easy to repair them.’, (2) Neutral communication: ‘Jeans - they always fit.’, (3) Consumption-promoting communication ‘Torn jeans? Buy a new pair.’

Procedure

After entering the survey, a screening question covered the social media use in terms of frequency and general internet use in terms of time expenditure. Next, participants were asked for their age, education level, income level and gender, in order to screen for quotas that ensure a representative sample for the German population actively participating on social media in all six conditions. This was followed by random assignment to one of the six communication conditions and a presentation of the intervention, consisting of four Instagram posts (for an example see Fig. 13). Participants were asked to look at the posts for a given time and like and comment on them. Each post was shown for at least 8 s, and

the median time that participants spent looking at each of the four posts was between 15 and 21 s. After manipulation, dependent variables were assessed (see next chapter).

Measures

All measures can be found in Appendix A. If not otherwise specified, items were assessed on a 5-point Likert scale, with the option ‘I don’t know’, which was defined as a missing variable in subsequent analyses.

Sufficiency behaviour in the domain of clothing was measured by a coupon choice. In a coupon raffle for 10 vouchers at 10 Euros each, participants could choose between four coupons: two options for popular retail shops representing a consumption-oriented choice, and two options representing sufficiency behaviour, namely a voucher for a second-hand online shop, or a donation of the given amount to a NGO that campaigns for sustainable clothing consumption. The option ‘I do not want to take part in this raffle’ was defined as a missing variable. To determine sufficiency behaviour as a dichotomous variable, voucher choices for the charity donation and second-hand online shop were coded as 1 = yes, and the regular online-shop vouchers were coded as 0 = no.

Aspiration level of clothing see study 1.

Personal norm for sufficiency see study 1.

Social norm for sufficiency was assessed using a set of eight items, on the descriptive social norm of the peer group for sufficiency (e.g. reduced consumption, repair, sharing), that varied slightly from study 1, this time defined as ‘Instagram users’, $\alpha = .82$.

Attitude towards sufficiency-promoting communication was measured with five new items assessing how users liked the posts ($\alpha = .77$), e.g. ‘The social media presence of the clothing company is appealing’.

Attitude towards the sender measured how participants perceived the online shop due to its communication. The scale ‘motives of the sender’ was used ([Armstrong Soule & Reich, 2015](#)). In it, the altruistic dimension, and reversed strategic and exploitive motives were integrated ($\alpha = .77$). Each dimension consists of three items. ‘Tries to address new customers’ or ‘does not really care for the environment’ are examples for motives of the sender.

Universal values was assessed using a short version of Schwartz’s value scale ([Steg, Perlaviciute, et al., 2014](#)) to measure altruistic and biospheric values in the category of self-transcendence, $\alpha = .88$, and egoistic and hedonistic values in the category of self-enhancement, $\alpha = .77$, with eight items ranging from -1 ‘opposed to my values’, 0 ‘unimportant’ to 7 ‘guiding principle’.

Manipulation check. To check whether participants received and understood the communication content, they were shown one of the four social media posts in all three communication versions (i.e., neutral, consumption-promoting, sufficiency-promoting), as well as the option ‘I did not see any of these posts’ and were instructed to pick which one

of them was presented to them. Socio-demographics. We assessed the socio-demographic variables gender, age, education level, income level and time spent online.

Statistical analysis

To test the hypotheses of sufficiency-promoting communication or consumption-promoting communication (*H1*), their interaction with peer endorsement on sufficiency behaviour (*H5*), as well as the covariates of universal values (*H6*), step-wise hierarchical logistic regression was applied, as this allowed us to measure both the direct effect of sufficiency communication, as well as how this effect changes when other predictors are included and allowed to interact with the manipulation (Field, 2013). The impact on the attitude towards the message and the sender (*H7*) was computed with variance analysis (ANOVAs). These analyses are computed in SPSS 25. Mediation analyses, including sufficiency-promoting communication (*H2a-H4a*) and consumption-promoting communication (*H2b-H4b*), were tested against the neutral condition in two separate models, each with a mediation analysis applying diagonal weighed least squared estimator (DWLS) in R lavaan (Rosseel, 2012; Steinmetz, 2015).

Results

Outcome and mediator variables are shown in Table 18. Sufficiency behaviour as coupon choice was rather rare, with 18.3 % of participants choosing to donate their prize to an NGO for sustainable clothing, and 9.2 % choosing the coupon for an online peer-to-peer second-hand marketplace, whereas the other 72.5 % chose one of the two clothing shop coupons.

The influence of communication condition, peer endorsement and values as covariates on sufficiency behaviour was assessed by hierarchical logistic regression (Table 19). Hypothesis 1a was confirmed at Step 1, not including covariates. If participants were presented the sufficiency-promoting communication, they were 1.51 [95 % CI 1.06–2.14] times as likely to choose the sufficiency coupon as participants in the neutral condition. Further analyses revealed that this effect was explained by participants with high self-transcendence values, shown in the interaction effect of self-transcendence and sufficiency promotion (Step 3). Additionally, high self-enhancement values decreased sufficiency behaviour. The participants who saw consumption-promoting communication did not choose the sufficiency option less often than those in the neutral condition (*H1b*). The step-wise procedure produced the best model fit ($\chi^2(6) = 35.52, p < .001$) for the model seen in Table 19 that excluded peer endorsement (Block $\chi^2(1) = 0.18, p = .67$), the interaction effect between communication conditions and peer endorsement (*H5*, Block $\chi^2 = 0.49, p = .78$), and the interaction effect between communication conditions and self-enhancement (Block $\chi^2(2) = 1.11, p = .57$), which had no effect on sufficiency behaviour.

Table 18: Online experiment: descriptive variables

	Consumption promotion				Neutral condition				Sufficiency promotion			
	Peer endorsement:				Peer endorsement:				Peer endorsement:			
	without		with		without		with		without		with	
	N = 129		N = 145	N = 154		N = 146			N = 162		N = 145	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Sufficiency behaviour*		24.03%		20.00%		25.97%		25.34%		33.95%		34.48%
Ideal level of consumption	38.48	36.8	36.46	33.84	33.44	29.58	43.02	35.02	22.64	26.19	23.26	27.26
Sufficient level												
of consumption	9.51	12.27	10.10	14.62	8.88	12.50	11.91	13.84	5.75	10.53	6.52	9.14
Aspiration level	24.00	22.18	23.28	21.57	21.16	18.97	27.47	21.09	14.20	16.55	14.89	16.42
Personal norm	3.21	1.12	3.19	1.13	3.17	01.04	2.99	1.11	3.33	01.03	3.45	1.04
Social norm**	3.21	0.72	2.16	0.56	2.21	0.64	2.23	0.68	2.24	0.74	2.30	0.81
Attitude towards												
communication	3.14	0.82	3.32	0.84	3.24	0.86	3.16	0.83	3.77	0.81	3.73	0.78
Attitude towards sender	2.49	0.48	2.52	0.48	2.66	0.49	2.69	0.45	3.25	0.59	3.23	0.64
Self-transcendence	5.18	1.21	5.13	1.09	5.32	1.15	5.20	01.05	5.23	1.23	05.08	1.10
Self-enhancement	3.68	1.11	3.57	1.08	3.52	1.19	3.05	01.12	3.37	1.16	3.57	01.01

Notes. * Dichotomous variable: percentage of participants showing sufficiency behaviour.

** *N* in the above order: 121, 134, 140, 136, 150, 135 (due to option: 'I don't know').

Table 19: Hierarchical logistic regression model predicting sufficiency behaviour

		<i>b</i>	<i>se</i>	<i>Wald</i>	<i>df</i>	<i>p</i>	<i>odds ratio</i>	<i>Lower 95%CI</i>	<i>Upper 95%CI</i>
Step 1	Communication condition			11.62	2	.003			
	Sufficiency promotion	0.41	0.18	5.24	1	.022	1.51*	1.06	2.14
	Consumption promotion	-0.21	0.20	1.12	1	.290	0.81	0.55	1.19
Step 2	Communication condition			10.75	2	.005			
	Sufficiency promotion	0.42	0.18	5.49	1	.019	1.53	1.07	2.18
	Consumption promotion	-0.16	0.20	0.69	1	.408	0.85	0.57	1.25
	Self-transcendence	0.18	0.07	6.86	1	.009	1.20	1.05	1.37
	Self-enhancement	-0.21	0.07	8.80	1	.003	0.81	0.71	0.93
Step 3	Communication condition			4.68	2	.097			
	Sufficiency promotion	-1.94	0.90	4.64	1	.031	0.14	0.02	0.84
	Consumption promotion	-0.82	0.94	0.76	1	.385	0.44	0.07	2.79
	Self-transcendence	-0.03	0.12	0.05	1	.823	0.97	0.77	1.23
	Self-enhancement	-0.20	0.07	7.81	1	.005	0.82*	0.72	0.94
	Interaction communication								
	* self-transcendence			7.64	2	.022			
	Sufficiency								
	* self-transcendence	0.45	0.17	7.16	1	.007	1.56*	1.13	2.16
	Consumption								
* self-transcendence	0.12	0.18	0.48	1	.490	1.13	0.80	1.60	

Notes. $R_2 = .04$ (Cox–Snell); $R_2 = .06$ (Nagelkerke). Model $\chi^2(6) = 35.53$, $p < 0.001$.

The mediation model of sufficiency-promoting communication compared to the neutral condition on sufficiency behaviour ($H2a - H4a$), revealed that effects from sufficiency-promoting communication on sufficiency behaviour were mediated by a lower aspiration level for clothing (Table 20, Fig. 10). Sufficiency communication also influenced the personal norm for sufficiency (path a2, $\beta = .13$), but this did not translate into more sufficiency behaviour (path b, n.s.). The personal norm and aspiration levels were negatively correlated, $\beta = .43$. No mediation effect could be found for the social norm of other social media users. Since logistic regression analysis had shown that consumption-promoting communication had no significant effect on sufficiency behaviour, the mediation model for consumption-promoting communication was equally non-significant ($H2b - 4b$), and can be found in Appendix B. Finally, we addressed the attitude towards sufficiency-promoting communication and its sender. As hypothesised ($H7$), there was a significant main effect of the communication condition on the attitude towards the communication $F(2) = 42.20$, $p < .001$, partial $\epsilon^2 = .09$. Contrasts revealed that the attitude towards the sender of sufficiency-promoting communication was more positive than to senders of both neutral, $b(SE) = 0.57$ (0.10), $t = 5.91$, $p < .001$, partial $\epsilon^2 = .04$ and consumption-promoting communication, $b(SE) = 0.41$ (0.10), $t = 4.21$, $p < .001$, partial $\epsilon^2 = .02$.

Peer endorsement $F(1) = 0.12$, $p = .724$, and its interaction with communication, $F(2) = 2.15$, $p = .112$, did not have a significant effect. Accordingly, there was a significant main effect of the communication on the attitude towards the sender, $F(2) = 154.92$, p

$< .001$, partial $\epsilon^2 = .26$. Contrasts revealed that the attitude towards the sender in the sufficiency-promoting condition was more positive than both the neutral condition, $b(SE) = 0.54 (0.06)$, $t = 8.64$, $p < .001$, partial $\epsilon^2 = .08$ and consumption-promoting condition, $b(SE) = 0.71 (0.06)$, $t = 11.44$, $p < .001$, partial $\epsilon^2 = .13$. However, in this model too, neither peer endorsement $F(1) = 0.14$, $p = .709$, nor its interaction with communication, $F(2) = 0.21$, $p = .812$, had a significant effect.

