

## Article

# Can Reflective Diary-Writing Increase Sufficiency-Oriented Consumption? A Longitudinal Intervention Addressing the Role of Basic Psychological Needs, Subjective Well-Being, and Time Affluence

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

**Keywords:** consumer behavior; diary method; intervention; psychological needs; behavioral intention; pro-environmental behavior; environmental psychology; self-reflection; reflective writing; sufficiency orientation

## 1. Introduction

How can we minimize ecological footprints and support lifestyles that are compatible with ecological limits? In face of the climate crisis [1,2] and the high consumption levels of industrialized nations [3], investigating ways to change non-ecological consumption patterns is critical. Although risk awareness about the climate crisis is generally high [4], individuals and societies still fail to perform behaviors that substantially lower CO<sub>2</sub>-emissions [5,6]. Current Western societal norms are embedded in growth imperatives [7], promoting materialistic goals as a means to a meaningful life, whilst perpetuating environmentally destructive consumption and human ill-being (i.e., lack of well-being and happiness) [8,9]. Given these growth imperatives, the societal and political debate on climate change mitigation has widely focused on efficiency improvements (i.e., more effective use of resources) over the past decade. However, a one-sided focus on efficiency

can lead to rebound effects, as it makes consumption more profitable (compare Jevons' paradox, [10–12]). Instead, the sufficiency sustainability strategy needs to be increasingly considered. According to the Oxford dictionary, sufficiency is “an amount of something that is enough for a particular purpose” [13]. The term entered the sustainability debate as a strategy that, in contrast to efficiency and consistency, aims at reducing absolute consumption of resources with the goal of meeting every human's basic needs [14–17]. It can be approached looking at both minimum and maximum thresholds for consumption (see [17,18]). However, most people refer to upper limits for consumption in Western consumerist cultures, such as Germany, that significantly contribute to environmental degradation and global socio-ecological injustice. What does a sufficiency orientation look like concretely?

### 1.1. Sufficiency Orientation as Multidimensional Construct

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

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

Balderjahn et al. [31] developed the *General Consciousness for Sustainable Consumption Scale* to measure an “intention to consume in a way that enhances the environmental, social, and economic aspects of quality of life” [31] (p. 182). In particular, three sub-dimensions correspond to the sufficiency sustainability strategy: (1) “voluntary simplicity”, defined as the voluntary reduction in resource use in peoples' everyday life (see also [32,33]); (2)

“collaborative consumption”, defined as the shared use of items for the purpose of saving resources (and money, see also [32,34]); and (3) “environmentally friendly consumption”, defined as consumer consciousness for environmentally friendly consumption regarding packaging, recycling, local production, and climate impact. Nevertheless, we argue that Balderjahn et al.’s [31] work does not capture the sufficiency construct in its entirety (it was not designed to do so in the first place). In our opinion, when measuring individual sufficiency orientation, one needs to incorporate attitudes in line with the sufficiency sustainability strategy. Thus, we build on recent work by Verfuert et al. who measure sufficiency orientation as an attitude reflecting a “person’s evaluation of a sufficiency-oriented lifestyle” [25] (p. 375). Former research showed that people who score high on sufficiency orientation actually consume less resources and have lower ecological footprints in several fields of action [25,35,36], such as clothing consumption [37], or in online shopping environments [38].

### 1.2. Sufficiency Orientation and Subjective Well-Being

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

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

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

### 1.3. Sufficiency Orientation and Time Affluence

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

Sufficiency-oriented practices (e.g., abstaining from buying unneeded products), however, save time and could contribute to a sense of time affluence [51,53]. Based on these findings, the direction of the relation between time affluence and sufficiency orientation remains unclear. We explored if:

