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Do people make sufficiency-oriented mobile phone choices based on dynamic norms? The perception and effectiveness of sufficiency-promoting messages in online media

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Excessive consumption poses a significant threat to the environment. Therefore, overall consumption reduction is necessary. The sufficiency strategy aims to achieve this reduction by enabling individual behavioral changes. In the context of mobile phone choices, one way to promote sufficiency is by encouraging consumers to refrain from purchasing new devices and instead prolong the lifespan of their existing ones. As companies play a major role in shaping products and market conditions that influence consumption, they have a responsibility to support consumers in adopting sufficiency-oriented mobile phone use. However, previous research on the effectiveness of sufficiency-promoting communication and the use of dynamic norms in behavior-change interventions has yielded mixed results. We conducted an online experiment with two specific objectives: First, we examined whether messages emphasizing a dynamic norm have positive impacts on individuals' intentions and behavioral choices regarding sufficiency-oriented mobile phone use. The results indicated no significant effects of a sufficiency-promoting message emphasizing a dynamic norm, compared to two other conditions. Nevertheless, regardless of the message people received, one third of the individuals in all groups chose a sufficiency-oriented voucher. Materialism was found to positively predict both the intention to buy a new mobile phone and sufficiency-oriented behavior, partially contradicting our hypothesis. This suggests that sufficiency-oriented consumption may also be motivated by aspirations for status, albeit in the context of sufficiency. In contrast, personal norms for sufficiency consistently predicted intentions or behaviors aligned with sufficiency, however, not always in the direction we hypothesized. Second, we investigated consumers' attributed motives for online media by comparing a search engine, as an unbiased source of information, with an online store driven by commercial interests. Our analysis revealed significant differences in consumers' perceptions, with altruistic motives attributed to the search engine and exploitative motives attributed to the online store. Our results contribute to the ongoing discussion about the requirements for effective communication strategies that

promote sufficiency-oriented choices. We confirm the limited effectiveness of interventions based on dynamic norms in online settings. Nevertheless, our study offers valuable insights for designing future communication initiatives aimed at fostering sufficiency-oriented behaviors.

KEYWORDS

sufficiency, dynamic norms, online media, mobile phones, communication

1. Introduction

To transition to sustainability, an increasing number of scholars are advocating for a sufficiency approach (O'Neill et al., 2018; Lorek and Spangenberg, 2019; Vita et al., 2019; Jungell-Michelsson and Heikkurinen, 2022). This approach highlights the potential of demand-side mitigation options at the household level and adopting multiple lifestyle changes to reduce carbon footprints and meet the 1.5-degree target (Heinonen et al., 2022). Sufficiency includes individual behaviors that support absolute reduction, modal shift, product longevity, and sharing practices (Sandberg, 2021). It is also a matter of changing societal infrastructures (e.g., legislation on the reparability of products) that facilitate sufficiency-oriented consumption at the behavioral level, i.e., providing infrastructures and consumption options from which people can then choose the one that most satisfies them. Currently, there is limited knowledge about how businesses can effectively accompany and support this shift in consumption patterns. However, businesses have a responsibility to contribute to the socio-economic transition toward sustainable lifestyles (Jungell-Michelsson and Heikkurinen, 2022), as they significantly influence the products and market conditions driving consumption.

To date, there have been few business-driven initiatives aimed at curbing consumption, and research on business sufficiency strategies is still in its early stages. Scholarly contributions have identified opportunities for companies to embrace social-ecological responsibility and transform their business models (Kropfeld and Reichel, 2021; Niessen and Bocken, 2021; Beyeler and Jaeger-Erben, 2022). Research has examined sufficiency-promoting marketing as a means for companies to influence consumer behavior and help to reduce consumption levels (Gossen et al., 2019; Bocken and Short, 2020). However, recent studies have shown that sufficiency-promoting communication has only short-term positive effects on sufficiency decisions (Frick et al., 2021) or does not influence sufficiency orientations at all (Tröger et al., 2021). Therefore, there is a need to explore other triggers that can bring about changes in people's response to sufficiency-promoting communication, such as leveraging the potential impact of social influence on behavior. Social influence plays a crucial role in shaping pro-environmental intentions and behaviors (Farrow et al., 2017). Dynamic social norms that reflect behavioral tendencies in a given context have been shown to be effective in shaping certain sufficiency-related behaviors (Sparkman and Walton, 2017; Loschelder et al., 2019; Sparkman et al., 2020). This study aims to expand our understanding of the effects of dynamic norms on behavior in the context of sufficiency-promoting communication.

Furthermore, this study examines the impact of the attributed motives of the sender on message effectiveness, as

previous studies have highlighted the importance of perceived credibility in sufficiency-promoting communication. Demands for sufficiency-oriented consumption may be seen as unattractive and controversial if they are perceived as limiting consumer sovereignty, freedom of choice, or as incompatible with a company's business model and growth strategy (Gossen and Heinrich, 2021). However, when a sustainability-oriented company communicates a sufficiency-promoting message, both the message and the sender are generally perceived as credible and positively evaluated by the recipients (Ramirez et al., 2017; Gossen and Frick, 2018; Frick et al., 2021). Recent findings suggest that this effect is attributed to altruistic motives rather than strategic and exploitative motives on the part of the company (Frick et al., 2021). As the internet has transformed the consumption process, new online media platforms have become influential sources of consumption-related information. Therefore, comparing different message senders and investigating how consumers perceive and evaluate them in terms of attributed altruistic motives would provide valuable insights for practitioners designing sufficiency-promoting communication strategies.

We chose mobile phone use as the targeted behavior because of their short periods of usage and longevity (Zhou and Gupta, 2020). In other words, sufficiency-oriented use is currently rare in this field of behavior (Cordella et al., 2021). Avoiding the purchase of a new generation of mobile phones or extending the life cycles of existing devices through repair and reuse can significantly reduce the environmental impact of mobile phone production (Clément et al., 2020).

Our research contributes to the knowledge on business-driven communications aimed at promoting sufficiency-oriented lifestyles, which is a growing field of scientific and practical interest (Jung and Jin, 2016; e.g., Hwang et al., 2016; Gossen et al., 2019; Niessen and Bocken, 2021). By exploring the effectiveness of sufficiency-promoting messages emphasizing dynamic norms and examining consumer perceptions of different message senders in an online context, we aim to provide further insights into these areas.

2. Theoretical background, research questions and hypotheses

2.1. Social norms, dynamic norms, and their influence on sufficiency-related intentions and behaviors

A popular way of achieving behavior change is to introduce communications that draw attention to specific social norms. Social norms are general standards of behavior and attitudes within

a particular social group (Sunstein, 1996). They affect a wide range of individual attitudes, choices, and behaviors. The basic assumption is that consumers who have information about what other consumers think, feel, or do about a particular behavior will adjust their attitudes and behaviors to conform to the imagined social norm when certain conditions, such as observability and normative expectations, are met (Cialdini et al., 1991). Research shows that people respond more positively to a behavior when there is social proof for it (Cialdini, 2009) yet they are also unaware of such influence (Nolan et al., 2008). Further, there is evidence that social norms can be strong predictors of pro-environmental behavior (Farrow et al., 2017; Yamin and Lahlou, 2019; Cialdini and Jacobson, 2021). At the same time, other studies found ineffective results from interventions that test normative influences (e.g., Yeomans and Herberich, 2014; Anderson et al., 2017). In summary, evidence on when and how social norms are particularly effective remains inconsistent (Abrahamse and Steg, 2013).

Recent research on social norms that refer to the actual behavior of other people (descriptive norms) distinguishes between two types: static norms, which describe a current status quo, and dynamic norms, which emphasize that a norm is currently changing, suggesting that more people are changing their behavior in the desired, norm-compliant direction (Sparkman and Walton, 2017; Loschelder et al., 2019). Dynamic norms are considered particularly effective when the desired behavior is freely chosen, violates the norm (as in the case of sufficiency, which contradicts the prevailing norm of overconsumption), and when the situation is ambiguous or novel (e.g., Cialdini, 2009). Moreover, dynamic norms can motivate a wide range of sustainable behaviors without relying on strong social pressure (Sparkman et al., 2021; Boenke et al., 2022). Evidence of the effectiveness of dynamic norms on intentions to reduce particular consumption patterns has been provided, for example, by Sparkman and Walton (2017). They tested dynamic norms to communicate a recent increase in the proportion of people reducing their meat consumption. As result, the use of dynamic norms increased people's interest in reducing their meat consumption. In addition, communicating dynamic norms doubled the proportion of people who ordered a vegetarian meal for lunch in a field study. In another study that included both online and field experiments in a college café and restaurant, Sparkman et al. (2020) observed both an increase in intentions to reduce meat consumption and an actual percentage increase in purchasing plant-based meals induced by dynamic norm communication. The authors interpreted this effect in terms of communicating that more people were choosing to reduce consumption made it more likely for people to believe that this was a continuing trend that could replace the existing norm, and they were therefore more likely to change their behavior to "conform" to the future norm. Loschelder et al. (2019) found evidence that dynamic norms were effective in improving plastic to-go cup avoidance behaviors. Carfora et al. (2022) showed that environmental messages with dynamic norm information increased positive attitudes toward reducing meat consumption and decreased meat consumption.