Table 20: Mediation model of sufficiency-promoting communication (following Figure 1)

	<i>b</i>	<i>se</i>	<i>b</i>	<i>z</i>	<i>p</i>
Path					
a1	0.05	0.06	.04	0.82	.415
a2	0.27	0.09	.13*	3.08	.002
a3	-9.60	1.71	-.25*	-5.63	<.001
b1	-0.10	0.08	-.07	-1.26	.207
b2	0.11	0.06	.11	1.84	.066
b3	-0.01	0.00	-.24*	-3.86	<.001
c	0.13	0.11	.07	1.17	.241
Indirect mediation effects					
Social norm	0.00	0.01	.00	-0.69	.493
Personal norm	0.03	0.02	.01	1.59	.112
Aspiration level	0.12	0.04	.06*	3.13	.002
Total effect	0.28	0.11	.14*	2.49	.013
Covariates					
Social norm - personal norm	0.05	0.03	.06	1.62	.106
Social norm - aspiration level	-1.19	0.63	-.09	-1.90	.058
Personal norm - aspiration level	-8.55	1.01	-.43*	-8.44	<.001

Discussion

Compared to the other conditions, sufficiency-promoting social media communication led to more sufficiency behaviour and a better attitude towards the communication content and towards the company. Including values into the regression model revealed that sufficiency communication was mainly effective for participants scoring high on self-transcendence values. Mediation analyses further showed that, as a short-term effect, a higher aspiration level mediates the relationship between sufficiency-promoting communication and sufficiency coupon choice. Promoting sufficiency had a positive effect on the personal norm for sufficiency, yet this effect seemed to be too weak to translate into actual behaviour (this is also given for Study 1). This result is in line with an earlier study that found this lack of connection between personal norm and behaviour (Frick, Matthies, et al., 2021). An alternative explanation would be that the effect of personal norm is mediated through a lower aspiration level. Consumption-promoting communication, however, did not lead to less sufficiency behaviour compared to the neutral condition.

This finding contrasts with past research showing the consumption-increasing effects of advertisement (e.g., Hoch et al., 2016; Kasser & Kanner, 2004). Possibly, the neutral condition of the fictional company’s communication was not perceived as completely neutral but may be perceived as advertising of some sort since individuals expect companies’ primary marketing goals to be consumption promotion (Stoeckl & Luedicke, 2015). Another possibility to explain this lack of difference is that, as consumption-promoting communication predominates in online environments, a habituation effect might be occurring whereby one consumption-promoting post does not make a difference, but sufficiency-promoting communication attracts more attention due to its novel character (Gossen et al., 2019).

Compared to the other conditions, sufficiency-promoting communication also positively affected attitudes towards the communication and sender whereas consumption-promoting communication did not cause a change in these attitudes. This finding is in line with previous research on institutional sufficiency-promoting marketing, which found that a message amplifying sufficiency behaviour boosts favourable attitudes towards green demarketing advertising (Reich & Soule, 2016) and enhances customers’ perceptions of the firm (Ramirez et al., 2017). Consumption-promoting communication may not have an effect compared to a neutral condition due the fact that advertising is so common that it is not actively processed. This effect may also have influenced perceptions of the fictional company in our laboratory experiment.

Peer endorsement did not moderate the relationship between communication and any of the dependent variables. One reason for this might be that the fictional posts and comments were perceived as ‘fake’. For that matter, also the laboratory setting of the study lacks external validity because the posts were isolated and not presented in a news-feed along with other posts, as is common on Instagram. This isolation resulted in less distraction than in a real-world setting. Most previous studies that have found effects of social norms included social information from real peers that participants actually knew. The study at hand, conversely, showed comments and likes of other social media users that participants did not personally know. Social norms of the more distant peer group of social media users are thus not as effective as social norms transported by close peers.

General discussion

We find that sufficiency-promoting communication in social media can be effective for enhancing sufficiency behaviour and attitudes in the short term. Table 21 provides an overview of hypotheses and respective results. In the field experiment, all participants reduced their level of clothing consumption regardless of whether or not they had seen the intervention. Therefore, either the engagement with the questionnaire itself (especially among individuals with a high interest in sustainability) could have evoked behaviour change towards sufficiency or participants were in different consumption cycle stages.

Despite these shortcomings, the study shows the practical limitations of social media when it comes to behaviour change. Compensating the methodological weaknesses of the field experiment, the laboratory experiment showed significant short-term effects of sufficiency-promoting communication on sufficiency behaviour and attitudes towards the communication and its sender. With the sufficiency-promoting communication, participants were 1.5 times more likely to choose a sufficiency-oriented coupon and rated the communication and its sender more positively than under the neutral condition. Interestingly, this effect was apparent mainly for participants with high self-transcendence values, meaning that the intervention was most effective for target groups already engaged in the topic.

Table 21: Overview of hypotheses and results.

		Study 1	Study 2
<i>H1a</i>	Sufficiency-promoting communication increases sufficiency behaviour compared to a neutral communication condition.	no	yes
<i>H2a</i>	The perceived descriptive social norm mediates the positive impact of sufficiency-promoting communication on sufficiency behaviour.	no (only path a)	no
<i>H3a</i>	The personal norm for sufficiency mediates the positive impact of sufficiency-promoting communication on sufficiency behaviour.	no	only path a
<i>H4a</i>	A decrease of the aspiration level for clothing mediates the positive impact of sufficiency-promoting communication on on sufficiency behaviour.	no (only path b)	yes
<i>H5a</i>	Peer endorsement moderates the positive impact of sufficiency-promoting communication on sufficiency behaviour.	-	no
<i>H1b-5b</i>	Effects for consumption-promoting communication	-	no
<i>H6</i>	Individuals with high self-transcendence values show more sufficiency behaviour whereas individuals with high self-enhancement values show less sufficiency behaviour	-	yes
<i>H7a, b</i>	Sufficiency-promoting communication leads to a more positive attitude towards the communication and sender than neutral communication(a) and consumption-promoting communication (b).	-	yes

The effects of universal self-transcendence and self-enhancement values (e.g., [Geiger & Keller, 2018](#)) could be replicated for sufficiency behaviour in the clothing domain: whereas a strong emphasis on self-enhancement consistently decreased sufficiency choice, self-transcendence interacted with the sufficiency communication.

Although the effect size was relatively small, it is still worth noting that the short-term effect of sufficiency-promoting communication was as influential as self-transcendence or

self-enhancement. From this finding, we draw two conclusions. First, the short-term effects may best unleash their potential when the intervention is timed shortly before a relevant consumption decision (e.g., before customers of an online shop move to the cashier). As a practical implication, sufficiency-promoting communication would be valuable as a sufficiency nudge (Thaler & Sunstein, 2009). Second, as we only found short-term effects; long-term effects remain to be tested in future research. Although, in our study, single social media posts were too weak as an intervention (as was also found by Young et al., 2017), it remains to be explored in greater depth whether, for example, a more repeated exposure to sufficiency cues from several sources or incorporating social norms from direct peers (as in Bond et al., 2012) has an effect.

The laboratory Study 2 showed a mediation effect: Sufficiency-promoting communication changes the self-reported aspiration level in the short-term, which then influences sufficiency behaviour. In the field experiment, the relationship between the aspiration and consumption level was also present. Yet, no changes could be detected for the mediator social norm for sufficiency in either study, and only a tendency for the personal norm as a mediator for sufficiency was found in Study 2. The interventions in both studies included sufficiency-promoting messages addressing normative motives (Joanes et al., 2020) and hedonistic motives (Herziger et al., 2020). Apparently, these messages had an effect only in the laboratory setting. The sufficiency-promoting communication may have activated normative motives, as suggested in previous research, which found that activating normative goals weakens hedonistic consumption motives (Maio et al., 2009). Also, finding the aspiration level to be a strong mediator shows how environmental psychology could enable more knowledge on behavioural determinants to be gained by examining factors of unsustainable behaviour (Thøgersen, 2014). Whereas normative determinants and intentions in favour of pro-environmental behaviour have been thoroughly studied (S. H. Schwartz, 1977; Stern et al., 1999), gain and hedonistic motives that hinder pro-environmental behaviour are less often included in empirical studies (Thøgersen, 2014), but see (Frick, Matthies, et al., 2021). As well as strengthening personal norms and pro-environmental values, attenuating hedonistic motives, such as aspiration levels, materialism, or fashion consciousness, may be a viable strategy to increase well-being and foster a sufficiency-oriented lifestyle (e.g., Geiger & Keller, 2018; Steg, Perlaviciute, et al., 2014).

Peer endorsement from users of the respective social media platform did not influence sufficiency behaviour. The perceived norms within this group did not have a significant effect on sufficiency behaviour. We conclude that it might be necessary to readjust expectations on how social media may be able to change behaviour through social norms (e.g., Ballew et al., 2015; E. B. Goldsmith & Goldsmith, 2011). Prior research showed that peer action on social media can influence behaviour (e.g., Bond et al., 2012) and that social norms are most effective when the influencing individuals are personally known in real life (Abrahamse & Steg, 2013). Perceiving peer endorsement from one's own social

network has been found to be more influential than that from unknown people (Senbel et al., 2014). In our study, peer customers or social media users did not fulfil that condition.

Nonetheless, companies can benefit from their communicational efforts to support sufficiency behaviour. Our research showed that attitudes towards the communication and its sender are positive after receiving a sufficiency-promoting intervention. This finding supports the results of other studies that emphasise the beneficial effects of sufficiency-promoting marketing on the reputation and credibility of the respective company (Ramirez et al., 2017; Reich & Soule, 2016).

Strengths and limitations of the studies

The combination of a field experiment with a laboratory experiment presents a strength of our study. Whereas the field experiment provides valuable practical and exploratory insights, the laboratory experiment allowed us to adopt best-practice strategies such as full randomisation and ethical approval. The studies both have behavioural outcome variables, which have been called for to enhance environmental psychology studies (Kormos & Gifford, 2014): In Study 2, actual consumption decisions, also known as revealed preferences, could be measured by a real-world coupon raffle. Such money-allocation tasks are commonly used behavioural measures (F. Lange & Dewitte, 2019). The consumption advantage of being measured differently to Likert-scale measures, with a specific time-frame and frequency (as opposed to an unspecific frequency measure such as “often”, F. Lange & Dewitte, 2019). Recalling the number of clothing items acquired is prone to memory bias, yet this affects both times of measurement equally, holding a possible bias constant.

Both studies, however, also had their restrictions. We encountered a number of practicability issues of the transdisciplinary approach, where we conducted the whole research process of the field experiment together with an existing online shop. These issues included the selective convenience sample, the quasi-experimental assignment to conditions, poor control over the communication during the intervention, and the limited number of research questions that could be asked. At the same time, we gained practical and methodological insights on the design, dissemination, and evaluation of sufficiency-promoting communication, which we find have practical implications and are valuable for the research community. Overall, it still must be considered that the methodological challenges of the field study limit the explanatory power of the intervention. Since the laboratory experiment presented social media posts outside the usual context of an Instagram news-feed, it may lack realism. Further, given the hypothetical nature of the company, it is not completely clear whether individuals would react in accordance with our findings in situations with real brands, which bring a plethora of brand associations and histories. From a methodological perspective, improvements in designing and implementing future studies are also advisable, e.g., the assignment to experimental or control group should be randomised, instead of self-assessed by the respondents. Since we suggest that the behavioural changes found in

our field study result from a mere-measurement effect, this assumption should be tested in future research.