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

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

Basic psychological need satisfaction may be an important concept to consider when investigating the psychology of sufficiency orientation. While need satisfaction is often considered a consequence of sufficiency, it is also understood to be a source of it [54]. People whose basic psychological needs are satisfied have more psychological resources to cope with challenges, such as climate change, may develop a sufficiency orientation, and in turn create contexts that further satisfy needs [55]. Such a process would be consistent with Self-Determination Theory [55,56], a dialectical, humanistic theory of basic psychological needs and human motivation. It proposes three innate basic psychological needs as pre-requisites for psychological functioning, well-being, and the experience of intrinsic motivation when performing specific actions. First, competence need satisfaction involves experiencing personal mastery in goal attainment and the ability to reach desired outcomes. Second, the basic need for autonomy is satisfied when people feel a sense of choice and volition and are able to act in absence of restrictions and coercion (e.g., hierarchies, time restrictions). Third, relatedness needs are satisfied when people feel meaningfully connected with important others. It is important to note that Deci and Ryan define needs as “innate psychological nutriment that are essential for ongoing psychological growth, integrity, and well-being” [55] (p. 3). Basic psychological needs are thus not the same as physiological needs (e.g., for nourishment, such as food or water) or drives. Basic psychological need satisfaction is always a function of the social context: Social contexts can be more or less need-satisfying. At the same time, people shape social contexts depending on their need satisfaction. Thus, need satisfaction and social contexts shape each other reciprocally.

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

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

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

Another factor influencing sufficiency orientation may be self-reflection. Reflection, in general, is a meta-cognitive strategy defined as the profound thought about something. It is relevant for goal-striving and accomplishing goals [67,68]. In self-reflection, the self is an essential, concrete object of thinking; it aims to broaden its own perspectives through new insights, analyses of the self in relation to others and the environment, and often pursues the goal of changing certain behaviors [69]. Self-reflection is key for successful learning [70,71] and is applied in therapy [72] or team work processes [73]. A series of

studies has shown that reflection interventions lead to a reduction in materialism: For example, when participants were asked to write short essays about their favorite intrinsic values over a prolonged period of time, they reported reduced materialism and benefits for well-being (i.e., increased positive affect and vitality) [74]. In another study, deep reflection about one's own mortality reduced materialism [75] and people who reflected on what they are grateful for reported less materialistic goals [76]. Kasser [44] concludes that self-reflection may redirect people's focus toward intrinsic values and goals. We argue that critical reflection about one's own consumption goes in line with a reflection about values and ways to live one's life, reducing materialism, as in other studies. Based on these empirical results and theoretical considerations, we expected reflection on one's own consumption to increase sufficiency orientation. Therefore, we hypothesized that:

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

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

Reflective diaries can induce reflective processes [77,78]. A diary is “a frequently kept, often daily, record of personal experiences and observations in which ongoing thoughts, feelings, and ideas can be expressed” without being observed or judged by someone else [79] (p. 204). They are commonly used to investigate psychological processes in everyday situations. They are common in work and organizational psychology [80], health psychology [81,82], and in particular in professional education science to support self-regulated learning and academic performance [78,83]. Reflective diaries, in particular, differ from log-like diaries, which are highly structured and list factual accounts only. Reflective diaries increase peoples' self-awareness and have an intimate character [79]. Self-reflection during the writing process aids people in identifying potential mismatches between their attitudes, intentions, and behaviors [79]. This process can be helpful for the modification of subsequent behavior [82]. Reid et al. [84] found that keeping a household diary and reflecting over consumption raised awareness for ecological behavior and influenced actual household consumption.

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

We argue that self-reflection could also help satisfy the basic psychological need for competence. For example, gaining new insights in one's own behavior and potentially deriving strategies to reduce one's own consumption may ease efforts to consume more sufficiency-oriented, given supportive structural pre-conditions. In fact, some literature suggests that self-reflection fosters performance and skills, which satisfies needs for competence [91,92]. In line, self-reflection should also satisfy needs for competence, enabling behavior change in favor of increased sufficiency orientation. We hypothesized that:

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



### 1.6. The Present Research

Based on these considerations, we examined whether inducing self-reflection through reflective diary writing meets peoples' needs for autonomy and competence and fosters sufficiency orientation. We assumed that self-reflection meets basic psychological needs, especially for autonomy and competence, and further fosters a sufficiency orientation. To investigate this, we ran a week-long online diary intervention study. We gave people either a reflective or a descriptive task: We asked people either to reflect about their personal experiences about attempting to consume sufficiency-oriented for a week (experimental group, EG) or to merely list what they had consumed each day over the course of a week (control group, CG). We measured short- and medium-term effects of the intervention and investigated the following hypotheses (see Figure 1 for an overview):