Considering the potential positive influence of dynamic norms on reduced consumption, the dynamic norm concept and findings presented provide a valuable theoretical foundation for the present

study. Based on these considerations, we formulated the following research question:

RQ1: How does a sufficiency-promoting message that emphasizes a dynamic norm influence consumers' actual sufficiency-oriented mobile phone intentions and behavioral choices?

To investigate RQ1, we formulated the following hypotheses:

H1. People who receive a sufficiency-promoting message emphasizing a dynamic norm show less intention to buy a new mobile phone and a higher intention to sufficiency-oriented use of mobile phones than people receiving a sufficiency-promoting message without emphasizing a dynamic norm or a consumption-promoting message.

H2. People who receive a sufficiency-promoting message emphasizing a dynamic norm less often choose to purchase a new mobile phone (i.e., show more sufficiency-oriented behavioral choices) than those receiving a sufficiency-promoting message without emphasizing a dynamic norm or a consumption-promoting message.

2.2. The role of materialism and personal norms for sufficiency when targeting sufficiency-oriented behavioral change

Previous research demonstrate that materialism is associated with negative environmental effects by aligning with certain high-emission consumption patterns. Materialism is defined as "a set of core beliefs about the importance of possessions in a person's life" (Richins and Dawson, 1992; p. 308) and reflects individuals' attachment to material possessions (Belk, 1985). A meta-analysis suggests a moderately negative relationship between materialism and pro-environmental attitudes and behaviors (Hurst et al., 2013). Individuals with higher levels of materialism display less concern for environmental issues (Joung, 2013) and are less likely to engage in pro-environmental behaviors, such as reusing plastic bags (Brown and Kasser, 2005). Research has proposed that sufficiency involves the interplay between levels of materialistic consumption (Spengler, 2016) and the relationship between materialism and sufficiency (e.g., Lorek and Spangenberg, 2019). Furthermore, it is argued that sufficiency is determined by a set of non-materialistic values (McDonald et al., 2006), and materialism is negatively associated with related concepts such as anti-consumption (Lee and Ahn, 2016). Given these findings, we examine the relationship between materialism and the likelihood of sufficiency-oriented behavior. We hypothesize:

H3a. Materialism negatively predicts sufficiency-oriented mobile phone intentions and behavioral choices.

In contrast to materialism, a personal norm for sufficiency is positively related to sufficiency-oriented intentions and behaviors, fostering the intention to reduce consumption (Joanes, 2019; Heidbreder et al., 2020). Joanes et al. (2020) found that personal

norms, defined as “feelings of personal obligation” (p. 942), exhibited the strongest direct positive association with intentions to reduce consumption due to environmental concerns, as well as with overall intention to reduce clothing consumption. This relationship has already been explored in various domains of sustainable behavior, such as the purchase of environmentally friendly products or organic food (Aertsens et al., 2009; Onwezen et al., 2013). Building upon these findings, we propose the following hypothesis:

H3b. Personal norms for sufficiency positively predict sufficiency-oriented mobile phone intentions and behavioral choices.

Although materialism may seem contradictory to the general trend of consuming less, its relationship with behaviors such as repairing objects or buying used products is more complex. Some studies suggest that materialism serves specific functions in valuing certain products, which in turn may motivate individuals to repair items in order to preserve their personal value. Shrum et al. (2014) conducted a meta-analysis that highlights the positive aspects of materialism, which can also be observed in moral decisions such as donating or purchasing ethically sound items. The researchers argue that materialism can have short-term positive effects under certain conditions, such as when it enhances status and motivation in favor of the environment (e.g., using consumption as a means to protect the environment). For example, in the context of our study, one’s attachment to a mobile phone may influence people’s intention to repair it or buy a refurbished one, either to maintain the same model or to fulfill one’s own environmentally conscious identity, thereby enhancing status.

Theoretical work in consumer research suggests a correlation between materialism and higher involvement in products such as clothes, cars, jewelry, and houses, as these items possess symbolic meaning and can convey impressions and images to others (Lertwannawit and Mandhachitara, 2012). This correlation could play a role in certain sufficiency-related behaviors, such as repairing a mobile phone. Furthermore, when people are shopping or are exposed to online advertisement that prompt them to reconsider their consumption, they tend to reflect on their own values, either implicitly or explicitly. Based on this, we argue that materialism moderates the effect of the message emphasizing a dynamic norm on intention and behavior.

Moreover, previous research has identified values as potential moderators in the theory of planned behavior within the context of consumption and decision-making processes. For example, Vermeir and Verbeke (2008) examined the role of Schwartz’s (1992) list of values in the formation process of purchase intentions for sustainable dairy products. Materialism moderated the effect of product attractiveness on purchase intention (Koay et al., 2021) and the relationship between attitudes, norms and intentions to boycott unethical products (Delistavrou et al., 2019). Given these findings, we propose that materialism may moderate the influence of dynamic norms. However, based on these arguments surrounding conspicuous consumption as part of self-expression and identity formation direction of moderation remains unclear: materialism may either weaken or strengthen the impact of a normative message. Therefore, we formulate the following hypothesis:

H4. The influence of a sufficiency-promoting message emphasizing a dynamic norm on sufficiency-oriented mobile phone intentions and behavioral choices is moderated by materialism.

2.3. The role of the sender and its attributed motives for adopting sufficiency-promoting communication

Prior research has provided initial insights into the effects of sufficiency-promoting communication by companies, highlighting its positive impact on the reputation and credibility of the sender. For instance, studies have shown that messages reinforcing sufficiency-oriented behaviors strengthen positive attitudes toward green demarketing advertising (Reich and Armstrong Soule, 2016) and enhance customer perceptions of a company (Ramirez et al., 2017). Consistent with these findings, Frick et al. (2021) observed positive attitudes toward the sender following a sufficiency-promoting intervention, while consumption-promoting communications did not alter attitudes. In all of these studies, the message advocating reduced consumption was attributed to a fictional for-profit manufacturing company. However, it remains unclear how consumers would respond if the sender is not the manufacturer or seller of the product they are currently interested in.

As major parts of consumption shift to online environments, consumers’ decision-making processes are influenced by a plethora of new channels for inspiration, search, and purchase. For example, online users primarily rely on search engines and online marketplaces to discover e-commerce sites for online purchases (The Future Shopper Report, 2022). Search engines, in particular, provide users with a convenient and rapid overview of product choices as they explore and evaluate shopping information. Furthermore, many users trust search engines (Lewandowski, 2012), in particular, younger users consider them to be fair and unbiased sources of information (Purcell et al., 2012). As a result, search engines have assumed a mediating role between providers and consumers.

Nonetheless, it remains an open question as to whether users believe that search engines possess the integrity to provide unbiased information regarding sufficiency-oriented behavior, as compared to other message senders. Additionally, the perceived positive motives of the sender are essential conditions that prompt users to process the embedded information and click on the provided links. Thus, our study aims to investigate whether search engines, as providers of sufficiency-promoting messages, are perceived differently from sales-oriented online stores that deliver similar messages. By doing so, our research complements prior studies that have examined the perceived motives behind sufficiency-promoting communications. These studies have demonstrated that consumers attribute more altruistic motives to brands with strong environmental reputations, while perceiving brands with poor reputations as having exploitative motives in response to green demarketing messages (Armstrong Soule and Reich, 2015). We examine whether consumers consider the motives of a fictional intermediary sender with neutral interests (a fictitious search

engine) as more altruistic and less exploitative than those of a fictional sender with a strong sales interest (a fictitious online store). Therefore, our second exploratory research question is:

RQ2: How do consumers perceive sufficiency-promoting messages from a fictitious search engine compared to sufficiency-promoting messages from a fictitious online store?

Our research model is depicted in [Figure 1](#).

3. Method

Data analysis was performed using R Studio version 4.1.2 (Studio Team, 2020) using several packages (Wickham et al., 2019, 2023; Fox et al., 2020; Kassambara, 2020; Lenth, 2020; rstatix, 2020; Navarro, 2021; Stanley, 2021; Lüdtke et al., 2022; Bao, 2023; Singmann et al., 2023). Study materials, data, and scripts for data analysis are available on the Open Science Framework (OSF; <https://bit.ly/3vPM7cW>).

3.1. Study design

The study was conducted as an online experiment. Participants were randomly assigned to one of six conditions using a three-by-two multifactorial design. The first factor was the type of message presented to participants and varied in three levels: sufficiency-promoting message (experimental group 1 (EG1)), sufficiency-promoting message emphasizing a dynamic norm (experimental group 2 (EG2)), and consumption-promoting message (control group (CG)). The other factor was the type of sender from which the participants received the message, which was either a fictitious search engine or a fictitious online store.

3.2. Material

The manipulation included three communication variants, each consisting of three info-boxes of either a fictitious search engine or a fictitious online store. Regardless of the condition, all info-boxes were designed identically, with similar images and text arrangements, to ensure parallelism between conditions and avoid effects due to different parameters. Only the text in the message varied between conditions. For the sufficiency-promoting message emphasizing a dynamic norm (EG2), the claim was “In collaboration with scientists, we found out ...” because we wanted to take advantage of the positive effect of norm-oriented messages sent by a researcher, which has been demonstrated by previous research (Boenke et al., 2022). An example of a selected info-box in the three communication versions is shown in [Figure 2](#). The full manipulation can be found in the online Supplementary material.