Another challenge was the operationalisation of the concept behind sufficiency behaviour. In the field experiment, we equated clothing sufficiency behaviour with the reported number of purchased items. Thus, we applied a broad understanding of the concept, which included reduced clothing consumption but also alternative forms of consumption that help to decrease purchases of new products (e.g., sharing or second-hand purchases). Yet in the laboratory setting, a behavioural measurement fit for short-term effects had to be found. It was important that the dependent variable measures actual behaviour and not just intentions or attitudes. To address this, we used a coupon choice, with the downside that ‘consumption reduction’ could not be promoted as an option. Thus, participants could opt for donating to a clothing-related NGO or choose a voucher for a second-hand marketplace. This indicator of sufficiency behaviour was adapted from theory (e.g., [Jenny, 2016](#); [Kleinhueckelkotten et al., 2019](#)). However, the sufficiency vouchers could have been chosen for other reasons. In contrast to second-hand vouchers or donating to a NGO for sustainability, the option of not participating in the raffle had no biospheric cues (see Appendix A). As data security concerns could also have impeded people from choosing any voucher at all, we decided not to define this choice as a sufficiency behaviour. Apart from that reason, there is no indication that other, unrelated reasons such as novelty or attractiveness would not be randomly distributed between experimental and control groups. Therefore, they were not expected to alter results but could increase measurement error and thus, statistical power. Future research may further refine this measurement.

Future research

Implications for future research firstly relate to the question of how sufficiency-promoting communication has to be designed to have long-term effects on sufficiency behaviour. Because the social media posts were presented in the context of a laboratory experiment, the effect should be replicated in another study, for example by integrating the communication posts in participants’ news-feeds. Due to the fictional sender and the related limitations, it would add support to test findings when existing companies and real social media communication are used.

Future research should also consider the timing and nature of the sufficiency-promoting message, for instance whether more concrete communication (i.e., fast fashion and textile waste) would be more effective than more abstract ones, i.e., overconsumption and sustainability ([Peifer et al., 2020](#)). Also, the laboratory experiment revealed that both the personal norm as a normative motive and aspiration level as a hedonic motive influence sufficiency behaviour. Thus, future environmental psychology research should examine not only pro-environmental motives but also motives that might pose a barrier towards sustainable consumption. Our research showed that peer endorsement through comments

and likes of other social media users not personally known to participants does not influence sufficiency behaviour. To find out more on this issue, future research could compare in a real-world scenario the social norms of known peers with those of unknown people. Another research direction would be to investigate from the perspective of environmental psychology other influential factors that may moderate the effects of sufficiency-promoting communication.

Our findings imply that, especially in a real-world setting, single-post interventions may be too weak to change behaviour, yet further studies are needed to find out more about the possible long-term effects of social media communication and peer endorsement, especially in relation to how well-known peers are to the participants. It would be of great interest to re-investigate the effects of social media interventions with field experiments including a representative sample, randomised group allocation, and a more intense intervention with communication clearly asking participants both to reduce consumption and to do so repeatedly.

Also, the laboratory testing of other peer groups that may transfer pro-environmental social norms offers an interesting path for future research. Examining other sufficiency fields prevalent in online environments, for example plant-based nutrition or the avoidance of air travel, could be promising, as could studying the effectiveness of a message depending on the sender of the communication. Although we could not find reactance to possible green-washing in the sample with a fictional company, differences could be tested between actual companies with varying sustainability reputations, and also non-governmental or governmental organisations. Finally, our research did not investigate marketing techniques such as personalisation based on the evaluation of personal data from social media, user profiles, or community forums. The increasing importance of micro-targeting, on- and offline tracking, big data evaluations, and personalised advertising compared to traditional advertising formats might cause their importance for sufficiency-promoting communication to grow as well. As Study 2 showed sufficiency-promoting communication to be most effective for people already interested in the topic, personalisation may target these groups. At the same time, people with low pro-environmental values may show even less sufficiency over time if they are only confronted with conventional marketing content. Either way, further research is needed in this area.

Conclusion

Our research demonstrated that sufficiency-promoting communication in social media can be successful in increasing sufficiency behaviour in the short-term. Companies can also benefit from their sufficiency efforts since customers' attitudes towards social media communication and its sender are mostly positive. For establishing social norms for sufficiency, our attempts to boost the effect through the endorsement of distant peer groups, such as fellow customers or social media users, proved to be non-effective. This

lack of effectivity possibly dampens the often-articulated hope that social media is a tool for behaviour change.

With this research, we contribute to a better understanding of the opportunities and pitfalls of sufficiency-promoting communication. Finding positive short-term effects of sufficiency promotion raises hopes: Companies are able to be actors of change. And online communication fostering sufficiency can help in understanding that, in affluent societies, consumption reduction is better for people and the planet.

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5 General Discussion and Reflection

This thesis has investigated the influence of online environments on sufficiency-oriented consumption. To systemically define online environments' effects, I applied an environmental psychology perspective, also integrating interdisciplinary literature, e.g., on environmental effects of ICT, cyberpsychology, or media psychology. I formulated two research questions. First, I analysed the relationship of perceived behavioural efficiency gains of online shopping and sufficiency-oriented consumption (*RQ1*). Second, I examined the motivational influence of content in online advertisement or social media on sufficiency-oriented consumption (*RQ2*). In Chapter 5.1, I give an integrative overview on findings of my empirical studies, discussing the extent to which the research questions could be addressed and implications for future research. I provide a critical reflection and implications on my theoretical (Chapter 5.2) and methodological (Chapter 5.3) approach and reflect insights concerning the inter- and transdisciplinary setting of my research (Chapter 5.4). Additionally, I derive practical implications from the findings (Chapter 5.5), and end with a concise conclusion and outlook.

5.1 Integration and critical reflection of results

To address the first research question (*RQ1*) on the perceived behavioural efficiency gains of online shopping, I conducted a cross-sectional survey. It showed that shopping online was perceived less behaviourally costly than in-store purchase, for all domains except alternative transport modes. Also, purchase intentions persistently predicted respective consumption levels, e.g., the intention to buy new clothing regularly predicted consumption levels of new clothing in the last three months. The hypothesis that online shopping is perceived as less behaviourally costly than in-store purchase *H1a* was confirmed in most consumption domains, yet the inconsistency in the travel domain shows how behavioural costs depend on the consumption domain and context: whereas buying a plane ticket online is easy, booking long-distance train rides through several countries may often involve a complicated online search and booking process. Individuals who perceived behavioural efficiency gains of online shopping also had significantly higher online shopping consumption levels, showing that the perceived behavioural costs of purchase do influence purchase behaviour. Yet, the link between behavioural efficiency gains and overall consumption levels was heterogeneous (*H1b*, *H1c*). For clothing, consumption levels did not correlate with behavioural efficiency gains. So, individuals perceiving online shopping as less behaviourally costly did not buy more new items, but rather in-store purchase was substituted with online purchase.

The surveys showed a direct relationship between online shopping efficiency gains and digital devices purchase, yet an affinity for technology (Franke, Attig, & Wessel, 2019) may confound this finding, strongly limiting its interpretability. For air travel booking, those with high consumption intention showed a stronger correlation between behavioural efficiency gains and consumption levels.

Sufficiency-oriented product purchase, on the other hand, was directly predicted by behavioural efficiency gains in all domains (*H1b*). Yet, about a quarter of the sample was not included in my analyses for second-hand consumption, since those participants had had no prior experience with second-hand consumption, resulting in missing values. Thus, the direct relationship between perceived efficiency gains and second-hand consumption could only be measured for participants who had already experienced second-hand consumption. It could thus be argued that the purchase intention could be seen as a necessary precondition, without which individuals may not concern themselves with the respective behaviour (e.g., second-hand consumption) and thus not be able to estimate behavioural costs.

The surveys showed that individuals do not buy more clothing or book more travels merely because it is convenient and available at low cost in online environments. Lower behavioural cost for purchase did not directly predict higher consumption levels, as expected in *H1b* according to economic models of rebound, induction or beneficiary effects. It was less the access to purchase options per se but rather motivational factors and their interaction with behavioural efficiency gains that accounted for increased consumption. To predict the effect of behavioural efficiency gains, the users' pre-existing motives need to be considered. The results indicate that the influence of behavioural costs is highly dependent on context, consumption domain, and motivational factors. Results supported the psychological perspective that efficiency gains through online shopping increase the agency for fulfilling pre-existing consumption intentions (enabling effect, Bandura, 2002; Midden et al., 2007), and the exact relationship needs to be examined in detail depending on the consumption domain and context.

These findings revealed a more nuanced perspective on the relationship between individuals and consumption: whereas economists often treat consumption motives as a given (rational consumers want to increase their own well-being by means of increased material consumption), and consumption preferences as static (Santarius & Soland, 2018), the psychological perspective could show that such consumption motives actually vary between individuals and cannot be taken as a given. Psychological research highlights the contextual malleability and the individuality of consumption-related motives. This necessity of pre-existing motives for consumption behaviour and also their variability, are in line with action determination models such as the stage model by Bamberg (2013): Behavioural costs and self-efficacy are decisive in establishing behaviour once a behavioural intention is present, yet these purchase intentions vary between individuals, depending on their consumption motives.

Individuals act within a complex set of motives to have a resourceful and good life (gain and hedonic motives) but also to protect the environment, to act socially responsibly, and to comply with societal norms (normative motives, Steg & Vlek, 2009). Depending on which motives are salient in a specific consumption context or domain, individuals may react differently to new technological possibilities that enable consumption behaviour. Due to this relevance of motivational factors, I took a closer look at them by examining the influence of online content on sufficiency-oriented consumption *RQ2* in the second part of the survey, Publication B, and decided to focus on motivational factors rather than behavioural efficacy in the two experiments that followed, described in Publication C. The further studies thus addressed how the perception of online content may change sufficiency-oriented consumption through motivational factors. As the separate findings' implications and limitations are discussed in detail in Publications B and C, I focus here on integrating all study findings regarding *RQ2*.

As described in Chapter 3.2, Table 3, I addressed *RQ2* with three empirical methods. Whereas in the surveys (Publication B), the predictor, i.e., perception of online content, could only be measured by self-report, in the field and laboratory experiments (Publication C), this predictor was manipulated. Yet, only the laboratory experiment could guarantee randomised assignment: In the quasi-experimental field experiment, individuals self-reported whether they had seen the sufficiency promotion. The strengths and weaknesses of these different methods are decisive when interpreting the heterogeneous results that were found in the different studies (for an overview, see Table 22).

Assessing the effect of online content *H2a*, I found that, neither in the surveys nor in the field experiment did the perception of sufficiency-promoting content in online advertisement and social media predict sufficiency-oriented consumption. However, in the online experiment, sufficiency promotion increased sufficiency-oriented consumption in the form of a sufficiency-oriented choice (opting for a donation or second-hand clothing voucher instead of a voucher for the purchase of new products). This finding means that a short-term effect was found, yet long-term influences of sufficiency-promoting content could not be identified in the field. The opposite pattern was found for consumption-oriented online content. Whereas the self-reported perception of consumption-promoting online content consistently predicted higher consumption levels and aspiration levels in the surveys, there was no evidence of a lower probability of sufficiency-oriented consumption for individuals who had seen consumption-promoting social media posts, compared to those who had seen neutral posts, in the laboratory experiment.