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

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

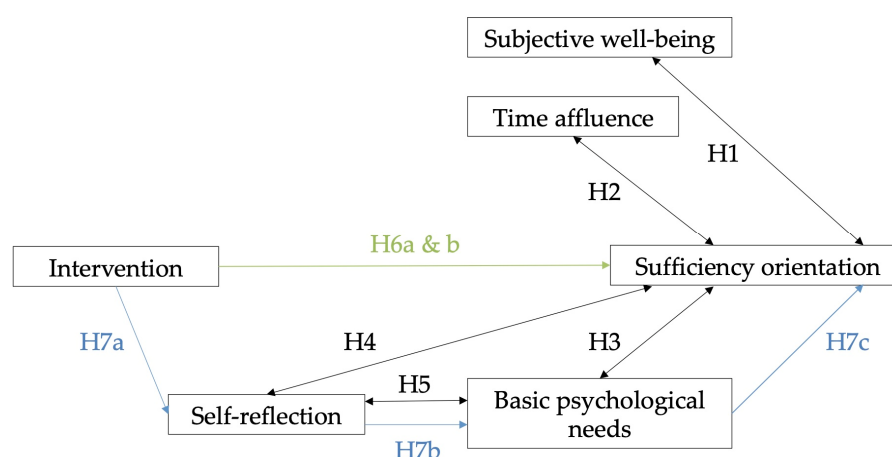


Figure 1. Overview of hypotheses.

## 2. Materials and Methods

### 2.1. Participants and Procedure

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

After participants gave their informed consent ( $N = 248$ ), we randomly assigned them to either the EG ( $n = 128$ ) or the CG ( $n = 120$ ). Depending on group membership,

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

Furthermore, before (T1) and after the intervention (T2), participants answered questions about their sufficiency orientation, basic psychological need satisfaction, self-reflection, time affluence, SWB, and socio-demographics (age, gender, education, income). We also assessed political orientation as a covariate due to its relations with sufficiency orientation and pro-environmental attitudes [24,94].

We excluded three people because they did not pass an attention check at T1 and ten outliers (i.e., participants who scored more than 2.5 *SDs* above or below scale mean values, compare pre-registration; for analyses without exclusion of outliers see Supplementary Material S2). Sample size for analysis at T1 was  $N = 223$ . In total, 69 participants did not participate in T2 (27.82% dropout rate). They did not systematically differ from completers on any study variable. We excluded participants that completed less than four diary entries ( $n = 7$ ), did not pass an attention check at T2 ( $n = 2$ ), and were outliers at T2 ( $n = 11$ ). The total sample size at T2 was  $N = 134$  ( $n_{EG} = 65$ ,  $n_{CG} = 69$ ). In total,  $N = 131$  participated in a follow-up assessment (T3) four weeks after T2, answering the same questions as in T1 and T2 (Please note that we decided to conduct the intervention over the course of one week because we wanted people to reflect on both working days and weekends and expected that an effect of the intervention would not be visible after only a few days. Furthermore, we chose a follow-up assessment after four weeks because we judged this as resulting in acceptable attrition rates. A longer time between the end of the intervention and follow-up measurement would have likely resulted in a higher attrition rate. In addition, we were interested if effects would be maintained over longer periods of time, which is of general interest in intervention studies regarding pro-environmental attitude and behavior changes [95]). There were no differences between completers and non-completers at T3 on any study variables. We excluded one participant who did not pass the attention check and  $n = 6$  outliers. Final sample size at T3 was  $N = 124$  ( $n_{EG} = 65$ ,  $n_{CG} = 59$ , see Supplementary Material S3 for participant flow chart). Ages ranged from 16 to 69 ( $M_{T1} = 32.56$ ,  $SD_{T1} = 12.60$ ). Our sample was female-dominated (78%), highly educated (63% had a Bachelor's degree or higher), and indicated left-leaning political orientation ( $M_{T1} = 26.50$ ,  $SD_{T1} = 15.12$ ; see Supplementary Material S1 for demographics at T2 and T3).