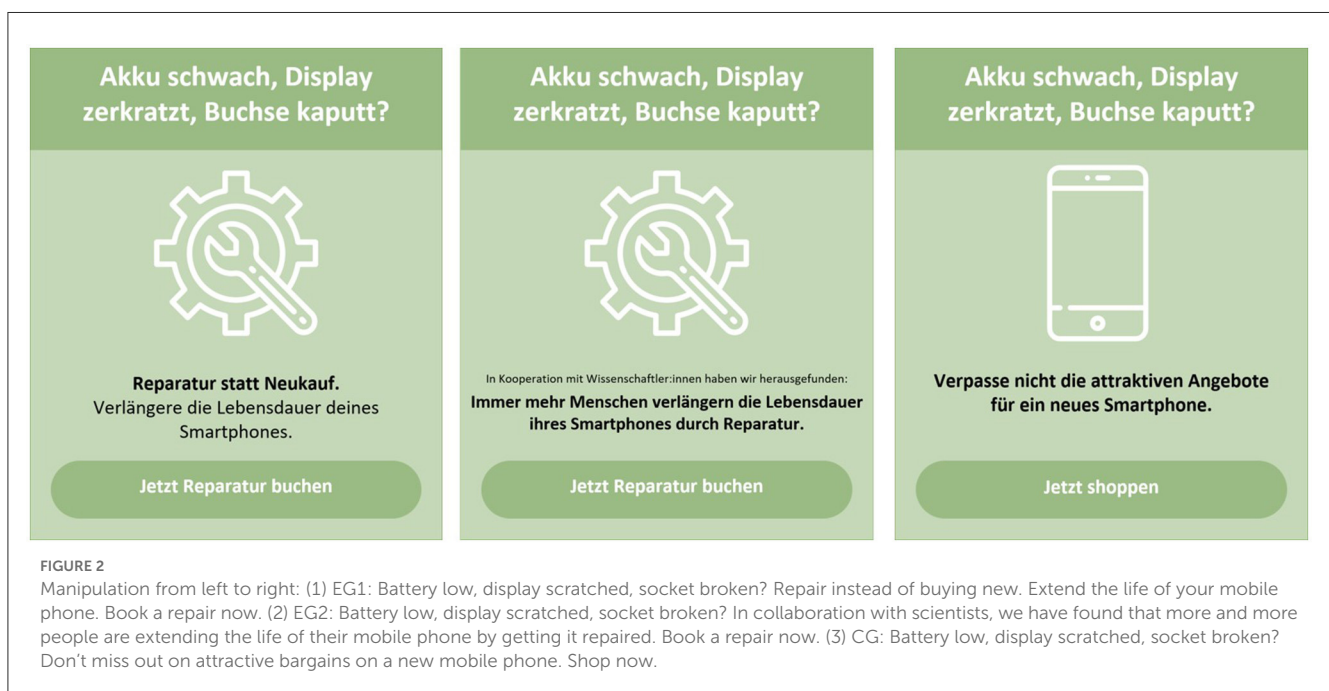
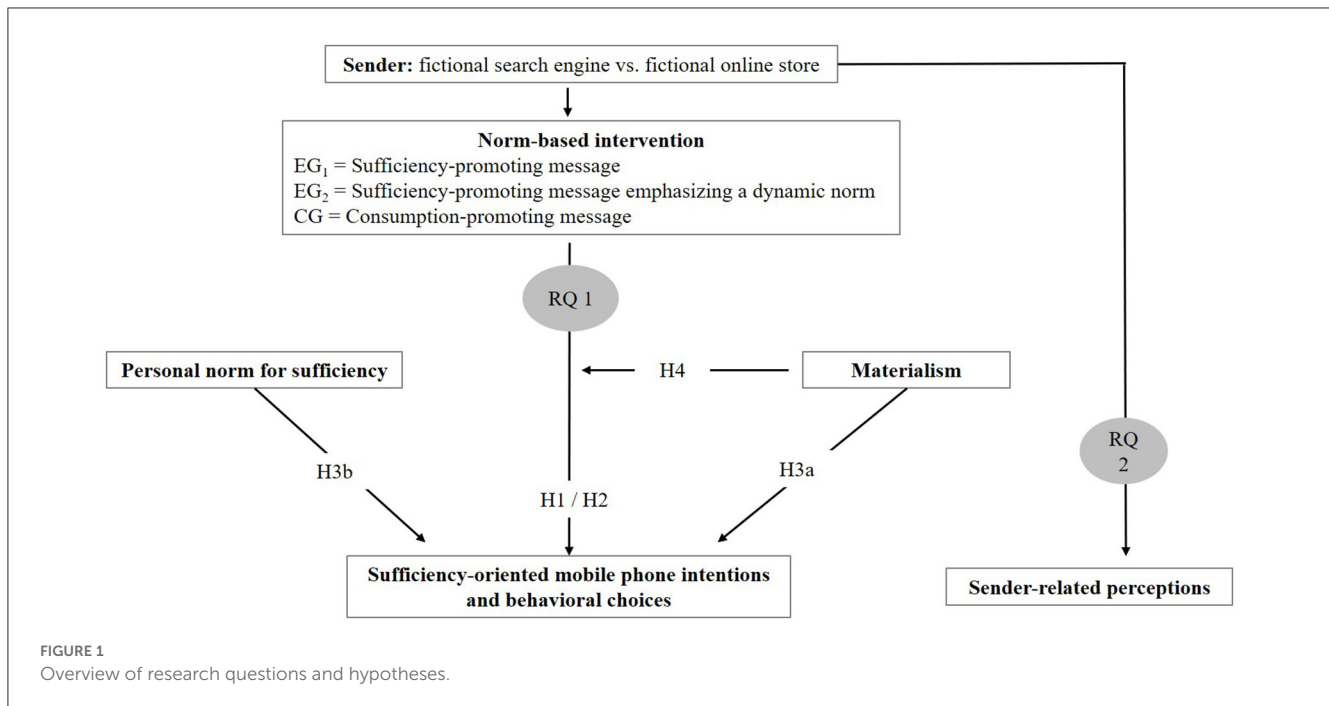
3.3. Procedure

After entering the survey, participants were asked to indicate their age and gender to determine a representative sample of the German population. As our main research question involves mobile phone users in an online setting, we recruited only people who actively use the Internet. To ensure this, three screening questions were asked about online shopping habits and frequency. The first question asked whether individuals purchase products from online stores such as Amazon, eBay, or Zalando several times a year (yes-no response format). To counteract data bias due to social desirability and context effects such as the priming effect (Möhring and Schlütz, 2019), participants were not exclusively asked about their online shopping behavior but were additionally asked to indicate whether they “go on vacation,” “attend concerts or other events,” or “redecorate their apartment” several times a year. In line with our research question, only those who shopped online several times a year were included. A second screening question asked participants how regularly they used online search engines. Responses were given on a frequency scale of 1 = “never” to 6 = “several times a day.” Respondents who used online search engines at least “weekly” or more frequently (“daily,” “several times a day”) participated in the survey. The third screening question asked about the likelihood of a participant searching the Internet for information about mobile phones in the near future. We included this question to ensure that respondents were interested in communication about new or refurbished mobile phones and to control for a general interest in the topic. Respondents were asked to answer the question on a 7-point scale ranging from 1 “extremely likely” to 7 “extremely unlikely.” Only respondents who indicated they were 3 “likely,” 2 “very likely,” or 1 “extremely likely” to obtain information about mobile phones online in the near future were allowed to proceed to the full survey.

Following the screening questions, the mobile phone purchase intention was measured as the dependent variable of this study prior to the manipulation (see Section 3.4 for more details on the measures). This step was followed by random assignment to one of the six conditions and presentation of the messages, which consisted of three different info-boxes. Participants processed the information by reading through the info-boxes. Each info-box was shown for at least 10 seconds. Dependent, predictor, and control variables were then assessed. The full questionnaire is available in the online Supplementary material.

3.4. Measures

The experiment was conducted in German. Whenever possible, we used established German scale versions. When these were not available, we translated and cross-checked the scales. The full list of items and translations are in the online Supplementary material. Unless otherwise indicated, responses were rated on 5-point Likert scales ranging from 1 (“I strongly agree”) to 5 (“I strongly disagree”). Before conducting the experiment, the questionnaire was pre-tested with experienced researchers to assess appropriateness, clarity, completeness, wording, and structure. Only minor amendments were made.



3.4.1. Dependent measures

Four items were used to measure *sufficiency-oriented mobile phone intention*. The items were adopted from [Rausch and Kopplin \(2021\)](#) and reformulated for our purposes. The sufficiency-oriented items were developed based on [Sandberg's \(2021\)](#) typology of sufficiency-oriented behavior. The wording of the items was as follows: How likely would they be to (1) “buy a mobile phone or get one from a contract renewal (new device),” (2) “get my current mobile phone repaired,” (3) “buy a refurbished mobile phone,” and (4) “forgo buying a mobile phone even though I need it.” All questions were answered on a 7-point Likert scale ranging from

1 “definitely” to 7 “definitely not.” An exploratory factor analysis was conducted to determine an appropriate scale structure. Two latent factors were identified. However, only the first item loaded on a separate factor while the other three formed another factor. From this analysis, we decided to form an index of *intention to use mobile phones in a sufficiency-oriented manner*, including items two through four ($\alpha = 0.61$) and separately analyzing the single item reflecting the *intention not to buy a new mobile phone*.