One way of explaining these oppositional results is by the prevalence of consumption promotion and sufficiency promotion in online environments. The surveys revealed sufficiency promotion as a rare phenomenon both in social media and online advertisement. This low prevalence of sufficiency promotion in the field may explain that no long-term correlation with consumption levels could be found, as these rare and dispersed messages

are unlikely to induce long-term behaviour change (as also found by [Young et al., 2017](#)). Yet the unusual sufficiency-promoting content raised attention in a laboratory setting: individuals were not expecting a company to advertise for consumption reduction, which, at the same time, led to a positive appraisal of the communication and the company, as was previously found in a mixed method study ([Gossen & Frick, 2018](#)).

Finding long-term correlations, but no short-term influence for consumption promotion, can equivalently be explained by its high prevalence. Consumption-promotion frequency correlated with aspiration and consumption levels in the surveys. I therefore replicated for online environments what has been a repeated finding in multidisciplinary empirical studies on advertisement (e.g., [Molinari & Turino, 2018](#)): long-term exposure to advertisement induces higher aspiration levels (or related concepts such as materialism and consumerism) and thus, consumption levels. Yet in a short-term laboratory study, the influence of a fictional company's social media posts that promoted consumption (e.g., "these are the new, fashionable colours you need to wear this year") was compared with neutral communication (e.g. "colours are beautiful"). A pretest allowed the identification of consumption promotion posts, i.e., ones that were perceived as more consumption-inducing and neutral communication posts that were perceived as neither consumption- nor sufficiency-inducing. Nevertheless, it cannot be ruled out that, in the laboratory experiment, participants inferred that any communication that stems from a clothing company's social media channel is in some way intended to foster product purchase. In this case, also the "neutral" condition may have been perceived as a form of consumption promotion. As consumption promotion is the prevalent default version of marketing ([Gossen et al., 2019](#); [Kasser & Kanner, 2004](#)), it may also not have captured participants' attention in the laboratory experiment, due to habituation towards ubiquitous marketing in mass media, public spaces, and in online environments ([Kingaby, 2020](#); [Stoeckl & Luedicke, 2015](#)). As a consequence, future studies should test whether neutral communication from companies may be perceived as marketing, and how this could be controlled for.

To examine the motivational factors through which online content influences sufficiency-oriented consumption (*H2b*), I assessed normative motives (personal norm and social norms) as well as consumption-oriented motives (aspiration levels) in the surveys and experiments. As summarised in Table 22, sufficiency-promoting online content could predict personal and social norms for sufficiency (with the exception of personal norms in the field experiment). Yet, sufficiency-promoting content could not decrease predictors of overconsumption, i.e., the aspiration level or the social norm for consumption. The short-term effect of sufficiency-promotion on consumption in the laboratory experiment was mediated by aspiration levels, but not by normative motives. In the surveys, consumption-promoting online content could positively predict consumption-oriented motivational factors, but interestingly, in some cases, a negative prediction of the personal norm or social norm for sufficiency was found. According to [Maio et al. \(2009\)](#), activating self-

enhancement values can undermine self-transcendence values, and [Bauer et al. \(2012\)](#) found that consumption-oriented cues can decrease feelings of personal responsibility and activate self-enhancement values. Therefore, consumption-promoting content can also be a predictor for normative behavioural determinants that are included in most action determination models ([Bamberg, 2013](#); [Klößner & Blöbaum, 2010](#)), and deserves more attention in future research.

All in all, these findings are in line with research showing that motives for consuming more and consuming less are distinct predictors of consumption behaviour ([Ajzen & Sheikh, 2013](#); [Richetin et al., 2012](#)). At least in the consumption domains under study, especially the clothing domain, I found consumption-oriented motives to have stronger predictive power than sufficiency-oriented motives. This finding further supports the relevance of predictors of such consumption-oriented motives, one of which I identified as online content in marketing and social media.

Results on social norms were mixed, and this can partly be explained by their varying operationalisation in the studies. The studies addressed different referential groups and consumption norms. In the surveys, both sufficiency-oriented and consumption-oriented norms were assessed, and the reference group were peers in the personal every-day surrounding (which is the most common referential group in environmental psychology, e.g. [Bamberg & Möser, 2007](#)). In contrast, the experiments addressed only sufficiency-oriented social norms. Further, the reference groups were more distant: the field study assessed the perception of social norms held by fellow customers of the communicating company and the laboratory experiment that of fellow social media users (to be precise, other users of Instagram). In the field experiment, the social norm for sufficiency (of fellow customers) was slightly increased, yet this did not translate into behaviour. Also in the laboratory experiment, the social norm (operationalised by likes and comments of other social media users) did not predict sufficiency-oriented consumption. A reason for this may be that social norms are stronger if the reference group is known, e.g., friends, rather than people that individuals only meet in online environments (e.g., [Bond et al., 2012](#); [Senbel et al., 2014](#)). The extent of interpersonal communication about a behaviour may impact the degree to which norms influence behaviour ([Chung & Rimal, 2016](#)). [Granovetter \(1973\)](#), for example, differentiated the influence of close peers as stronger ties with often stronger influence and more distant peer groups as weak ties. In my studies, I found that social norms of more distant peer groups might not influence behaviour (as did [Young et al., 2017](#)). This constraint needs to be considered when planning future interventions on social media. Social media may not be the silver bullet some authors have hoped for ([E. B. Goldsmith & Goldsmith, 2011](#)). Rather, the reference group as well as the intensity of social norms (the amount of information such as posts) are decisive.

Table 22: Overview on *RQ2* hypotheses

Hypotheses	Survey I	Survey II	Survey III	Field experiment	Laboratory experiment
<i>Sufficiency-online promoting content...</i>					
... increases sufficiency-oriented consumption (<i>H2a</i>)	×	×	×	×	✓
<i>Mediators (H2b)</i>					
... increases personal norm for sufficiency	✓	✓	✓	×	✓
... increases social norm for sufficiency	✓	✓	✓	✓*	✓**
... decreases aspiration level	×	×	×***	×	✓
... decreases social norm for consumption	×	×	×	n/a	n/a
<i>Consumption-promoting online content...</i>					
... decreases sufficiency-oriented consumption (<i>H2a</i>)	✓	✓	✓	n/a	×
<i>Mediators (H2b)</i>					
... decreases personal norm for sufficiency	✓	✓	×	n/a	×
... decreases social norm for sufficiency	✓	×	✓	n/a	×
... increases aspiration level	✓	✓	✓	n/a	×
... increases social norm for consumption	✓	✓	✓	n/a	n/a

✓ hypothesis confirmed, $p < .01$; × hypothesis rejected, not significant

* reference group: fellow customers; ** reference group: social media users

*** Contrary relationship to hypothesis

5.2 Reflections and implications on theory development

This thesis examined several research areas that have so far not been at the centre of attention in environmental psychology research and where more research is needed. There have been calls for more research on the influence of a contextual factors (Steg & Vlek, 2009), on online environments (Gifford, 2014; Stokols, 2018; Van der Linden, 2019), as well as on behavioural determinants of unsustainable consumption (Steg & Vlek, 2009; Thøgersen, 2014). Due to this early research stage, the approach in the thesis was, to some extent, exploratory. As a starting point, I consulted theories and concepts from the field of environmental psychology that systematise the effect of technology on behaviour (Midden et al., 2007; Steg & Vlek, 2009). Leaving the better-known research areas of environmental psychology, I consulted theoretical approaches from a broader field in psychology (e.g., cyberpsychology, media psychology, human-technology-interaction, Bandura, 2001; Giles, 2003), but also interdisciplinary concepts and research approaches (e.g., Börjesson Rivera et al., 2014; Hilty & Aebischer, 2015; Horner et al., 2016; Røpke, 2012), as well as reports and policy briefs from civic or scientific associations (Kingaby, 2020; WBGU, 2011). Integrating these interdisciplinary perspectives in my empirical studies, I found two possible pathways that may be promising to follow in future research in environmental psychology.

5.2.1 Theory development in the context of online environments

As argued in Chapter 2, individuals select the online environments they spend time in, and the environments are often personalised: the environment and the individual mutually influence each other. In this case, causal models can be circular, in contrast to linear action determination models, which can be challenging to assess empirically (Gifford,

2014). Stokols (2018) saw online environments as an opportunity for environmental psychologists to reassess the bidirectional relationship between individuals and their environments. Uzzell and Rätzzel (2009) argued that environmental psychology should adopt a transactionalist and dynamic approach that is less focused on individual choice, but targets the transformation of the consumption-production system as a whole.

I relied on established cross-sectional survey methods and discussed bidirectional causality and reciprocal influence between personalised online environments and behaviour in Publication B. Applying the construct of behavioural costs to the influence of online shopping efficiency in Publication B, I found that findings varied strongly between consumption domains. This finding affirms the importance of contextualising behaviour within consumption domains. Environmental psychologists can understand the emerging research field of online environments as an invitation to enrich linear models of contextual and motivational factors on behaviour by exploring how cause and effect are linked in a reciprocal or transactionist way, acknowledging the complex relationship between environments and individual behaviour (Stokols, 2018; Uzzell & Rätzzel, 2009). New method strategies are needed to assess how online environments, perception and behaviour interact (Stokols, 2018).

5.2.2 The relevance of antecedents of unsustainable consumption

Apart from findings specific to online environments, the studies also provided more general insights for behaviour change theories and behavioural determinant models in environmental psychology. As already mentioned, a robust finding in all three studies was the missing predictive power of personal and social norm for sufficiency-oriented consumption and the negative predictive power of aspiration levels for sufficiency-oriented consumption.

Starting with the personal norm, I found sufficiency promotion to correlate with a higher personal norm for sufficiency in the surveys, and also in the laboratory experiment. In the field experiment, this effect was not found, but this finding has to be treated with caution due to the intervention's weakness of effect (as explained in detail in the field experiment's discussion section). The personal norm however could not predict sufficiency-oriented consumption. Further, it only predicted the aspiration level in the clothing survey, but not in the digital devices or air travel survey, nor in either of the experiments. These results replicated other findings, that, in certain consumption domains, pro-environmental motivational factors such as the personal norm fail to predict pro-environmental behaviour. In some previous studies, pro-environmental personal and social norms could not (Alcock et al., 2017; Herziger et al., 2020; Jaeger-Erben et al., 2021; S. Moser & Kleinhüchelkotten, 2018; Verfuërth et al., 2019) or only weakly (Joanes et al., 2020) predict sufficiency-oriented consumption in the consumption domains of clothing, air travel, or digital devices (i.e., smartphones). The finding contrasts with a long tradition of environmental psychology

research establishing the relevance of personal and social norms for pro-environmental behaviour (Bamberg & Möser, 2007; Steg & Vlek, 2009). Yet, that research was, to a large degree, based on consumption domains of household energy-saving behaviour, everyday mobility, or recycling whereas research in the consumption domains of clothing, electronics, or long-distance travel was less frequent. It is likely that, in the context of household energy use and recycling, pro-environmental motives are more salient than in the context of shopping for clothing or booking holidays, which are behavioural categories for which hedonic motives are more salient (Barr & Prillwitz, 2012; Steg, Perlaviciute, et al., 2014). These contrasting findings further indicate that action determination models need to be tested and re-evaluated when applied in new consumption domains and that consumption behaviour always needs to be examined in consideration of its context.