## 2.2. Intervention and Material

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

*Sufficiency orientation* was assessed using 13 items of the belief component of the *Consciousness for Sustainable Consumption Scale* ([31], e.g., “Even if I can financially afford a product, I only buy it if I really need it”). We excluded the social dimension from the complete item list of the original belief component because it did not assess sufficiency orientation as defined in this study (see [31]). For the sake of completeness, we list the respective items in Supplementary Materials S3–S5. Participants answered this part of the sufficiency items on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Furthermore, we used six items by Verfuert et al. [25] from the *Sufficiency Attitude Scale* (e.g., “All the new things that are sold all the time are a big waste of resources to me”) and seven own items (e.g., “Abstaining from consumption can significantly reduce

the extent of global warming"). Participants answered these items on five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree). An exploratory main axis analysis with oblique rotation revealed four dimensions (see Supplementary Material S1 for details) after removing nine items with  $KMO < 0.65$ ,  $h^2 < 0.2$ , factor loadings  $< 0.3$ , or that were cross-loading: (1) Consumption critique ( $\alpha_{T1-T3} = 0.82 - 0.87$ ); (2) voluntary simplicity ( $\alpha_{T1-T3} = 0.80 - 0.88$ ); (3) collaborative consumption ( $\alpha_{T1-T3} = 0.68 - 0.83$ ); (4) eco-friendly consumption ( $\alpha_{T1-T3} = 0.68 - 0.79$ ).

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

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

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

Basic psychological need satisfaction was measured with 15 items of the *Balanced Measure of Psychological Needs Scale* ([100]; German translation: [101]). We adapted the scale to measure satisfaction of the basic psychological needs for autonomy (e.g., "I was free to consume my own way") and competence (e.g., "When it came to consumption I took on and mastered hard challenges") in the context of consumption, and used the original scale to measure relatedness need satisfaction (e.g., "I felt a sense of contact with people who care for me, and whom I care for"). We adapted one item by Sheldon et al. [102] to supplement the autonomy subscale ("My consumption choices were based on my true interests and values"), and adapted one item by Taljaard and Sonnenberg [65] ("I am able to live frugally") to complement the competence subscale. Participants answered the items on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). An exploratory main axis analysis with oblique rotation revealed the items to cluster slightly differently than expected after removing two items with  $KMO < 0.6$ , and five items with  $h^2 < 0.25$  (see Supplementary Material S1 for details). While the relatedness subscale was retained ( $\alpha_{T1-T3} = 0.83 - 0.85$ ), the other items clustered on need satisfaction ( $\alpha_{T1-T3} = 0.60 - 0.73$ ) and need frustration ( $\alpha_{T1-T3} = 0.72 - 0.78$ ) in the context of consumption, respectively.

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

*Intervention.* The aim of the intervention was to encourage participants to reflect about their everyday consumption experiences in order to increase their sufficiency orientation. After all participants completed the first questionnaire, assessing baseline values of the respective study variables, the EG read a short text about sufficiency and its significance. The EG was then encouraged to take a few minutes to remember the situations in which they bought, consumed, or refrained from consuming something over the course of their day. We provided four guiding questions for the purpose of inspiring self-reflection (see [46], e.g., "What did I feel and think today when I consumed something, wanted to consume, or refrained from consuming?", see Supplementary Material S3 for complete instructions). Otherwise, we designed the diary in a way that would be as supportive of participant's autonomy as possible. People in the CG did not receive an information



text and got the descriptive task to list everything they had bought, used, and consumed on that respective day. We provided some guiding questions to help respondents to remember consumed items, for example “What material goods have I consumed today? Some examples: Clothing, hygiene products, electronics, etc.?.”

### 3. Results

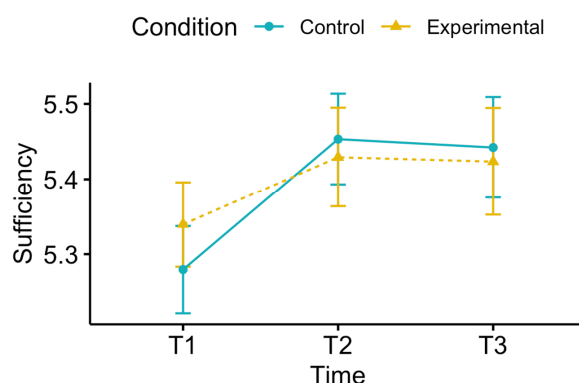
We analyzed data using the statistical program R, version 4.0.3 [104]. Detailed results, a complete analysis without exclusion of pre-registered outliers, and syntax used to reproduce the analysis can be found in Supplementary Materials S1, S2, and S6.