Sufficiency-oriented mobile phone choice was measured using a voucher question. The measurement was adapted from [Frick et al. \(2021\)](#). Participants were invited to enter a raffle for 10

vouchers of 20 euros each (the wording of the question was: “Which of the following vouchers would you like to receive if you win the raffle?”). If interested, participants could choose between four options: one voucher for popular retail stores for electronic products, representing a purchase decision, and three options for other vouchers that had been classified by the authors as sufficiency-oriented behavioral choices. These options were (a) a voucher for an online marketplace for remanufactured electronic products, (b) an online service for electronic device repairs, or (c) the option to donate the specified amount to a non-governmental organization. The willingness to donate to charitable causes was also interpreted as a sufficiency-oriented decision (following Frick et al., 2021). In addition, individuals could also indicate that they did not want to participate in the raffle which we categorized as not a sufficiency-oriented decision. In summary, to determine the sufficiency-oriented behavioral choice related to mobile phone use, the dichotomous variable was the choice of the voucher for the repair or refurbishment options or the donation to charity and the subsequent statement “I do not want to consume,” which was coded as 1 = yes, and the choice of the regular online store voucher was coded as 0 = no.

3.4.2. Predictors and correlates

Attitudes toward the sender were measured using the Motives of the Sender scale (Armstrong Soule and Reich, 2015), which captures three subdimensions: altruistic, strategic, exploitation. The altruistic subdimension was measured with three items: “The search engine/online store feels morally obligated to help the environment,” “The search engine/online store is trying to give something back to society,” “The search engine/online store genuinely cares about the well-being of the environment.” It had a good scale property ($\alpha = 0.86$). The strategic sub-dimension was measured as “The search engine/online store is trying to increase profits,” “The search engine/online store is trying to gain new customers,” and “The search engine/online store is trying to please its current customers.” It had an unacceptable scale property ($\alpha = 0.37$) and was therefore excluded from the analysis. The exploitation sub-dimension was measured with three items: “The search engine/online store is just trying to make its product seem more attractive so it can charge a higher price,” “The search engine/online store is just taking advantage of the “green” trend to make more money,” and “The search engine/online store does not genuinely care about the environment.” It had an acceptable scale property ($\alpha = 0.70$).

Materialism was measured using a scale proposed by Frick et al. (2022) to measure materialistic values, affinity for novelty, and impulsive buying behavior, based on the short version of the Materialism Scale (Richins, 2004) and the Impulsive Buying Scale (Badgaiyan et al., 2016). The scale consists of seven items: “I admire people who own expensive homes, cars, and clothes,” “I like a lot of luxury in my life,” “I would be happier if I could afford to buy more things,” “Stylish furniture is important to me,” “I like to own gadgets that are state of the art,” “I always keep my eyes open for new trends,” “I often buy things spontaneously without thinking about it.” It showed a good scale property ($\alpha = 0.81$).

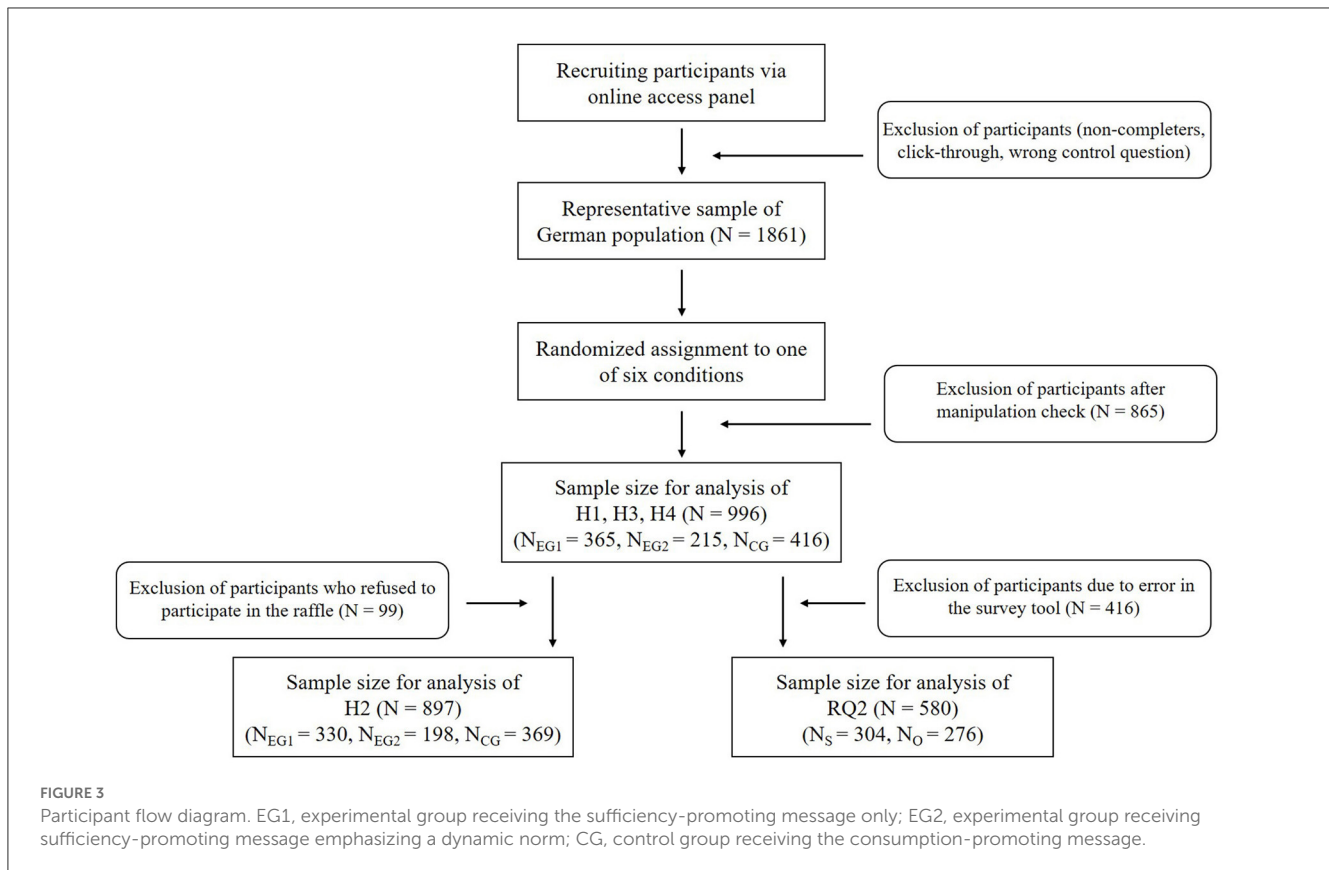
Three items measured *personal norms for sufficiency* (Joanes et al., 2020): “No matter what other people think or do, my principles tell me that it is right to reduce my personal consumption,” “Reducing my personal consumption is the right thing to do,” and “I feel a strong personal obligation to reduce my personal consumption.” It had a good scale property ($\alpha = 0.89$).

Sufficiency attitudes were measured using the Sufficiency Orientation Scale for attitudes toward a sufficiency-oriented lifestyle developed by Verfuert et al. (2019). This scale consists of seven items on topics such as consumption and resource use. For the experiment, five of the original six items were used: “Through my lifestyle I want to use as few resources as possible,” “I find it desirable to possess few things only,” “I reject the idea that more and more is being consumed,” “My comfort is more important than a frugal way of life,” “I think it is unnecessary to have this affluence of different products in our supermarkets,” “All the new things that are sold all the time are a big waste of resources to me,” “I find it appealing to grow and produce as much food by myself as possible.” It had a good scale property both pre- ($\alpha = 0.80$) and post intervention measurement ($\alpha = 0.79$).

Consciousness for sustainable consumption was measured using the short version of the Consciousness for Sustainable Consumption Scale (CSC) (Balderjahn et al., 2013; Ziesemer et al., 2016). The 12-item short scale serves as a comprehensive measure of the environmental, social, and economic dimensions of CSC and has been shown to be highly reliable in former studies (Buerke, 2016). Response categories and introduction were based on Buerke (2016). However, for consistency with our other measurements, we used a 5-point Likert scale instead of the 7-point Likert scale. We asked the following question: “We are interested in your general purchasing habits and how much you generally pay attention to the following product characteristics. Regardless of which product it is (e.g., clothing, household cleaners and electrical appliances) please indicate how important is it for you personally that...” “a product is packaged in an environmentally friendly way,” “a product is made from recycled materials,” “a product is produced in an environmentally friendly way,” “a product is manufactured with respect for the human rights of workers,” “in the manufacture of a product, workers are not discriminated against,” “in the production of a product, workers are treated fairly or paid fairly,” “a product can be shared with others rather than owned,” “a product can be borrowed from friends rather than owned,” “I really need this product,” “is a useful product,” “I do not have to forgo future purchases,” “the expense does not put undue strain on my financial situation.” The overall reliability of the scale was good ($\alpha = 0.86$). Each subscale also showed high or even excellent scale reliability (see Supplementary material for more details).

3.4.3. Socio-demographics

We assessed the socio-demographic variables gender (male = 463, female = 530, diverse = 3), age in years ($M = 42.86$, $SD = 14.28$), education level in five categories (50% of the participants had a German Abitur (high-school leaving certificate) or higher), and income in nine income categories ($M = 4.84$, $SD = 2.63$; with 50% of the participants indicating an income between 3,000 and 3,500 €, i.e., category five, or higher; see Supplementary material).