In contrast to sufficiency-oriented motives, aspiration levels were stable mediators in the survey and the online experiment, and negatively predicted sufficiency-oriented consumption across all analyses. Aspiration levels were an indicator of perceived consumption desires and needs that address the question of how often new products need to be purchased. A similar study on the use time of smartphones found that the desire for novelty (owning the newest device) was a predictor of smartphone renewal (Jaeger-Erben et al., 2021). Similarly, it was found that consumerist motives predicted less sufficiency-oriented energy consumption in the smart home (Frick & Nguyen, 2021). Collectively, these results support the central role of consumption desires as predictors of unsustainable consumption in affluent societies, as proposed by Ahlström et al. (2020); Thøgersen (2014). Also, consumption-oriented social norms were correlated with aspiration and consumption levels in the surveys. My findings show that social norms for (unsustainable) consumption (consumption norms, Thøgersen, 2014) should therefore complement the social norm directed towards target behaviour that is normally assessed.

Most action determination models, however, do not, or only implicitly, include such consumption-oriented motives (e.g., Bamberg, 2013; Klöckner & Blöbaum, 2010; S. H. Schwartz, 1977; Stern et al., 1999). These models are useful and established to explain intentional pro-environmental behaviour (Bamberg & Möser, 2007). However, they were mainly applied in consumption domains such as energy saving, recycling and every-day mobility. Further, future research may not just consumption-oriented motives, but also their predictors, at least in the consumption domains I investigated. As examples, I found online advertisement and social media content to be strong predictors of aspiration levels and consumption norms.

Several existing theories and research findings may serve as a starting point for future studies. For example, Matthies (2005) included "other motives" into her action determination model. In his model explaining unsustainable consumption, Thøgersen (2014) described environmental impact as an unintentional side-effect of consumption behaviour that is intended to follow other motives. In their goal framing theory, Lindenberg and

Steg (2007) deepened the understanding of such motives by categorising normative, gain and hedonic goals guiding behaviour. Barbopoulos and Johansson (2017) developed a consumption motivation scale based on the goal framing theory that may be useful for identifying antecedents of unsustainable consumption in specific consumption domains. A related study in the housing domain has applied the consumption motivation scale and found consumption motives such as consumerism to predict higher consumption levels of energy (Frick & Nguyen, 2021). A further study found the perceived attractiveness of newness of products predicted higher consumption levels for smartphones (Jaeger-Erben et al., 2021). Future attempts to integrate research findings into theory development may further elaborate on how such determinants may best be included.

5.3 Methodological reflections and implications

Reflections on methodological improvements include, additionally to the points made in the publications, several aspects that are described in the following paragraphs.

5.3.1 Combination of research methods

Empirical research on possible rebound-, induction or beneficiary effects of digital technology concerning environmental impact has predominantly analysed macro-level datasets from an engineering and lifecycle assessment (J. Pohl et al., 2019), economic disciplinary perspective (e.g., S. Lange et al., 2020; Lohmann, 2015). In social sciences, Y. Wang and Hao (2018) combined surveys with macro-level data. Yet analyses at the micro-level of individuals are still rare, which is why I applied cross-sectional online surveys. This approach allowed insights to be gained on consumption-related effects on an individual and also motivational level. The representative surveys further had the advantage of sample generalisability, as well as generalisability and comparability over different consumption domains, as I included several consumption domains. However, as with the macro-level analyses, these surveys remained on a correlational level.

To examine paths of causality, I thus included two experiments with a narrower focus on the clothing domain. Whereas the field experiment mainly contributed to a better methodological understanding of online interventions including practice actors (see Chapter 5.4), and was restricted to a selective convenience sample, the laboratory experiment was conducted under high internal validity with a representative sample. Each of these methods had its strengths and weaknesses (see Table 3), and to gain insights into effects of online environments, their combination was necessary. This strategy of applying a variety of methods to complement their strengths and address complex research questions is discussed under the term of triangulation (Hussein, 2009) in social sciences, or also mixed methods in the case of combining qualitative and quantitative methods (Creswell, 1999). Method combination is also a typical trait of examining complex societal problems

in transdisciplinary research (Scholz, 2017). In preparation of the sufficiency-promoting experiments in Publication C, a preceding mixed methods study was conducted (Gossen & Frick, 2018). Qualitative data on the perception of sufficiency-promoting online content was especially helpful for preparing manipulation material, as well as for exploring and understanding mediating motives between online content and consumption behaviour.

When addressing complex societal issues, such as online environments' influence on consumption, future psychological studies could profit from integrating a wider range of research methods. A stronger integration of qualitative studies in a mixed methods approach, for example, could deepen understanding of how online environments influence consumption behaviour, not only the confirmatory approach of testing hypotheses but also exploring new and often complex interactions between individuals and online environments.

5.3.2 Diversification of sources for data collection

A weakness of my studies was the low variety of data sources. All studies conducted in this thesis took place in an online survey setting. As digitalisation is advancing, not only does research examine more digital aspects but also the research methods themselves become digitalised. Online surveys, especially when administered by professional panel institutes, provide more convenient and time- and money-saving recruitment and better access to a large number of participants. Yet, this approach also poses challenges. Laboratory settings and participants' undivided attention towards the study are harder to establish and control for in an online setting (Buchanan & Hvizdak, 2009). The high number of case exclusions in my panel surveys (e.g., > 15 % for the instructed response item, Publication A and B) shows the low attention span in the panel samples, as well as the importance of rigorous data cleansing for online survey research. Yet, not only the online setting, but also the paid panel sample could be a reason for low data quality. Comparatively, the data quality in the online field experiment with customers of a sustainability-oriented online shopping platform was higher, arguably because this target group was highly motivated to contribute to sustainable consumption. In contrast to the panel institute's sample, the participants were also not yet habituated to taking surveys as regularly. Yet, this convenience sample was not representative of the general population (i.e., more environmentally conscious, younger, more female, and with a higher education level), and recruitment in collaboration with a practice partner took more effort. It should, however, be considered that participants recruited by panel institutes can suffer from survey fatigue, which results in lower data quality (Porter, Whitcomb, & Weitzer, 2004). Therefore, it has become especially vital to take up specific measures guaranteeing high data quality. These involve a short duration to complete online surveys, controlling for attention through instructed response items and defining a minimum duration in which questions can be answered (Huang et al., 2012; Meade & Craig, 2012). On a meta-level, researchers should also reflect whether paid panels are the appropriate data source for answering their respective research questions. Despite

this method's convenience, research findings are more robust and reliable if data is gained from more diverse sources (Hussein, 2009).

5.3.3 Operationalisation of constructs

When it comes to operationalising the influence of online environments, a chicken-and-egg problem that accompanies research on online environments' influence was anticipated, as described in Chapter 1.2: individuals can choose the online environments they visit and online environments react to individuals' online behaviour and preferences through personalisation (see also Luzsa & Mayr, 2019). To be accurate, content of online environments therefore cannot be considered truly "independent" variables, which poses a new methodological challenge. In this thesis, only first ideas on how to address this challenge have been explored (see also Chapter 5.2). For *RQ2*, I addressed this challenge by applying several empirical methods to answer the research question. Through replication with several methods, any weaknesses can be compensated (described in Table 3). Of course, this set of applied methods was limited, and future research should include a more diverse set of methods that go beyond quantitative research (e.g., quantitative surveys and experiments) and also include, for example, more qualitative methods, mixed method approaches (Gossen & Frick, 2018), or digital methods that rely less on self-report measures and integrate large online data sets with the traditional psychological methods (Salganik, 2019).

A further challenge throughout the studies was the operationalisation of sufficiency-oriented consumption, which includes consumption reduction through absolute reductions, modal shifts, product longevity, or sharing practices (Sandberg, 2021). To measure sufficiency-oriented consumption in a long-term setting (surveys and field study), the consumption level during a certain period of time were suitable as dependent variables (and was also applied by Joanes et al., 2020). The period of time in which the consumption level was reported needed to be possible for participants to remember and representative of consumption cycles in the respective domain. This time can vary for different consumption domains, depending on consumption needs and product lifetimes. Further, longer the retrospective period, the more individuals tend to underestimate their level of consumption; For clothing, Joanes et al. (2020) had found that reported consumption levels of clothing were higher when a daily diary study was executed than for retrospective self-reports of consumption levels in the one or three months. Apart from consumption reduction, sufficiency-oriented consumption can also be operationalised by second-hand consumption as a means to increase product lifetime, or modal shifts from air travel to less resource-intensive transport modes such as the train or bus (Sandberg, 2021). This approach was applied in Publication A, measuring how decreasing behavioural costs of purchase can increase the choice of sufficiency-oriented products. It proved to be more difficult to find a suitable operationalisation of sufficiency-oriented consumption for short-term measurement. Consumption reduction can be expressed when deciding not to buy a new

item in a consumption decision, and thus a voucher choice between new products and second-hand products (prolonging product lifetime, [Sandberg, 2021](#)) or a donation to a NGO for sustainable clothing consumption (avoiding purchase, [Jenny, 2016](#)) was used. These operationalisations may be helpful for future studies, as the voucher choice can be interpreted as real-world behaviour and reported consumption levels are less prone to subjective appraisals.

5.4 Reflections on inter- and transdisciplinary research settings

The transdisciplinary setting of this thesis, as described in Chapter 3.1, posed theoretical and methodological challenges but also enriched the research process. Co-creation and implementation of the field experiment to generate transformation knowledge showed how the influence of social media campaigns is limited not only by the recipients' limited attention but also the challenge of making messages visible in the vast amount of online information. In this context, the interdisciplinary collaboration with marketing sciences was fruitful in gaining further insights into companies' perspectives on consumption-promoting and sufficiency-promoting online content ([Gossen & Heinrich, 2021](#); [Gossen et al., 2019](#)). Collaboration with sociologists was useful in understanding the interdependency of behaviour with the societal, political, and economic setting (e.g., social practice theory, [Hargreaves, 2011](#)). Finally, interdisciplinary work with environmental engineering helped gaining a more nuanced understanding of rebound-effects and environmental impacts ([J. Pohl et al., 2019](#)) and macroeconomics contributed to understanding the role of individual consumption in an economic context ([Alcott, 2008](#)).

Further, sufficiency-oriented consumption was a controversial choice of research topic. In my literature reviews, the most substantial part of studies on online environment's influence on sufficiency-oriented consumption stemmed from the field of marketing and economics. These studies examined how various constructs, such as the ease of use of websites (e.g., [Ashraf et al., 2014](#)), online marketing, or social media ([Stephen, 2016](#)), may foster purchase intention. However, with a few exceptions ([P. M. Brown & Cameron, 2000](#); [Hwang et al., 2016](#); [Lohmann, 2015](#)), these studies interpreted "purchase intention", "conspicuous consumption" or "impulsive buying" as a desirable target outcome. As an example, [Taylor and Strutton \(2016\)](#) stated that "[a]n understanding of the psychology linking social media use to conspicuous consumption can aid managers in developing marketing strategies to encourage the purchase and usage of positional goods" (p. 231). Or, [Hoch et al. \(2016\)](#) warn practice actors not to restrict marketing activities, for fear of a decrease of business innovation and GDP growth. The perspective of these studies is derived from a traditional economic and marketing perspective, following the dominant social paradigm of consumption and economic growth ideologies ([Kilbourne, McDonagh, & Prothero, 1997](#)).