#### 3.1. Descriptive Statistics

Descriptive statistics of all study variables are displayed in Table 1. Correlations of sufficiency orientation with study variables can be found in Table 2. On average, participants reported high sufficiency orientation, high basic psychological need satisfaction, medium self-reflection, SWB, and time affluence at T1.

#### 3.2. Effect of the Intervention

A series of Welch *t*-Tests revealed that EG and CG did not significantly differ on any study variables at T1 (see Supplementary Material S1). A G\*Power analysis [105] assuming a small to medium effect size of  $f = 0.2$ ,  $1 - \beta = 0.80$ , and  $\alpha = 0.05$  suggested that our initial sample was sufficiently large to use mixed ANOVA for testing our assumptions H6a and H6b. Five mixed ANOVAs to test for effects of the intervention (between subject variation), time (within subject variation), and their interaction on sufficiency orientation (overall and subscale mean scores) showed no significant effect of the intervention ( $F[1, 95] = 0.12$ ,  $p = 0.911$ ) but a significant change in overall mean sufficiency orientation scores over time ( $F[2, 190] = 12.91$ ,  $p < 0.001$ ,  $\eta^2 = 0.024$ ). There was no significant interaction between group and time on overall sufficiency orientation ( $F[2, 190] = 0.32$ ,  $p = 0.725$ ; Figure 2). Pairwise comparisons between time points using *t*-tests with Bonferroni correction, indicated a significant increase for overall sufficiency orientation from T1 ( $M_{CG} = 5.28$ ,  $SD_{CG} = 0.61$ ;  $M_{EG} = 5.34$ ,  $SD_{EG} = 0.59$ ) to T2 ( $M_{CG} = 5.45$ ,  $SD_{CG} = 0.50$ ;  $M_{EG} = 5.43$ ,  $SD_{EG} = 0.53$ ;  $t[126] = -4.07$ ,  $p < 0.001$ ,  $p_{adj} < 0.01$ ,  $\eta^2 = 0.15$ ) and from T1 to T3 ( $M_{CG} = 5.44$ ,  $SD_{CG} = 0.51$ ;  $M_{EG} = 5.44$ ,  $SD_{EG} = 0.51$ ;  $t[117] = -3.52$ ,  $p < 0.001$ ,  $p_{adj} = 0.002$ ,  $\eta^2 = 0.09$ , Figure 2). We analyzed subscales with mixed ANOVAs. However, none of the interactions were significant (see Supplementary Material S1). These results do not confirm H6a and H6b.



**Figure 2.** Mean sufficiency orientation scores (y-axis) over three assessment points (x-axis) with standard errors for both groups.

To test H7a, we ran a mixed ANOVA for effects of the intervention (between subject variation), time (within subject variation), and their interaction on self-reflection scores. This analysis revealed no effect of the intervention ( $F[1, 95] = 0.73$ ,  $p = 0.394$ ) but a significant change in self-reflection over time ( $F[2, 190] = 117.73$ ,  $p < 0.001$ ,  $\eta^2 = 0.356$ ). There was no significant interaction ( $F[2, 190] = 0.16$ ,  $p = 0.854$ ). Pairwise comparisons, using paired *t*-tests

with Bonferroni correction on time points indicated that all comparisons were significant (T1 to T2:  $t[126] = -17.4$ ,  $p_{adj} < 0.001$ ,  $\eta^2 = 0.71$ ; T1 to T3:  $t[117] = -2.73$ ,  $p_{adj} = 0.007$ ,  $\eta^2 = 0.06$ ; and T2 to T3:  $t[100] = 13.4$ ,  $p_{adj} < 0.001$ ,  $\eta^2 = 0.64$ ). Self-reflection mean scores in both groups increased from T1 ( $M_{CG} = 3.04$ ,  $SD_{CG} = 0.71$ ;  $M_{EG} = 3.14$ ,  $SD_{EG} = 0.74$ ) to T2 ( $M_{CG} = 4.04$ ,  $SD_{CG} = 0.55$ ;  $M_{EG} = 4.16$ ,  $SD_{EG} = 0.35$ ) and decreased again at T3 ( $M_{CG} = 3.17$ ,  $SD_{CG} = 0.67$ ;  $M_{EG} = 3.27$ ,  $SD_{EG} = 0.62$ ). This indicates that self-reflection increased across groups and indicates that our manipulation was not specifically successful, contrary to H7a. Furthermore, self-reflection and basic psychological need satisfaction were unrelated at T2, contrary to H5.