3.5. Sample

The planned sample of the study was $N = 1,861$, and 310 respondents per group were aimed for in order to compare the means of all groups with a statistical power of 0.8 and a small effect size of 0.2. We conducted qualitative pretests of the material in order to improve comprehensibility. Data were collected by a market research organization as part of its online access panel in August 2022. As inclusion criteria, participants were screened for frequency of online shopping, search engine use, and online information search on mobile phones. Only participants who shopped online several times a year and used a search engine at least once a week were included (see Section 3.3 for more details). To ensure representativeness, a socio-demographic distribution was chosen that is representative of the part of the German population that uses the Internet frequently (Destatis, 2022). Therefore, participants were selected according to the criteria of age (between 16 and 69 years) and gender. Of all the people who accessed the survey, those who failed a control question ("Please click option 2") or whose interview duration was more than 60% below the median of the average interview duration (the average interview duration was 10 minutes and 10 seconds) had been excluded by the market research organization and were not part of our sample.

3.6. Manipulation check

We implemented a manipulation check to assess whether participants consciously processed the intervention and, in

particular, remembered the messages given to them. The manipulation material was presented to participants again, i.e., one of the three info-boxes in all three communication variants was shown at the end of the questionnaire. Participants were asked to indicate which of the info-boxes they had already seen at the beginning of the survey by clicking on the info-box that had been presented to their group. Individuals who did not pass the manipulation check or indicated that they either had not seen any of the images or did not remember were excluded from subsequent data analyses ($N = 865$).

Of the final $N = 996$ participants, 99 did not want to participate in the raffle that was part of the behavioral choice task, thus reducing the sample size for the H2 analyses to $N = 897$. Due to an error in the survey tool, further participants had to be excluded, resulting in a sample size of $N = 580$ for the RQ2 analyses. The participant flow diagram in Figure 3 shows the various exclusion steps and the final sample sizes for each research question and hypotheses.

4. Results

4.1. Descriptive results and correlational structure

After data cleaning, the total sample size was $N = 996$ (see Figure 3). To obtain an overview of the relationships between the main variables and scales included in our study, we analyzed the

TABLE 1 Means, standard deviations, and correlations with confidence intervals.

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender ^d	0.53	0.50												
2. Age	42.86	14.28	−0.01											
			[−0.07, 0.05]											
3. Education	3.74	1.11	−0.07*	−0.10**										
			[−0.13, −0.00]	[−0.16, −0.04]										
4. Income	4.84	2.63	−0.10**	−0.04	0.28**									
			[−0.17, −0.04]	[−0.10, 0.03]	[.22, 0.34]									
5. Norms for Sufficiency	2.44	0.90	−0.09**	−0.08*	0.02	0.06								
			[−0.15, −0.03]	[−0.14, −0.02]	[−0.04, 0.08]	[−0.00, 0.13]								
6. Materialism	3.20	0.78	0.13**	0.35**	0.02	−0.05	−0.30**							
			[0.06, 0.19]	[.30, 0.41]	[−0.04, 0.08]	[−0.12, 0.01]	[−0.36, −0.25]							
7. S Intention ^b	4.61	1.20	−0.04	0.15**	0.01	0.12**	0.35**	−0.00						
			[−0.10, 0.02]	[0.09, 0.21]	[−0.06, 0.07]	[0.05, 0.18]	[.29, 0.40]	[−0.07, 0.06]						
8. S Attitude ^c	2.62	0.78	−0.14**	−0.12**	−0.01	0.09**	0.74**	−0.45**	0.32**					
			[−0.20, −0.08]	[−0.18, −0.06]	[−0.07, 0.06]	[0.02, 0.15]	[0.71, 0.76]	[−0.50, −0.40]	[0.26, 0.37]					
9. Intention to buy	3.53	1.76	0.05	0.03	−0.02	−0.12**	−0.09**	0.30**	−0.09**	−0.17**				
			[−0.01, 0.11]	[−0.03, 0.09]	[−0.08, 0.04]	[−0.18, −0.05]	[−0.16, −0.03]	[.24, 0.35]	[−0.15, −0.02]	[−0.23, −0.11]				
10. Behavior ^d	0.27	0.44	0.12**	0.08*	0.03	0.04	−0.21**	0.23**	−0.16**	−0.24**	0.18**			
			[0.05, 0.18]	[0.02, 0.14]	[−0.03, 0.10]	[−0.03, 0.11]	[−0.27, −0.15]	[0.17, 0.29]	[−0.22, −0.10]	[−0.29, −0.18]	[.12, 0.24]			
11. ENV_CSC	2.19	0.97	−0.11**	−0.09**	0.03	−0.01	0.54**	−0.19**	0.29**	0.52**	−0.08*	−0.18**		
			[−0.17, −0.05]	[−0.15, −0.03]	[−0.03, 0.09]	[−0.07, 0.06]	[0.49, 0.58]	[−0.25, −0.13]	[.23, 0.35]	[.47, 0.56]	[−0.14, −0.01]	[−0.24, −0.12]		
12. SOC_CSC	1.81	0.90	−0.15**	−0.06	0.02	0.02	0.46**	−0.17**	0.19**	0.44**	−0.05	−0.22**	0.62**	
			[−0.21, −0.09]	[−0.12, 0.00]	[−0.04, 0.08]	[−0.05, 0.08]	[0.41, 0.51]	[−0.23, −0.11]	[0.13, 0.25]	[0.39, 0.49]	[−0.11, 0.01]	[−0.28, −0.16]	[.58, 0.66]	
13. ECON_CSC	2.15	0.60	−0.09**	0.02	0.04	0.02	0.42**	−0.18**	0.25**	0.38**	−0.00	−0.11**	0.39**	0.39**
			[−0.15, −0.03]	[−0.04, 0.08]	[−0.03, 0.10]	[−0.04, 0.09]	[.36, 0.47]	[−0.24, −0.12]	[0.19, 0.31]	[.33, 0.43]	[−0.06, 0.06]	[−0.17, −0.05]	[0.34, 0.44]	[0.33, 0.44]

^a = dichotomously coded, 0 = male, 1 = female; ^b = intention to use mobile phones in a sufficiency-oriented manner (DV), ^c = Sufficiency attitude scale, ^d = sufficiency-oriented mobile phone choice (DV). Values in square brackets indicate the 95% confidence interval for each correlation. **p* < 0.05. ***p* < 0.01.

correlation structure within our dataset. Results are displayed in Table 1.

We found a significant positive medium correlation between intention to buy a new mobile phone ($r = 0.30$) and a small positive correlation to sufficiency-oriented mobile phone choice ($r = 0.23$) with materialism. Personal norms for sufficiency correlate significantly positively with sufficiency-oriented mobile phone intention ($r = 0.35$) but significantly negatively with sufficiency-oriented mobile phone choice ($r = -0.21$, small effect). To obtain correlations between our main independent variables and popular sufficiency concepts, we included the sufficiency attitude and CSC variables in our correlation analyzes (see Table 1). Sufficiency attitude is positively correlated at a medium level with the intention to use mobile phones in a sufficiency-oriented manner ($r = 0.32$), a small negative correlation with the intention to buy a new mobile phone ($r = -0.17$), and also with behavioral choice ($r = -0.24$). In addition, we find a medium negative correlation between materialism and sufficiency attitude ($r = -0.45$) and a large positive association between sufficiency attitude and personal norms for sufficiency ($r = 0.74$). Furthermore, materialism correlates significantly positively with gender ($r = 0.13$) and age ($r = 0.35$), but not with income and education.

4.2. Effects of the message intervention on sufficiency-oriented mobile phone intentions and behavioral choices

For H1, we analyzed $N_{EG1} = 365$ receiving a sufficiency-oriented message only, $N_{EG2} = 215$ receiving the sufficiency-oriented message emphasizing a dynamic norm, and $N_{CG} = 416$ receiving a consumption-promoting message. Since the sample has more than 30 participants both in total and in the individual groups, the distribution can be approximated by a normal distribution (Janssen and Laatz, 2017). We ran a one-factor ANOVA to test whether people who received a sufficiency-promoting message emphasizing a dynamic norm had less intentions to buy a new mobile phone and a higher intention toward sufficiency-related use of mobile phones than people who saw sufficiency-promoting only or consumption-promoting messages. The main effect of the group is statistically not significant and very small for the intention to buy a new mobile phone ($F(2, 993) = 1.35, p = 0.261; \eta^2 < 0.001, 95\% \text{ CI } [0.00, 1.00]$). Group mean scores did not differ significantly ($N_{EG1} = 365, M_{EG1} = 4.60, SD_{EG1} = 1.22; N_{EG2} = 215, M_{EG2} = 4.51, SD_{EG2} = 1.18; N_{CG} = 416, M_{CG} = 4.66, SD_{CG} = 1.20$) and *post hoc* analyses did not reveal any significant difference. Likewise, also the intention toward sufficiency-related use of mobile phones revealed no statistically significant main effect of the group ($F(2, 993) = 1.20, p = 0.302; \eta^2 < 0.001, 95\% \text{ CI } [0.00, 1.00]$). These results disconfirm H1.