In contrast, sufficiency research investigates strategies to reduce consumption levels. This leads to a situation where marketing researchers, among them psychologists, are actively promoting psychological constructs that, in other thematic and disciplinary fields, are seen as a risk factor for psychological well-being (Hurst et al., 2013), over-indebtedness (Ahlström et al., 2020), and sustainability (O’Neill et al., 2018; Thøgersen, 2014). So, this controversy on consumption’s role does not divide disciplines but is a normative debate on (often implicit) worldviews that also runs within the psychological discipline. It can be understood as part of a larger, ongoing scientific as well as public debate on the decoupling of economic growth from the depletion of planetary resources, where green growth and degrowth approaches are discussed (Hickel & Kallis, 2020).

Two topics became evident in experiencing this dissonance: social sciences in the field of sustainability are, by nature, oriented towards normative goals (Scholz, 2017) and also traditional marketers are implicitly following a normative paradigm (of consumerism, Kasser & Kanner, 2004). The transdisciplinary research approach proposes that research never happens in a value-free space, and thus researchers cannot escape a normative positioning. The approach thus claims that researchers need to reflect on their normative presumptions, and make them explicit in their research (Lang et al., 2012; Scholz, 2017). In this vein, I positioned my own research on system and transformation knowledge. I did not intend to create target knowledge but rather took scientific evidence on missing decoupling effects as a starting point for analysing sufficiency-oriented consumption: Under the normative assumption that, until the compatibility of indefinite economic growth with the earth’s limited carrying capacities and with social justice is established, pursuing economic growth at any cost is unreasonable and risky (a common conclusion drawn by sustainability researchers, O’Neill et al., 2018; Steffen et al., 2015). Despite remarkable technology-driven efficiency gains, an absolute decoupling of resource use and economic growth could not be found empirically (e.g., in the context of digitalisation, S. Lange et al., 2020). Therefore, my research had the normative goal of producing system knowledge on predictors of sufficiency-oriented consumption, and transformation knowledge on reducing absolute consumption levels in the Global North, as a way of keeping human resource consumption within planetary boundaries.

5.5 Practical implications for designing online environments

Although many of my results are preliminary and need to be examined further in long-term studies and experiments, some practical implications can be drawn from the presented studies.

5.5.1 Online platforms that enable sufficiency-oriented consumption

Sufficiency-oriented consumption (e.g., second-hand consumption, taking the train) is often more time- and effort-intense compared conventional consumption practices (Speck & Hasselkuss, 2015). Online tools such as comparative platforms can reduce behavioural costs for sustainable consumption, which can be taken advantage of. Perceived behavioural efficiency gains of online purchase of alternative travel modes and second-hand clothing or devices was correlated with a higher consumption of these products and services. This is an indication that increasing access to sufficiency-oriented consumption alternatives in online environments should increase their diffusion. Sustainability-oriented practical implications may therefore include funding and supporting the development of platforms that make sufficiency-oriented consumption easier (e.g., in the state-funded research on a green consumption assistant, green-consumption-assistant.de), or including sustainability criteria into existing platforms.

As a more specific recommendation within this aspect, I found a need to develop intermodal platforms for leisure travel. Results showed that booking alternative transport modes online was perceived both more behaviourally costly than booking air travels, and than booking trains or busses in an offline setting. This finding comes as no surprise as, for example, train journeys through several countries often include a complicated booking process with several companies. The finding implies that reducing behavioural cost for alternative transport modes by setting up easy-to-use online platforms for sustainable leisure travel options (e.g., a multimodal long-distance booking platform) holds potential for reducing leisure air travel. Further, alternative travel mode options could be positioned more prominently in existing multimodal search and comparison portals (e.g., rome-to-rio.de). Behavioural costs of the purchase of sufficiency-oriented consumption options can be decreased through optimised presentation of these products and services by placement and filtering in online shops and platforms (applying the nudging strategy of default options, Thaler & Sunstein, 2009).

5.5.2 Sufficiency promotion in online purchase situations

The laboratory experiment showed sufficiency-promoting content to increase sufficiency-oriented decisions directly afterwards by a priming effect (Bauer et al., 2012) or temporary salience of normative motives (Lindenberg & Steg, 2007). These short-term effects can be useful when designing online shops, marketplaces, search engines, or product comparison platforms. Practitioners may include sufficiency-promoting content temporally close to purchase decisions as a nudging strategy (Thaler & Sunstein, 2009). For example, online shops could include content marketing that invites customers to reflect on personal needs prior to purchase (for an example of sufficiency-oriented content marketing, see Gossen & Frick, 2018).

5.5.3 Online interventions and content that discourage consumption

In intervention studies of environmental psychology, sufficiency promotion is a central aspect (e.g., energy saving, modal shift from cars to public transport). For such interventions, my empirical work (along with others, e.g., [Herziger et al., 2020](#)) can add the insight that not only normative motives for sufficiency and the behavioural efficiency or behavioural cost of sufficiency-oriented consumption should be considered as determinants of the target behaviour. Rather, interventions should also appeal to motives that encourage individuals *not* to act sufficiency-oriented ([Richetin et al., 2012](#)) and the behavioural cost of *unsustainable* behavioural alternatives ([Ajzen & Sheikh, 2013](#)). This seems especially promising in consumption domains that are influenced by status and conspicuous consumption (e.g., clothing, [O’Cass & McEwen, 2004](#)), or where obsolescence and the attractiveness of newness are prevalent (e.g., digital devices, [Jaeger-Erben et al., 2021](#)). Sufficiency interventions should therefore not only target increasing normative motives, but also decreasing gain and hedonic motives that are connected to material consumption ([Steg & Vlek, 2009](#)).

These insights can be projected to the more general aim of designing online environments in a way that is compatible with both sustainable and self-determined lifestyles. In online-shopping, social media, and online advertisement, I found consumption-promotion to be more prevalent than sufficiency-promotion. Also, the intensity of consumption-promoting online advertisement perception predicted aspiration and consumption levels. Online advertising has additional negative effects, such as privacy violations ([Kokolakis, 2017](#)), and plays a central and controversial role in financing online environments ([Kingaby, 2020](#)). Therefore, a regulation and reduction of consumption-promoting online marketing could be a pathway both towards more sufficiency-oriented consumption and self-determination. Correspondingly, sufficiency researchers have called for commerce-free environments that do not promote consumption increase ([Spangenberg & Lorek, 2019](#)). In online environments, business models that are not dependent on marketing or data gathering and political regulation would be needed to decrease detrimental effects of online advertising (for more details, see [Frick, Gossen, et al., 2021](#)).

6 Conclusion and outlook

With this research, I explored and systematised influences of online environments on sufficiency-oriented consumption. As environmental psychology research on online environments is at an early stage, I started by reviewing the existing literature and thereby conceptualising possible effects and extracting two main research questions. *RQ1* assessed the enabling effect of online environments, examining whether behavioural efficiency gains of online shopping are correlated with sufficiency-oriented consumption. *RQ2* examined how online content in advertisement and social media influence motives (i.e., personal and social norms, aspiration levels) and, thereby, sufficiency-oriented consumption. I empirically tested the hypothesised relationships in three representative surveys, and followed up on *RQ2* with a quasi-experimental field study and an online laboratory experiment.

Earlier research had predicted that online environments are characterised by their ability to expand human agency and to increase the accessibility of information - for non-sustainable and sustainable forms of consumption alike. In the case of online shopping, I found that such enabling effects of online environments were indeed present in the considered consumption domains, yet I could find no “automatic” mechanism that makes people consume more. Rather, consumption motives were decisive for behaviour. Accordingly, I could show the close link between consumption-oriented motives (i.e., aspiration levels, social norms for consumption) and actual consumption levels. In a laboratory experiment, I found that sufficiency promotion had a positive short-term effect, which was mediated through aspiration levels. Analyses further showed that online environments can in fact support sufficiency-oriented lifestyles by facilitating access to second-hand products or sufficiency-oriented travel modes, and they can also inspire individuals to choose sufficiency through sufficiency-promoting content. As a practical implication, such sufficiency promotion may be applied in online purchase situations as a form of nudging.

All in all, I could begin to examine and understand the complex interrelations between individuals, their motives, consumption behaviour, and the many different aspects of online environments. Various interesting future research directions revealed themselves during my research. For example, long-term effects of online sufficiency promotion need to be further examined in future research. My findings further revealed the relevance of determinants of unsustainable (over-)consumption, which may take a more prominent role in future theory development of action determination models. Also, integrating online environments into the variety of environments under study in environmental psychology can advance the field; Online environments’ malleability and constant development allow environmental

psychologists to reassess the relationship of individuals with their environments. Finally, as environmental psychologists provide valuable insights for architects and planners to make built environments more environmentally and socially friendly, they may hopefully offer the same fruitful collaboration with software engineers and the designers of online environments in the future. In doing so, they can help to create online environments as spaces where individuals can make informed, self-determined and sustainable decisions.

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A Appendix of Publication A

Survey Items

Clothing purchase behaviour

Question: Where did you acquire pieces of clothing for yourself in the last 3 months? Please estimate the number of pieces that you acquired.

Scale: 0 pieces; 1 piece; [...]; 5 pieces; more than 5 pieces

Items:

- In a store (e.g. specialised shop, discounter)
- In a second-hand store
- In an online shop (e.g. Amazon, Zalando, Otto)
- Online-Resell, second-hand (e.g. Ebay, kleiderkreisel.de)
- Received as a present or swapped (not included in analyses)

Digital devices purchase behaviour

Filter question: Digital devices are devices that are able to connect with the internet, e.g. smartphones, laptops, tablets or computers. Which of the following digital devices did you acquire for yourself in the last 12 months?

Please tick all acquired items.

- Smartphone
- Tablet
- Laptop
- Computer (Desktop-PC)
- E-Book-Reader
- Network printer or copier
- Smart TV
- Digital camera
- Wearable Device (e.g. smart watch, fitness devices)
- game console
- Virtual reality glasses
- Digital assistant system (e.g. Alexa, Google Nest)
- Home Audio System (e.g. portable Bluetooth-speaker, soundbar, docking station, Internet radio)

- Smart home system
- Smart household device (e.g. coffee machine or fridge connected to the internet)

Question: Where did you acquire the [device ticked]?

- Conventional store (e.g. discounter, specialised shop)
- Second-hand store
- Online shop (e.g. Amazon)
- Online Re-sell (e.g. Ebay)
- Received as a present or swapped (not included in analyses)

Leisure travel purchase behaviour

Question: How often have you travelled to other countries for private purpose such as tourism or visiting people, defined as "leisure travel"?

Did you book the following leisure travels in the last 12 months for yourself?

- by bike (not included in further analyses)
- by car (not included in further analyses)
- by bus
- by train
- by plane

Question: Where did you book [the bus / train / air travel]?

Please estimate the number of travels (1 travel equals the trip there and back)

Scale: 0 leisure trips; 1; [...]; 5 trips; more than 5 leisure trips

Items:

- In-store at a travel agency
- In-store at the counter or ticket machine
- Online-booking portal (e.g. opodo.de, expedia.de, idealo.de)
- Online-shop of a mobility provider (e.g. airline, train or bus company)
- Received as a present or swapped (not included in analyses)

Perceived behavioural cost

Question on the online purchase of [clothing / digital devices / travels]:

Please evaluate the following statements on purchasing [clothing / digital devices / travels] on the internet.