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

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

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

SWB correlated slightly positively with overall sufficiency orientation, collaborative consumption, and eco-friendly consumption at T2 (see Table 2). Furthermore, SWB correlated with voluntary simplicity across time points (T1:  $r[221] = 0.17$ , 95%CI[−0.01, 0.24],  $p < 0.05$ ; T3:  $r[116] = 0.21$ , 95%CI[0.02, 0.34],  $p < 0.01$ ). Further, SWB at T2 correlated with overall sufficiency orientation at T3 ( $r[99] = 0.27$ , 95%CI[0.07, 0.43],  $p < 0.01$ ) and collaborative consumption at T3 ( $r[99] = 0.28$ , 95%CI[0.04, 0.42],  $p < 0.01$ ), and with voluntary simplicity at T3 ( $r[99] = 0.20$ , 95%CI[0.04, 0.42],  $p < 0.10$ ). These results indicate a trend for positive associations of SWB and sufficiency orientation but only partially confirm H1.

Time affluence and sufficiency orientation did not significantly correlate at T1 and T2 (see Table 2 and Supplementary Material S1). At T3, time affluence correlated with voluntary simplicity ( $r[122] = 0.19$ , 95%CI[−0.02, 0.31],  $p < 0.05$ ), and in tendency with consumption critique ( $r[122] = 0.16$ , 95%CI[0.03, 0.35],  $p < 0.10$ ) and overall sufficiency orientation ( $r[122] = 0.16$ , 95%CI[0.01, 0.34],  $p < 0.10$ ). These findings are in contrast to H2.

Sufficiency orientation and basic psychological need satisfaction in the consumption context showed medium positive correlations across groups. At T1, need satisfaction correlated with overall sufficiency scores ( $r[221] = 0.30$ , 95%CI[0.12, 0.37],  $p < 0.01$ ), consumption critique ( $r[221] = 0.21$ , 95%CI[−0.02, 0.27],  $p < 0.01$ ), voluntary simplicity ( $r[221] = 0.29$ , 95%CI[.18, 0.41],  $p < 0.01$ ), and collaborative consumption ( $r[221] = 0.14$ , 95%CI[−0.03, 0.22],  $p < 0.05$ ). There was a similar pattern at T2 (see Table 2) and T3 (overall:  $r[122] = 0.28$ , 95%CI[.11, 0.40],  $p < 0.01$ ; consumption critique:  $r[122] = 0.34$ , 95%CI[0.09, 0.41],  $p < 0.01$ ; see Supplementary Material S1). Furthermore, we found a positive correlation between need frustration and eco-friendly consumption at T1 ( $r[221] = 0.14$ , 95%CI[.00, 0.25],  $p < 0.05$ ) and negative correlations between need frustration and overall sufficiency orientation ( $r[122] = -0.12$ , 95%CI[−0.22, 0.11],  $p < 0.10$ ) and consumption critique ( $r[122] = -0.20$ , 95%CI[−0.34, 0.03],  $p < 0.05$ ) at T3. These results are in line with our hypothesis and partially confirm H3.

Self-reflection and sufficiency orientation were unrelated across all time points (see Table 2 and Supplementary Material S1), not confirming H4.

### 3.4. Predicting Sufficiency Orientation

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

**Table 1.** Descriptive statistics of study variables across time points and groups.

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

**Table 2.** Spearman correlations of sufficiency orientation and study variables at T2.

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

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

**Table 3.** Hierarchical multiple regression analyses predicting sufficiency orientation at T2 (after the intervention).

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

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

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

#### 4. Discussion

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

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

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

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



their behavior and have an implemental mindset, other techniques such as the formulation of implementation intentions should be added to reflection, in order to increase successful goal-attainment (see [111,112]). A diary intervention focused on reflection and monitoring one's behavior is potentially more effective in participants that score lower on sufficiency orientation and are in pre-decisional action phases. Tailoring an intervention that both measures peoples' mind-sets and action phases may be most effective and sustainable in strengthening sufficiency orientation.