To test H2, we excluded participants who refused to participate in the raffle (see Figure 3) resulting in divergent sample sizes for each group: $N_{EG1} = 330, N_{EG2} = 198, \text{ and } N_{CG} = 369$. We ran a Chi-square test of independence to compare participants' behavioral choices. There is no significant difference between the groups, $\chi^2(2) = 4.84, p = 0.089$. The share of participants who chose a sufficiency-oriented voucher is highest in EG2, (i.e.,

TABLE 2 Sufficiency-oriented mobile phone choice per group.

Group	Sufficiency-oriented choice	N	Percentage
EG1	No	234	70.9
EG1	Yes	96	29.1
EG2	No	129	65.2
EG2	Yes	69	34.8
CG	No	270	73.2
CG	Yes	99	26.8

34.8%), followed by EG1 (i.e., 29.1%). The CG shows the lowest sufficiency-oriented behavioral choice (i.e., 26.8%, see also Table 2 for the group-wise descriptive results of the behavioral choices). In addition, we fitted a logistic regression model (estimated using ML) to predict behavioral choice within Group. However, the model's explanatory power is weak (Tjur's $R^2 = 0.005$). The model's intercept, corresponding to EG1, is at -0.89 (95% CI $[-1.13, -0.66], p < 0.001$). Within this model, the effect of EG2 is statistically non-significant and positive (beta = 0.27, 95% CI $[-0.11, 0.64], p = 0.168$; Std. beta = 0.27, 95% CI $[-0.11, 0.64]$). The effect of CG is statistically non-significant and negative (beta = -0.11 , 95% CI $[-0.44, 0.22], p = 0.506$; Std. beta = -0.11 , 95% CI $[-0.44, 0.22]$). Thus, H2 must be rejected.

4.3. Role of materialism and personal norms for sufficiency

To test our hypotheses regarding materialism including the interaction with group, and the personal norms for sufficiency (H3a, H3b, H4), we ran several regression analyses on our three main dependent variables, i.e., *the intention to buy a new mobile phone, the intention to use mobile phones in a sufficiency-oriented manner, and the sufficiency-oriented mobile phone choice*. Results are displayed in Tables 3, 4.

We fitted a linear multiple regression model (estimated using OLS) to predict peoples' intention to buy a new mobile phone with Group, materialism, Group x materialism, personal norms for sufficiency, and controls. The model explains a statistically significant but weak proportion of variance ($R^2 = 0.12, F(9, 870) = 13.61, p < 0.001, \text{adj. } R^2 = 0.11$, see Table 3). Within this model, the effect of materialism is statistically significant and positive (beta = 0.80, 95% CI $[0.57, 1.04], t(870) = 6.72, p < 0.001$; Std. beta = 0.36, 95% CI $[0.25, 0.46]$). This result partially confirms H3a. Furthermore, there was no significant interaction between Groups and materialism, thus disconfirming H4.

We fitted a linear multiple regression model (estimated using OLS) to predict intention to use mobile phones in a sufficiency-oriented manner including Group, materialism, Group x materialism social norms for sufficiency, and controls. The model explains a statistically significant and moderate proportion of variance ($R^2 = 0.17, F(9, 870) = 19.33, p < 0.001, \text{adj. } R^2 = 0.16$, see Table 4). The effect of materialism is statistically not significant, partially disconfirming H3a and disconfirming H4 as there was no

TABLE 3 Regression results using intention to buy a new mobile phone as the criterion.

Predictor	<i>b</i>	<i>b</i> 95% CI	<i>sr</i> ²	<i>sr</i> ² 95% CI	Fit
(Intercept)	1.44**	[0.52, 2.35]			
GroupEG2	−0.30	[−1.53, 0.92]	0.00	[−0.00, 0.00]	
GroupCG	0.48	[−0.56, 1.52]	0.00	[−0.00, 0.00]	
Materialism	0.80**	[0.57, 1.04]	0.05	[0.02, 0.07]	
Personal norm for sufficiency	0.02	[−0.10, 0.15]	0.00	[−0.00, 0.00]	
Gender	0.00	[−0.22, 0.22]	0.00	[−0.00, 0.00]	
Income	−0.06**	[−0.11, −0.02]	0.01	[−0.00, 0.02]	
Age	−0.01	[−0.02, 0.00]	0.00	[−0.00, 0.01]	
GroupEG2: materialism	0.12	[−0.25, 0.49]	0.00	[−0.00, 0.00]	
GroupCG: materialism	−0.13	[−0.44, 0.19]	0.00	[−0.00, 0.00]	
					<i>R</i> ² = 0.123**
					95% CI [0.08, 0.16]

n = 880. A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. *sr*² represents the semi-partial correlation squared. ***p* < 0.01.

significant interaction in our model. The effect of personal norms for sufficiency is statistically significant and positive (beta = 0.50, 95% CI [0.41, 0.59], *t* (870) = 11.45.97, *p* < 0.001; Std. beta = 0.37, 95% CI [0.31, 0.44]), partially confirming H3b. Additionally, the effects of income (beta = 0.05, 95% CI [0.02, 0.08], *t* (870) = 3.43, *p* < 0.001; Std. beta = 0.11, 95% CI [0.05, 0.17]) and age (beta = 0.01, 95% CI [6.31e-03, 0.02], *t* (870) = 4.16, *p* < 0.001; Std. beta = 0.14, 95% CI [0.07, 0.21]) are statistically significant and positive.

We fitted a logistic model (estimated using ML) for predicting sufficiency-oriented mobile phone choice incorporating materialism and personal norms for sufficiency, as well as potential moderation effects for group and materialism and controls. The explanatory power of the model is weak (Tjur's *R*² = 0.09, see Table 5). The effect of materialism is statistically significant and positive (beta = 0.62, 95% CI [0.26, 0.99], *p* < 0.001; Std. beta = 0.48, 95% CI [0.21, 0.77]), which partially refutes H3a because we assumed a negative prediction. The effect of personal norms for sufficiency is statistically significant and negative (beta = −0.44, 95% CI [−0.65, −0.24], *p* < 0.001; Std. beta = −0.40, 95% CI [−0.58, −0.22]), which partially refutes H3b because we assumed a positive prediction of personal norms for sufficiency in our hypotheses. Furthermore, the effect of group x materialism is not significant, which does not confirm H4. However, the effect of gender is statistically significant and positive (beta = 0.37, 95% CI [0.04, 0.69], *p* = 0.027; Std. beta = 0.37, 95% CI [0.04, 0.69]) and the effect of income is also statistically significant and positive (beta = 0.07, 95% CI [4.94e-03, 0.13], *p* = 0.034; Std. beta = 0.17, 95% CI [0.01, 0.33]).

To summarize (see Table 6), H3a can only be partially confirmed: Materialism significantly positively predicts the *intention to buy a new mobile phone* in the assumed direction, however, with regard to the *intention to use mobile phones in a sufficiency-oriented manner* materialism was no significant (negative) predictor. In contrast, materialism significantly predicts the behavioral choice in a positive direction, which was not

assumed before. Partially in line with H3b, personal norms for sufficiency negatively predict the *intention to use mobile phones in a sufficiency-oriented manner* in the assumed direction but was no significant negative predictor for the *intention to buy a new mobile phone*. In regard to *sufficiency-oriented mobile phone choice*, personal norms for sufficiency negatively predict the voucher choice, which contradicts our assumption in H3b. Analyzing potential moderation effects of materialism with the intervention effect, we did not find any significant interaction. Thus, H4 needs to be rejected.

4.4. Sender-specific differences in the perception of sufficiency-promoting messages

To investigate RQ2 and analyze whether motive attributions toward the search engine and the online store as the sender of the messages differ, we conducted multiple independent-samples *t*-tests analyzing people's evaluations on two dimensions, i.e., altruistic and exploitative motive attributions. The *p*-values were Bonferroni-corrected to control for the family-wise error rate. Due to a programming error by the market research organization, we had to separate out participants who were presented with sufficiency-promoting messages either highlighted with a dynamic norm or not presented by a search engine (*N*_S = 304) and compare them to the responses of participants who were presented with the same messages in an online store (*N*_O = 276). Individuals in the control condition did not receive the corresponding dependent variables and were therefore excluded from the analysis. T-testing revealed a statistically significant difference between peoples' altruistic attributions, *t* (575.46) = 5.14, *p* < 0.001, *d* = 0.43. Participants who received the message from the search engine attributed a significantly higher altruistic motivation to the sender

TABLE 4 Regression results using intention to use mobile phones in a sufficiency-oriented manner as the criterion.

Predictor	<i>b</i>	<i>b</i> 95% CI	<i>sr</i> ²	<i>sr</i> ² 95% CI	Fit
(Intercept)	2.60**	[1.98, 3.22]			
GroupEG2	-0.57	[-1.40, 0.25]	0.00	[-0.00, 0.01]	
GroupCG	-0.48	[-1.18, 0.22]	0.00	[-0.00, 0.01]	
Materialism	0.00	[-0.15, 0.16]	0.00	[-0.00, 0.00]	
Norm for Sufficiency	0.50**	[0.41, 0.59]	0.13	[0.09, 0.17]	
Gender	0.00	[-0.15, 0.15]	0.00	[-0.00, 0.00]	
Income	0.05**	[0.02, 0.08]	0.01	[-0.00, 0.02]	
Age	0.01**	[0.01, 0.02]	0.02	[0.00, 0.03]	
GroupEG2: materialism	0.16	[-0.09, 0.41]	0.00	[-0.00, 0.01]	
GroupCG: materialism	0.17	[-0.05, 0.38]	0.00	[-0.00, 0.01]	
					<i>R</i> ² = 0.167**
					95% CI [0.12, 0.20]

n = 880. A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. *sr*² represents the semi-partial correlation squared. ***p* < 0.01.