Question on the in-store purchase of [clothing / digital devices / travels]:

Please evaluate the following statements on purchasing clothing in stores such as specialized shops, boutiques or discounters.

Scale: 1 = I do not agree at all; 7 = I fully agree; missing value= I don't know / It does not apply to me

Items clothing:

- It is convenient to buy clothing. (conventional, new)
- It is uncomplicated to find information about offered pieces of clothing. (conventional, new)
- It is effortful to find the right piece of clothing (-). (conventional, new)
- One quickly finds the right piece of clothing (-). (conventional, new)
- It is time-consuming to buy clothing (-). (conventional, new)
- You can buy clothing whenever it suits you. (conventional, new)
- One can find low-cost clothing (conventional, new)
- It is effortful to find second-hand clothing (-). (sufficiency-oriented)
- It is time-consuming to buy second-hand clothing (-). (sufficiency-oriented)
- One can find low-cost second-hand clothing. (sufficiency-oriented)

Items digital devices:

- It is convenient to buy digital devices. (conventional, new)
- It is uncomplicated to find information about offered digital devices. (conventional, new)
- it is effortful to find the right digital device (-). (conventional, new)
- One quickly finds the right digital devices (conventional, new)
- It is time-consuming to buy digital devices (-). (conventional, new)
- You can buy digital devices whenever it suits you. (conventional, new)
- One can find low-cost digital devices. (conventional, new)
- It is effortful to find second-hand digital devices (-). (sufficiency-oriented)
- It is time-consuming to buy second-hand digital devices (-). (sufficiency-oriented)
- One can find low-cost second-hand digital devices. (sufficiency-oriented)

Items leisure travel:

- It is convenient to book leisure travel. (conventional, new)
- It is uncomplicated to find information about offered travels. (conventional, new)
- It is effortful to find the right travel (-). (conventional, new)
- One quickly finds the right travel (conventional, new)
- It is time-consuming to book travels (-). (conventional, new)
- You can book travels whenever it suits you. (conventional, new)
- One can find low-cost travels. (conventional, new)
- It is effortful to find environmentally friendly alternatives to air travel (-). (sufficiency-oriented)
- It is time-consuming to book environmentally friendly alternatives to air travel (-). (sufficiency-oriented)

- One can find low-cost environmentally friendly alternatives to air travel. (sufficiency-oriented)

Purchase intentions

Question: In my future decisions on [clothing purchase / digital devices purchase / leisure travel booking], I intend to...

Scale: 1 = I do not agree at all; 7 = I fully agree; missing value= I don't know / This does not apply to me

Items clothing:

- ... often dress differently. (new products)
- ... buy new clothing regularly. (new products)
- ... own a big assortment of clothing. (new products)
- ... to repair clothing instead of buying new. (sufficiency-oriented products)
- ... to lend and share clothing instead of owning it. (sufficiency-oriented products)
- ... to buy used clothing instead of buying new. (sufficiency-oriented products)

Items digital devices:

- ... always be able to use digital devices with the best available technology. (new product)
- ... buy new digital devices regularly. (new products)
- ... be able to replace digital devices when new models come on the market. (new products)
- ... to repair digital devices instead of buying new. (sufficiency-oriented products)
- ... to lend and share digital devices instead of owning them. (sufficiency-oriented products)
- ... to buy used digital devices instead of buying new. (sufficiency-oriented products)

Items leisure travel:

- ... be able to choose from diverse destinations. (new products)
- ... travel new places in the world regularly. (new products)
- ... travel with the plane regularly. (new products)
- ... when possible travel with public transport, such as buses and trains, instead of taking the plane. (sufficiency-oriented products)
- ... chose travels that are as climate friendly as possible. (sufficiency-oriented products)
- ... to buy used clothing instead of buying new. (sufficiency-oriented products)

Environmental concern

Question: Do you agree with the following statements?

Scale: 1 = I do not agree at all; 4 = I fully agree; missing value= I don't know

Items:

- Environmental protection should be prioritized in Germany, even if it affects economic growth. Every one of us has to take up responsibility in their own surroundings for a liveable environment for future generations.
- For the conservation of nature, we all have to be ready to downsize our living standard.
- With our standard of living we are also responsible for environmental problems in other countries (e.g. exploitation of resources, waste export).
- At purchases I pay attention to the sustainability of products (e.g. environmental impact, longevity, fair trade).

B Appendices of Publication B

Item lists and factor loadings

Table 23: Item list and factor loadings for clothing

<i>Item</i>	<i>Formulation</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>
Consumption level:					
cl1	Number of clothing items purchased in 3 months	1.96	0.14	<.001	0.90
cl2	Yearly expenditure	0.89	0.07	<.001	0.64
Personal norm for sufficiency:					
pn1	Due to values that are important to me, I feel obliged to keep the amount of clothing I buy low.	1.45	0.08	<.001	0.87
pn2	For reasons of environmental protection, I have a bad conscience if I buy more new clothes than I really need.	1.46	0.08	<.001	0.85
Aspiration level:					
al1	Sufficient level of consumption	5.23	0.35	<.001	0.71
al2	Ideal level of consumption	8.44	0.50	<.001	0.83
Social norm for sufficiency:					
sns1	People who are important to me try to keep their clothing purchases as low as possible.	0.81	0.08	<.001	0.51
sns2	People who are important to me like if I try to keep my clothing purchases as low as possible.	1.36	0.07	<.001	0.83
sns3	People who are important to me like if I only buy as many pieces of clothing as I really need.	1.36	0.07	<.001	0.80
Social norm for consumption:					
snc1	People who are important to me buy new clothing for themselves regularly.	0.86	0.07	<.001	0.57
snc2	People who are important to me like if I buy new clothing regularly	1.20	0.07	<.001	0.77
snc3	People who are important to me like if I dress in the latest fashion.	1.33	0.07	<.001	0.78
Sufficiency-promoting online content:					
soc1	I see online advertisement or offers to buy LESS new clothing (e.g. banners, on Social Media).	0.73	0.07	<.001	0.73
soc2	I see posts, discussions or likes on Social Media on the topic of repair or non-consumption.	0.95	0.05	<.001	0.89
Consumption-promoting online content:					
coc1	I see online advertisement for clothing in search engines on or websites (e.g. ads, banners).	1.42	0.05	<.001	0.86
coc2	I see advertisement for clothing when using entertainment media (e.g. Youtube, streaming).	1.43	0.05	<.001	0.89
coc3	I see advertisement for clothing on social media.	1.05	0.05	<.001	0.80
coc4	I see on Social Media that my friends like pages or vendors of clothing and fashion.	1.58	0.05	<.001	0.84
coc5	I see posts, discussions or likes about clothing and fashion on social media.	1.08	0.05	<.001	0.59
coc6	I see on Social Media when friends have bought new clothing for themselves.	1.08	0.06	<.001	0.65
Time spent online:					
to1	Time spent online	2.26	0.07	<.001	0.95

Table 24: Item list and factor loadings for digital devices

<i>Item</i>	<i>Formulation</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>
Consumption level:					
cl1	Number of digital devices purchased in 2 years	1.04	0.11	<.001	0.77
cl2	Yearly expenditure	1.52	0.17	<.001	0.71
Personal norm for sufficiency:					
pn1	Due to values that are important to me, I feel obliged to keep the amount of digital devices I buy low.	1.56	0.05	<.001	0.90
pn2	For reasons of environmental protection, I have a bad conscience if I buy more new digital devices than I really need.	1.56	0.05	<.001	0.84
Aspiration level:					
al1	Sufficient level of consumption	1.12	0.10	<.001	0.64
al2	Ideal level of consumption	2.45	0.14	<.001	0.74
Social norm for sufficiency:					
sns1	People who are important to me try to keep their digital devices purchases as low as possible.	0.81	0.08	<.001	0.49
sns2	People who are important to me like if I try to keep my digital devices purchases as low as possible.	1.45	0.07	<.001	0.87
sns3	People who are important to me like if I only buy as many pieces of digital devices as I really need.	1.16	0.08	<.001	0.72
Social norm for consumption:					
snc1	People who are important to me buy new digital devices for themselves regularly.	0.95	0.08	<.001	0.57
snc2	People who are important to me like if I buy new digital devices regularly	1.32	0.07	<.001	0.82
snc3	People who are important to me like if I own the newest technology.	1.17	0.08	<.001	0.71
Sufficiency-promoting online content:					
soc1	I see online advertisement or offers to buy LESS new digital devices (e.g. banners, on Social Media).	0.83	0.06	<.001	0.73
soc2	I see posts, discussions or likes on Social Media on the topic of repair or non-consumption.	0.96	0.05	<.001	0.87
Consumption-promoting online content:					
coc1	I see online advertisement for digital devices in search engines on or websites (e.g. ads, banners).	0.96	0.05	<.001	0.58
coc2	I see advertisement for digital devices when using entertainment media (e.g. Youtube, streaming).	1.05	0.05	<.001	0.66
coc3	I see advertisement for digital devices on social media.	1.35	0.04	<.001	0.83
coc4	I see posts, discussions or likes about digital devices and fashion on social media.	1.29	0.04	<.001	0.86
coc5	I see on Social Media that my friends like pages or vendors of digital devices and technology.	1.30	0.04	<.001	0.91
coc6	I see on Social Media when friends have bought new digital devices for themselves.	1.10	0.05	<.001	0.87
Time spent online:					
to1	Time spent online	2.16	0.07	<.001	0.95

Table 25: Item list and factor loadings for leisure air travel

<i>Item</i>	<i>Formulation</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>
Consumption level:					
cl1	Number of flights last year	2.07	0.21	<.001	0.82
cl2	Yearly expenditure on air travel	2.52	0.20	<.001	0.63
Personal norm for sufficiency:					
pn1	Due to values that are important to me, I feel obliged to chose environmentally friendly alternatives to air travel.	1.34	0.05	<.001	0.84
pn2	For reasons of environmental protection, I have a bad conscience if I travel by plane.	1.44	0.06	<.001	0.90
pn3	Due to values that are important to me, I feel obliged to keep my number of travels low.	1.34	0.05	<.001	0.88
pn4	For reasons of environmental protection, I have a bad conscience if I travel more than I really need to.	1.40	0.06	<.001	0.90
Aspiration level (2 separate factors)					
al1	Sufficient level of consumption	2.05	0.09	<.001	0.95
al2	Ideal level of consumption	3.49	0.09	<.001	0.95
Social norm for sufficiency:					
sns1	People that are important to me try to find environmentally friendly alternatives to flights when travelling (e.g. bus, train).	1.18	0.06	<.001	0.71
sns2	People that are important to me approve of me trying to keep the amount of my travels low.	1.09	0.08	<.001	0.63
sns3	People that are important to me approve of me choosing environmentally friendly alternatives to flights when travelling (e.g. bus, train).	1.47	0.07	<.001	0.86
Social norm for consumption:					
snc1	People that are important to me regularly book new travels.	0.90	0.08	<.001	0.52
snc2	People that are important to me approve of me regularly travelling to new destinations.	1.19	0.08	<.001	0.75
snc3	People that are important to me approve of me regularly booking new travels.	1.50	0.06	<.001	0.89
Sufficiency-promoting online content:					
soc1	I see advertisement or offers on the internet to go on LESS long-distance travels (e.g. for holidays at home).	0.71	0.05	<.001	0.77
soc2	I see advertisement or offers on the internet for environmentally friendly alternatives to air travel (e.g. for travelling by public transport, bike).	0.84	0.05	<.001	0.88
soc3	I see posts, discussions or likes on social media on avoiding long-distance travel or spending holidays at home.	0.75	0.05	<.001	0.75
soc4	I see posts, discussions or likes on social media on the topic of environmentally friendly alternatives to air travel (e.g. for travelling by public transport, bike).	0.85	0.04	<.001	0.90
Consumption-promoting online content:					
coc1	I see online advertisement for travels on search engines or on websites (e.g. banners).	0.92	0.05	<.001	0.61
coc2	I see advertisement when using entertainment media (e.g. youtube, streaming).	0.89	0.05	<.001	0.65
coc3	I see advertisement for travels on social media.	1.29	0.04	<.001	0.86
coc4	I see posts, discussions and likes on social media on the topic of digital devices and trends.	1.28	0.04	<.001	0.81
coc5	I see that my friends like providers of digital devices on social media.	1.19	0.05	<.001	0.83
coc6	I see on social media, when friends have bought new digital devices for themselves.	1.35	0.04	<.001	0.91
Time spent online:					
to1	Time spent online	2.19	0.07	<.001	0.95