Furthermore, our intervention may not have been specific and timely enough to encourage reflection only in the intervention group. Contrary to our expectations, self-reflection and sufficiency orientation were less positively and clearly related as predicted. Participation in the study itself increased people's reported self-reflection, suggesting that both groups engaged in a reflective exercise. In a study by Hussein et al. [113], reflective diaries posed more concrete questions that engaged participants in mindful thinking right at the time of consumption (i.e., when eating). For instance, participants were asked about detailed features of the meal (e.g., smell) and prompted to put themselves in relation to the food they consumed and to reflect on what consuming that food meant for them in that moment. In contrast, our diary reflection was temporarily distant from the actual behavior and inspirational prompts were less specific. Accordingly, sufficiency orientation may be supported using more detailed, specific questions that engage people in reflection right at the time of consumption or immediately afterwards. This would be effective to intervene in habitual consumption, as timely reflection may better capture important salient feelings while consuming, inner conflicts, or ambivalences, and may better influence subsequent decision making (e.g., [114,115]).

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

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

Given that the underlying mechanisms of previous reflection interventions remain unclear, it may not have been the reflective process per se that was effective in other reflection interventions. One such underlying driver may be the satisfaction of basic psychological needs through the reflective process. However, self-reflection in this study did not influence basic psychological need satisfaction. Several explanations are possible: Perhaps a simple reflection exercise was not sufficient to influence need satisfaction, which is also influenced by other factors, such as the social context (see [87]). Furthermore, the instrument used to assess self-reflection had questionable psychometric properties [99]. Future studies should employ a reliable and valid measure of self-reflection to investigate its effects.

Nevertheless, basic psychological need satisfaction in the consumption context was an important correlate of sufficiency orientation in our study. This is in line with previous studies showing a positive relationship between basic psychological need satisfaction and pro-environmental behaviors, such as reduced clothing consumption [65] and well-being in voluntary simplifiers [66]. We expected this relation based on the literature on materialism and need frustration [44]. This finding is also in line with the sufficiency literature that argues in favor of infrastructures (e.g., possibility of voluntary working time reduction) that might assist in satisfying basic psychological needs and, thus, support sufficiency orientation and behavior [27,47]. Even though there are sporadic findings on basic psychological need satisfaction and sufficiency-oriented practices, our study is

the first to systematically investigate sufficiency orientation as a multifaceted construct in relation to basic psychological need satisfaction. We carefully argue that our study aids in integrating previous findings on individual behaviors into a more encompassing generalizable whole. Based on the relations we found in our study, we believe that it is possible to draw inferences on the relationship of basic psychological need satisfaction with other sufficiency-oriented practices.

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

Our results show that sufficiency orientation and SWB are positively related whilst causal relationships between them remain unclear. This finding fits into literature showing a positive relation between SWB and different facets of a sufficiency-oriented lifestyle, such as a voluntarily simple lifestyle [66], sufficiency-oriented clothing consumption [65], or decreased materialism [44,45,51].

Overall sufficiency orientation was unrelated with time affluence indicating that relations between time affluence and sufficiency orientation remain unclear. However, time affluence was a negative predictor of collaborative consumption. Thus, the lower the perceived time affluence the more participants intended to engage in collaborative consumption. This is an interesting finding, as one may have predicted the relationship the other way around: It requires time to find networks where goods and services are shared. Thus, when people do not perceive to have time affluence buying instead of sharing or renting may be the quicker option.

#### *4.4. Strengths and Limitations*

Our study has several strengths compared to previous studies in this field of research but could further be amended methodologically. By using a longitudinal experimental approach, our study contributes knowledge on sufficiency orientation, its psychological correlates, and (potential) modifiability over time. Even if we found small to medium correlations (i.e., the role of basic psychological need satisfaction) we were not able to detect causal relationships between self-reflection, basic psychological need satisfaction, and sufficiency orientation. As our intervention was not specific enough to detect why sufficiency orientation scores increased independently of group membership, future studies should explore if more elaborated and specific reflections can nevertheless increase sufficiency orientation, and investigate how basic psychological need satisfaction could foster this process. Furthermore, increasing the duration of the intervention and also elaborating longer-term effects should be of interest for future research [79,95,119,120].

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

### **5. Conclusions**

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

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

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

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