TABLE 5 Logistic regression results to predict sufficiency-oriented mobile phone choice.

Coefficients	<i>b</i>	<i>SE</i>	Odds ratio 95% CI	<i>z</i>	<i>p</i>
(Intercept)	-2.55	0.74	[-4.03, -1.14]	-3.46	0.00***
GroupEG2	0.16	1.01	[-1.86, 2.11]	0.16	0.88
GroupCG	0.15	0.88	[-1.57, 1.87]	0.17	0.86
Materialism	0.62	0.18	[0.26, 0.99]	3.34	0.00***
Norm for Sufficiency	-0.44	0.1	[-0.65, -0.24]	-4.27	0.00***
Gender	0.37	0.17	[0.04, 0.69]	2.2	0.03*
Income	0.07	0.03	[0.01, 0.13]	2.11	0.03*
Age	-0.00	0.01	[-0.01, 0.01]	-0.13	0.9
GroupEG2: materialism	0.29	0.29	[-0.57, 0.58]	-0.00	1
GroupCG: materialism	-0.06	0.25	[-0.56, 0.44]	-0.24	0.81

n = 880. $\chi^2(9) = 69.2, p > 0.0001$. **p* < 0.05. ****p* < 0.001.

TABLE 6 Overview of results.

Variables	Intention to buy a new mobile phone	Intention to use mobile phones in a sufficiency-oriented manner	Sufficiency-oriented mobile phone choice	Results/Hypotheses
Intervention	-	-	-	H1 and H2 rejected
Materialism	✓	✓	✓✓	H3a partially confirmed
Interaction effects materialism	-	-	-	H4 rejected
Personal norms for sufficiency	✓✓	✓✓	✓*✓*	H3b partially confirmed
Income	-✓	✓✓	-	x
Age	✓	✓✓	✓	x
Gender	-	-	✓✓	x

✓ = Significant relationship supported by regressions, ✓ = Significant relationship supported by correlations, *Significant relationship but opposing to direction as hypothesized; x = additional significant results reported.

($M_S = 3.04$, $SD_S = 0.89$) compared to the participants that received the message from the online store ($M_O = 2.66$, $SD_O = 0.86$). Furthermore, there was a significant difference between exploitative attributions compared between the respective groups ($M_S = 2.51$, $SD_S = 0.75$, $M_O = 2.73$, $SD_O = 0.83$) indicated by the significant t-test, $t(558.4) = -3.32$, $p < 0.001$, $d = 0.28$.

5. Discussion

5.1. Theoretical contributions

In our investigation of RQ1, we conducted an experiment that examined the effects of a message emphasizing a dynamic norm, which provided practical advice on mobile phone use intentions and behavioral choices aimed at sufficiency. Contrary to our main hypotheses (H1 and H2), the results did not confirm the expected outcomes. Consequently, our study calls into question the previous findings that demonstrated a positive influence of dynamic norms on sufficiency-oriented behavior (e.g., [Sparkman and Walton, 2017](#); [Loschelder et al., 2019](#)) aligning instead with empirical studies that have not found conclusive evidence regarding the impact of dynamic norms on sufficiency-oriented behavior ([Aldoh et al., 2021](#); [Lee and Liu, 2021](#); [Çoker et al., 2022](#)). While it is important to note that the decision to (not) purchase mobile phones is heavily influenced by factors such as price, product features, quality, and brand ([Goswami and Behera, 2021](#)), which distinguishes it from the domains studied in prior research, we recognize similar challenges and limitations in attempting to modify habitual behavior through social normative communication interventions.

Additionally, in line with a prior study conducted by [Frick et al. \(2021\)](#), our results suggest that single, short-term communication interventions, even when conveying a normative message, are insufficient to influence intentions and choices toward sufficiency-oriented behavior. However, it is worth noting that approximately one-third of participants from all groups opted for a sufficiency-oriented coupon from a list of potential consumption options, regardless of the manipulation message they had previously encountered (29.1% in EG1, 34.8% in EG2, and 26.8% in CG; see [Table 2](#)). This observation leads us to conclude that the act of participating in the survey itself may have had an effect, as individuals were prompted to contemplate their actual mobile phone usage during the study. Previous research has demonstrated that the mere act of assessing consumption intentions can temporarily alter subsequent behavior, a phenomenon known as the “mere-measurement effect” ([Morwitz and Fitzsimons, 2004](#)) which was also evident in the field experiments conducted of [Frick et al. \(2021\)](#) and [Tröger et al. \(2021\)](#). Furthermore, individuals’ intentions and behaviors often exhibit biases toward self-centered judgments, such as the “better-than-average effect” ([Zell et al., 2020](#)), which has also been observed in the context of pro-environmental behavioral engagement ([Bergquist, 2020](#)). Another explanation for the similar tendencies toward sufficiency-oriented consumption across all groups could be attributed to the mere presence of alternatives. Research on circular mobile phones ([Hunka et al., 2021](#)), refurbished mobile phones ([Mugge et al., 2017](#)), or repairable mobile phones ([Reischl, 2021](#)), has shown that

when individuals are presented with actual consumption options related to sufficiency, they are more likely to consider them.

Especially in online media, short-term sufficiency-promoting messages may encounter challenges in targeting individuals effectively for several reasons. Firstly, online platforms, including online stores and search engines, often prioritize convenience, constant availability, quick access to consumer items, prominent placement of deals, and simplified checkout processes, which shape consumer expectations ([The Future Shopper Report, 2022](#)). Consequently, this emphasis on convenience and immediate gratification discourages individuals from considering the long-term consequences of their consumption choices. Secondly, the online context presents individuals with a vast array of options and offers, making it increasingly challenging for them to make informed decisions. The abundance of choices can lead to decision overload, where individuals may feel overwhelmed and struggle to navigate through available information effectively. Since nearly half of our original sample failed the manipulation check (reported either not consciously perceiving any of the info-boxes or not remembering having seen them), this finding highlights the difficulty of capturing individuals’ attention amidst the multitude of messages they encounter online. The sheer volume of messages and the fast-paced nature of online information consumption make it challenging for sufficiency-oriented messages to break through the “noise” and effectively influence individuals’ consumption decisions.

Our results indicate that the intention to purchase a new mobile phone (or the intention not to purchase one) is influenced by materialism. Interestingly, materialism also plays a positive role in explaining sufficiency-oriented mobile phone choices, which may seem counterintuitive initially. Furthermore, both the intention to buy a new mobile phone and the voucher choice are positively associated with materialism, but negatively associated with personal norms for sufficiency. One could argue that certain sufficiency-oriented behaviors, such as purchasing used products or giving used items as gifts with the belief that others will recycle or reuse them, share underlying motives with materialism. Buying a refurbished mobile phone, for instance, can be viewed as a behavior that is both ecologically conscious and symbolic of a sufficiency-oriented lifestyle that values nature while acknowledging the need for consumption to some extent. Additionally, purchasing a refurbished mobile phone can be associated with the positive aspects of materialism, as it encompasses various facets and offers short-term benefits, such as a compensatory function or the satisfaction of a sense of guilt through prosocial behavior through donations.

An alternative interpretation of the relationship observed in our study between sufficiency-oriented mobile phone choices and materialism relates to the symbolic function of consumption. Similar to how status motives can increase the desire for green products ([Griskevicius et al., 2010](#)), the motivation to gain reputation and status could drive individuals toward sufficiency-oriented choices. Previous research has demonstrated that prominent anti-consumption signals can enhance the willingness to engage in sufficiency-seeking behaviors, particularly among individuals with moderate to high status needs ([Armstrong Soule and Sekhon, 2022](#)). Consequently, it can be supposed that sufficiency-oriented consumption also possesses the ability to signal

one's identity to peers and validate one's values, akin to the concept of conspicuous consumption (Rucker and Galinsky, 2009).

Descriptive socio-demographic differences may also contribute to the interpretation of our results. Firstly, we found that female gender identity correlates positively with materialism but negatively with sufficiency attitudes, which contradicts previous research indicating that women tend to exhibit more environmentally friendly consumption habits (Bloodhart and Swim, 2020). However, gender differences in environmental behavior align with gendered social roles. Women generally exhibit less environmentally friendly consumer behavior in certain areas such as clothing, while men tend to display less environmentally friendly behavior such as frequent commuting by car (Briscoe et al., 2019; Kronsell et al., 2020; Swim et al., 2020). In the context of our study, considering gendered social roles, one interpretation could be that electronic retailing and online shopping, which are more positive about the use of technology, remain predominantly associated with men (Kanwal et al., 2022). Consequently, female participants in our experiment may have felt less confident in making a sufficiency-oriented choice, which deviates from the norm. In addition, previous research has indicated that women are more prone to engaging in conspicuous consumption and impulsive purchasing behaviors (Millan and Wright, 2018; Tarka et al., 2022), a finding supported by our results. Surprisingly, income does not play a significant role in sufficiency-oriented mobile phone intentions and behavioral choice. It is plausible to suspect that higher levels of consumption are dependent on individual's financial resources, as previous studies have shown that individuals with higher incomes, despite having an environmentally friendly identity, often engage in environmentally harmful behaviors (Büchs and Schnepf, 2013; Zhang et al., 2017).