Exploratory factor analyses of predictor items

Table 26: Exploratory factor analysis for items measuring digital content perception in the clothing domain

	Component	
	<i>1</i>	<i>2</i>
I see advertisement for clothing on social media.	0.86	0.22
I see on Social Media that my friends like pages or vendors of clothing and fashion.	0.82	0.32
I see posts, discussions or likes on Social Media on the topic of clothing and fashion.	0.80	0.37
I see online advertisement for clothing in search engines on or websites (e.g. ads, banners).	0.80	0.02
I see advertisement for clothing when using entertainment media (e.g. Youtube, streaming).	0.77	0.16
I see on Social Media when friends have bought new clothing for themselves.	0.68	0.46
I see online advertisement or offers to buy LESS new clothing (e.g. banners, on Social Media).	0.13	0.89
I see posts, discussions or likes on Social Media on the topic of repair or non-consumption.	0.27	0.85

Notes. Extraction method: principal component analysis.

Rotation method: varimax with Kaiser normalization.

Rotation converged after 3 iterations

Table 27: Exploratory factor analysis for items measuring digital content perception in the digital devices domain

	Component	
	1	2
I see online advertisement for digital devices on search engines or websites (e.g. banners).	0.87	0.07
I see advertisement for digital devices when using entertainment media (e.g. youtube, streaming)	0.83	0.22
I see advertisement for digital devices on social media.	0.78	0.43
I see posts, discussions and likes on social media on the topic of digital devices and trends.	0.71	0.53
I see advertisement and offers on the internet to buy LESS digital devices (e.g. banners).	0.09	0.85
I see posts, discussions or likes on repair and consumption reduction on social media.	0.25	0.82
I see on social media, when friends have bought new digital devices for themselves.	0.55	0.66
I see that my friends like providers of digital devices on social media.	0.62	0.64

Notes. Extraction method: principal component analysis.

Rotation method: varimax with Kaiser normalization.

Rotation converged after 3 iterations

Table 28: Exploratory factor analysis for items measuring digital content perception in the air travel domain

	Component	
	1	2
I see advertisement for travels on social media.	0.87	0.21
I see posts, discussions or likes about travels on social media.	0.87	0.21
I see holiday posts and fotos from my friends on social media.	0.85	0.09
I see on social media, that my friends like travel providers.	0.79	0.29
I see online advertisement for travels on search engines or on websites (e.g. banners).	0.73	0.13
I see advertisement when using entertainment media (e.g. youtube, streaming).	0.71	0.28
I see advertisement or offers on the internet to go on LESS long-distance travels (e.g. for holidays at home).	0.13	0.93
I see posts, discussions or likes on social media on avoiding long-distance travel or spending holidays at home.	0.30	0.86

Notes. Extraction method: principal component analysis.

Rotation method: varimax with Kaiser normalization.

Rotation converged after 3 iterations

C Appendices of Publication C

Items of Study 1

Sufficiency behaviour, consumption level (T1, T3):

Question: We would like to know in which way you acquired clothing for yourself during the last four weeks. Please estimate the amount of clothes for each. All wearable textiles should be included, e.g. shirts, pullovers, pants, jackets, underwear or socks (1 pair counts as 1 piece of clothing).

Scale: 0 clothing items, 1, [...], 6 or more clothing items

Items:

- Local shop (e.g. department store, chain store)
- Online shop (e.g., Zalando, Tchibo, Otto, Avocadostore, other shops or online brands)

Social norm for sufficiency (T1, T2):

Question: Customers of the online shop ...

Scale: 1 = don't agree at all, 2 = rather don't agree, 3 = undecided, 4 = rather agree, 5 = strongly agree

Items:

- ... buy new clothes regularly. (recoded)
- ... only buy clothes if they really need them.
- ... try to keep the number of new purchases of clothing low.
- ... repair their clothes or have them repaired when they are torn, instead of buying new ones.
- ... treat their clothes with care, so that they last longer.

Personal norm for sufficiency (T1, T2):

Question: How much do you agree with the following statement?

Scale: 1 = don't agree at all, 2 = rather don't agree, 3 = undecided, 4 = rather agree, 5 = strongly agree

Items:

- I feel obliged to only buy new clothes when I really need them.

- My own values tell me that it is wrong to buy unnecessary clothing.
- It would give me a bad conscience to buy a new piece of clothing, despite having enough clothes in my cupboard already.

Aspiration level (T1, T2):

Question: Given limitless availability of money and time, how many pieces of clothing (outerwear) would you ideally like to buy annually?

[Commentary: Please only indicate the number of outerwear, such as trousers, T-shirts or jackets, not including socks or underwear].

- no clothing items
- 1-5
- 6-10
- ... in steps of 5
- 55-60
- more than 60

Question: And how many pieces of clothing would you need to buy annually for your well-being not to be restricted?

Here, we would like you to give an estimation on how many pieces of clothing (outerwear) you would need to buy in order for your well-being not to be restricted.

[Commentary: Please only indicate the number of outerwear, such as trousers, T-shirts or jackets, not including socks or underwear].

- 1-5
- 6-10
- ... in steps of 5
- 55-60
- more than 60
- clothing is not relevant for my well-being
- I would prefer not to buy any clothes at all

Environmental awareness (T1, Geiger, 2019):

Question: How much do you agree with the following statement?

Scale: 1 = don't agree at all, 2 = rather don't agree, 3 = rather agree, 4 = strongly agree

Items:

- It makes me angry when I see that Germany misses its goals for climate protection.
- More environmental protection means improved quality of life and health for everyone.
- There are natural limits of growth which our industrialised world has already reached.

-
- Every individual has a responsibility for ensuring a habitable environment for subsequent generations.
 - We have to find ways to live well independently of economic growth.
 - I buy ecologically cultivated foods.
 - When shopping, I choose products with eco-labels (e.g. blauer Engel, EU organic label or EU eco-label).
 - For my daily travel, I use the bike, public transport or I walk.

Cued recall of intervention (T1):

Question: Did you perceive the communication on the topic „Less is more“?

Please tick the box, if you saw the following:

[Screenshots of the manipulation]

- No Yes, once Yes, twice Yes, more than twice.

Additional items in Study 2

Sufficiency behaviour:

Question: Within this survey a raffle of 10 vouchers worth 10 EUR each will be held.

If you win in the raffle, which of the following vouchers worth 10 Euros each would you like to receive. The raffle will take place within the next 4 weeks.

- 10 EUR donation to getchanged.net

You will not receive a voucher personally; instead the amount will be donated to Get Changed - The Fair Fashion Network. This non-profit organisation promotes fair and ecological clothing production.

- 10 EUR voucher from H&M

H&M is a clothing store where you can find a wide range of fashionable clothing online or in a branch near you.

- 10 EUR voucher from C&A

C&A is a clothing store where you can find a wide range of fashionable clothing online or in a branch near you.

- 10 EUR voucher from kleiderkreisel.de

At Kleiderkreisel.de you can buy second-hand clothes from other users and you can also resell your own used clothes.

- I don't want to participate in this raffle

Social norm for sufficiency:

Question: Most Instagram users ...

Scale: 1 = don't agree at all, 2 = rather don't agree, 3 = undecided, 4 = rather agree, 5 = strongly agree

Items:

- ... buy new clothes regularly. (recoded)
- ... wear clothes of the newest fashion. (recoded)
- ... search for clothing online or in stores for fun. (recoded)
- ... only buy clothes if they really need them.
- ... treat their clothes with care, so they will be longlasting.
- ... repair their clothes or have them repaired when they are torn.
- ... pay attention to longevity when buying clothes.
- ... buy clothes second-hand instead of new.

Attitude towards communication:

Question: How much do you agree with the following statement?

Scale: 1 = don't agree at all, 2 = rather don't agree, 3 = undecided, 4 = rather agree, 5 = strongly agree

Items:

- ... appeals to me.
- ... is annoying. (recoded)
- ... is attractive.
- ... is easy to understand.
- ... is informative.

Attitude towards the sender used (Armstrong Soule & Reich, 2015):

Question: What do you think of the organisation „Clothing Company“ on the basis of their instagram appearance? The organisation ...

Scale: 1 = don't agree at all, 2 = rather don't agree, 3 = undecided, 4 = rather agree, 5 = strongly agree

Items:

- ... is trying to increase their profit. (-)
- ... is trying to win new clients. (-)
- ... is trying to please existing customers. (-)
- ... feels morally obliged to help the environment.
- ... is trying to give something back to the community.

- ... honestly cares for the well-being of the environment.
- ... is trying to present their products as more attractive, in order to set higher prices. (-)
- ... is using the green trend to increase takings. (-)
- ... does not really care about the environment. (-)

The full survey of study 2 is listed in the supplementary data of this article, which can be found online at doi.org/10.1016/j.jenvp.2021.101595. The universal values scale can be found with Lindeman et al. (2005).

Mediation for consumption-promoting communication

Table 29: Mediation model of consumption-promoting communication (following Figure 8)

	<i>b</i>	<i>se</i>	<i>z</i>	β	<i>p</i>
Path					
a1	0.03	0.06	-0.62	-.03	.538
a2	0.08	0.09	0.84	.04	.399
a3	-.14	1.86	-.08	.00	.938
b1	-0.02	0.10	-.15	-.01	.879
b2	0.09	0.07	1.32	.10	.187
b3	-.01	0.00	-.34	-.16*	.019
c	-.16	0.12	-1.32	-.08	.187
Indirect mediation effects					
Social norm	0.00	0.00	0.15	<.01	.882
Personal norm	0.01	0.01	0.71	<.01	.479
Aspiration level	0.00	0.01	0.08	<.01	.938
total	-0.15	0.12	-1.23	-.07	.217
Covariates					
Social norm - personal norm	0.08	0.03	2.63	.11	.008
Social norm - aspiration level	-1.37	0.64	-2.14	-.10	.032
Personal norm - aspiration level	-10.65	1.35	-7.88	-.46	<.001

D Declaration of honour - Ehrenerklärung

Ich versichere hiermit, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe.

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- fremde Ergebnisse oder Veröffentlichungen plagiiert
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Ich erkläre mich damit einverstanden, dass die Dissertation ggf. mit Mitteln der elektronischen Datenverarbeitung auf Plagiate überprüft werden kann.

Berlin, den 18.08.2021

Vivian Frick