In our investigation of RQ2, the present study contributes to the understanding of user perceptions regarding the sender of sufficiency-promoting communications, particularly online media. We found that participants perceive the motives of the fictional search engine as more altruistic and less exploitative compared to those of the fictional online store. The perception of search engines as a neutral and unbiased source of information (Purcell et al., 2012) appears to positively influence the perception of search engines as providers of sufficiency-promoting messages with altruistic and pro-environmental motives. Building upon previous research that has shown the direct positive impact of perceived credibility of a search engine on perceived value (Falcão and Isaías, 2020), our findings suggest that positive perceptions are reinforced by the implicit view of search engines as credible and trustworthy sources (Keane et al., 2008). However, if users perceive the info-boxes as sponsored links or explicit advertising, as found in other studies on user reactions (Clemons, 2009), their reactions may be negative. Furthermore, the perceived motives of the search engine may be negatively affected if there is a lack of clarity and transparency regarding the search engine's mechanism and ranking such as when the selection and listing criteria for presenting search results are hidden from the user.

Comparisons of our findings with previous research are challenging due to the limited existing empirical research on the perceived interests and motives of online media sending sufficiency-related messages. While researchers have examined corporate credibility in the context of online shopping and, with

online retailers' reputations being crucial factors for perceived product quality, perceived risk, and purchase intention (Rosillo-Díaz et al., 2019), there is a scarcity of empirical studies specifically focusing on the perceived interests and motives of online retailers when it comes to sustainability-related messages. Therefore, given the exploratory nature of our research, further empirical investigations are warranted to delve into the perceptions of different online media as senders of sufficiency-related communications.

5.2. Limitations

There is evidence suggesting that descriptive and injunctive norms should align in order to effectively influence behavior (Cialdini and Jacobson, 2021). However, it is important to note that we did not control for this factor in our study. We lack information on whether participants were aware of the descriptive norm and whether they perceived a correspondence between descriptive and injunctive norm through the dynamic norm presented in our experiment. It is worth mentioning that for norm-based messaging to be effective, individuals need to identify with the reference group (Tankard and Paluck, 2016; Sparkman et al., 2020). Consequently, it is possible that the broad group appeal we used ("people") was not specific enough for participants to feel a normative framework in which to implement their intentions. As a result, participants may not have felt a strong influence on their behavior. Furthermore, it is plausible that the design of messages emphasizing a dynamic norm was not suitable for the target audience. For example, the social referent (a researcher) used in our study may not have been meaningful to participants, or the timing and context in which the messages were received may not have been optimal for their effectiveness.

The implementation of our online experiment had certain limitations, which provide insights for the design and execution of future studies. One limitation is the potential lack of ecological validity of the online experiment, as it involved info-boxes presented by a fictitious online store or search engine. It remains uncertain whether individuals would respond differently in real-life scenarios involving actual companies with well-established brand associations. Another limitation is that the materials we used for the experimental manipulation were primarily based on text and information. However, modern online advertising often utilizes images and multimedia approaches. Therefore, our text-oriented material may have appeared unfamiliar or outdated to participants. Additionally, we did not control for factors such as the attractiveness of the design, the content and tone of the messages, or their relationship to the effectiveness of the communication. These factors could have influenced participants' perceptions and reactions to the messages, but we did not account for them in our study. Furthermore, the manipulation of the dynamic norm message being sent by a scientific source was only implemented in the second experimental group (EG2). This omission could have impacted the effectiveness of the sufficiency-promoting message, but we did not control for this factor.

Our measurement of sufficiency-oriented intention of mobile phone use was based on three items derived from Sandberg's (2021)

typology of sufficiency-oriented behavior. However, this measure was not validated, as indicated by its low reliability. Furthermore, in the statistical analyses of H1 and H2, we did not account for the fact that participants were assigned to six groups instead of three. Additionally, we did not control for the potential impact of different senders (search engine versus online store) on sufficiency-oriented intentions and behavioral choices, as the main effect of the communication manipulation was not significant.

Another limitation of our study is the small sample size. We had to significantly reduce the sample size due to a high error rate in the manipulation check, which was probably caused by the nearly identical design of the manipulation material in the two intervention groups. A larger sample size would have provided greater statistical power to detect significant effects. Furthermore, due to a misplaced filter, we were unable to assess differences in attitudes toward the sender of sufficiency-promoting messages (search engine or online store) between the experimental and control groups. Although this limitation prevented us from conducting a direct comparison between groups, our research focus was primarily on examining whether perceptions of the different senders differed. Therefore, we proceeded with the analysis using the incomplete data.

Lastly, we did not consider possible systemic effects. Research has indicated that demand-side climate-change policies may be susceptible to rebound effects, which can offset the intended environmental benefits. For example, [Amatuni et al. \(2020\)](#) found a rebound effect among individuals who did not own a car in Finland, as they ended up spending more on public transportation or holiday trips, thereby offsetting the emissions savings from not owning a car. In our study, the choice of the sufficiency-based voucher could have resulted in lower costs for consumers. However, if the money saved from choosing the voucher was redirected toward other forms of consumption, this could have led to negative environmental consequences. This systemic effect suggests that rebound effects may emerge from interventions aimed at promoting sufficiency-based consumption.

5.3. Learnings for marketing practice

While our study may have limitations and did not directly test the effectiveness of norms-based messages for promoting sufficiency-oriented mobile phone use, it does offer valuable practical insights for online media, marketers, and policymakers interested in encouraging sufficiency-oriented behavior. For example, it contributes to the existing knowledge on designing effective behavior change interventions.

Based on our findings and relevant literature, several suggestions can be derived for the design of communication aimed at promoting voluntary consumption reduction. Firstly, it is important to recognize that single, isolated interventions in online media may not be sufficient to bring about behavior change. Instead, research indicates that communication efforts could be repeated over time to have a lasting impact on individuals ([Nielsen et al., 2020](#)). Because messages promoting sufficiency-oriented alternatives may not be easily accessible or conspicuous enough in the online context to attract users' attention, specific

strategies may be needed to make sufficiency-promoting messages effective in online media: for example, by making them more prominent, providing them at the right time, and making it easy for users to respond to them. Another strategy that can be used to make sufficiency-promoting messages more effective in online media is targeting ([Cochoy et al., 2020](#); [Katsikeas et al., 2020](#)). For example, messages about sufficiency can be tailored to specific products, product categories, or consumer groups to make them more relevant to users.

A recent review of behavioral interventions to reduce single-use plastic consumption suggests that effective interventions should make the desired behavior as simple as possible, present the desired behavior as the default rather than the exception, and implement behavior change programs at times when people are more receptive to the desired behavior ([Borg et al., 2022](#)). Applying these principles to future communication efforts to promote sufficiency-oriented mobile phone use (not necessarily limited to online media) means that the sufficiency-oriented alternative to buying a new mobile phone must be economically attractive and easily accessible, i.e., sufficiency-related messages could be linked to incentives such as free or discounted repairs. A good example from the field is the recently introduced, government-funded repair program for broken electrical appliances, which is supported by a long-term communication campaign and has generated considerable interest among environmentally conscious consumers in Germany. In this way, 6,438 electrical appliances, 28% of which were mobile phones, were repaired in 2021 alone ([Eisentraut, 2022](#)). Public communication and campaigns, e.g., for mobile phone collection, could strengthen the relevance and visibility of individual company communication campaigns on sufficiency-oriented mobile phone use ([Welfens et al., 2016](#)). This combination could raise awareness among the general population about the environmental benefits of reusing, repairing, and recycling consumer electronics. In addition, publicizing sufficiency-promoting communications during marketing events such as the "Black Friday" weekend as part of the anti-consumerism movement would benefit from the attention that such global shopping events generate among more consumption-oriented consumers.

6. Outlook and conclusion

Our experimental study did not show any influence of dynamic norms on sufficiency-oriented mobile phone use in an online environment. This highlights the need for further investigation on the potential and effectiveness of dynamic norm messages in different areas of consumption beyond food and electronic devices. It would be valuable to explore the impacts of norm-based interventions using various norm sources and to examine behavior change outcomes in field experiments with representative samples, randomized group assignments, and more intensive interventions that involve repeated messages urging participants to reduce their consumption. Given the limited knowledge surrounding perceptions and effects of dynamic norms, qualitative research can also provide valuable insights into potential influences.

Despite contradictory results to the initial hypotheses, our study still offers an important contribution by reminding practitioners and researchers to carefully select behavior change tools when

supporting sufficiency-oriented consumption. It is evident that scattered and short-term sufficiency-promoting communication efforts may struggle to gain traction in online media, as they must compete with a plethora of engaging content that promotes lifestyles contrary to sufficiency-oriented values. Future efforts should focus on creating impactful and sustained interventions that effectively compete for attention and engage individuals in adopting sufficiency-oriented behaviors.

Data availability statement

The questionnaire, material, list of variables, raw data, analysis files, and output files are available online for reproducibility (OSF; <https://bit.ly/3vPM7cW>).

Ethics statement

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

Author contributions

MG, HE, and JB contributed to the conceptualization of the research design and methodology. JT, MV, and HE were responsible for data analysis. MG wrote the initial draft of the manuscript. JT, JB, and MG revised the manuscript. All authors read and approved the submitted version.

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Conflict of interest

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

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