



# Explicit and Implicit Affective Attitudes toward Sustainability: The Role of Mindfulness, Heartfulness, Connectedness to Nature and Prosocialness

Annica Winkelmair<sup>1</sup> · Markus Siebertz<sup>1</sup> · Leonardo Jost<sup>1</sup> · Franziska Anna Schroter<sup>1</sup> · Christopher Timm Johannes Bartenschlager<sup>1</sup> · Petra Jansen<sup>1</sup>

Accepted: 6 June 2023  
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## Abstract

The present study aims to investigate explicit and implicit affective attitudes toward sustainability, aspects of mindfulness, and their related factors. Therefore, different areas of sustainability (e.g., mobility, nutrition, packaging) were considered. We focused mainly on the indirect effects of mindfulness on attitudes through prosocialness and connectedness to nature. Furthermore, heartfulness, as the emotional quality of mindfulness, was considered. 458 subjects answered a series of questionnaires (mindfulness, connectedness to nature, prosocial behavior, gratitude, and self-compassion questionnaire) and completed an explicit affective evaluation task, as well as an affective priming task measuring implicit attitudes. The participants explicitly evaluated sustainable concepts more positively in comparison to non-sustainable ones. There was no significant correlation between implicit and explicit affective attitudes. Furthermore, the results of structural equation modeling revealed inner awareness and insight as predictors for prosocialness, and prosocialness in turn for the explicit affective attitudes toward sustainability. In addition, exploratory analyses showed a significant relationship between self-compassion and explicit attitudes toward sustainable concepts and a significant overall relation between gratitude, prosocialness, and explicit attitudes toward sustainable concepts. None of the relations to the implicit attitudes was significant. Our findings suggest prosocialness as a relevant mediating factor for the relation of explicit attitudes toward sustainability and mindfulness. However, this connection might be more complex, and the differentiation of mindfulness aspects inner and outer awareness seems insightful and should be considered even more in further research.

**Keywords** Attitudes · Sustainability · Mindfulness · Heartfulness · Connectedness to Nature · Prosocialness

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✉ Annica Winkelmair  
Annica.Winkelmair@ur.de

<sup>1</sup> Faculty of Human Sciences, University of Regensburg, Universitätsstraße 31, 93053 Regensburg, Germany

## 1 Introduction

The progressing ecological crisis, population growth, and, therefore, the increasing demand for consumption goods puts the issue of sustainability and how sustainable consumer behavior can be promoted in the focus of many research projects. The European Commission defines sustainability as the use of resources in a way that the capacity of the earth is not exceeded (“Sustainable Food—Environment—European Commission”, 2016). Recently it has been acknowledged that an inner transformation, in the sense of exploring and addressing inner dimensions, is relevant for sustainability to support individual, collective, and systemic change (Woiwode et al., 2021) and that the preoccupation with the global change toward sustainability has neglected the transformation of the “inner worlds” so far (Ives et al., 2020). This inner transformation can include concepts like people’s values, personal growth through compassion, and personal attitudes (Woiwode et al., 2021). Individual consumer background variables such as socio-demographic factors (Panzone et al., 2016) and personality (Hopwood et al., 2022) are connected to sustainability. In general, there is evidence for a considerable association between personality traits and pro-environmental attitudes and behaviors (Soutter & Möttus, 2021). For instance, regarding the choice of organic food, extraversion and openness to experience in the Big Five personality model show opposing relations to the attitudes of organic foods (Gustavsen & Hegnes, 2019).

However, sustainable and enduring change in behavior is difficult and complex, as, for example, Böhme’s relational lifestyle approach suggests (Böhme et al., 2022). Since attitudes are identified as a central concept for explaining actual behavior in the consumer behavior literature (Schäufele & Janssen, 2021), one relevant question is which factors are related to the attitudes toward sustainability.

### 1.1 Explicit and Implicit Attitudes toward Sustainability

Attitudes can be differentiated into explicit and implicit ones. While explicit attitudes can be reported and consciously controlled, implicit attitudes are attitudes that people have no explicit awareness of and whose activation cannot be controlled (Rydell & McConnell, 2006). Previous research in the field of sustainability has demonstrated that implicit and explicit attitudes do not necessarily correlate with each other, implying a low congruence between explicit and implicit sustainability orientations (Steiner et al., 2018). The study of Jansen et al. (2021) confirmed this result and provided evidence for a more positive explicit attitude toward e-mobility compared to gasoline cars. In contrast, the affective implicit rating did not show such a difference.

Sustainable behavior can be explained through several theoretical frameworks. One of them is the stage model of self-regulated behavior change that has been incorporated in former studies of mindfulness (SSBC; Bamberg, 2013). In this model, attitudes play an essential role. The SSBC-model, related to the model of action phases (Heckhausen & Gollwitzer, 1987), includes a fixed sequence of stages for behavioral change (predecision, preaction, action, and postaction stage). In addition, the authors suggest

stage-specific different forms of intentions and predicting variables. In the predecision stage, goal intention, social and personal norms, and (explicit) attitudes play an important role in progressing to the next stage and, ultimately, sustainable behavior (Richter & Hunecke, 2020).

Thus, a person's attitudes are a crucial factor in this early stage and previous research has provided evidence for attitudes to be predictors of actual behavior. However, there is considerable variability in attitude-behavior consistency (Glasman et al., 2006). An attitude-behavior gap exists, which implies that even though consumers might have positive attitudes toward sustainable products, they do not always purchase them (Morwitz et al., 2007; Park & Lin, 2020; Schäufele & Janssen, 2021). In the framework of the SSBC-model, this gap could be explained by other factors of the model as attitudes are only one predictor for sustainable change behavior. Considering implicit attitudes might be a valuable extension of the model and could play a role in the attitude-behavior gap (Jansen et al., 2021; Siebertz et al., 2022). Interestingly, there seems to be a relation between the trait or dispositional aspect of mindfulness and attitudes toward sustainability, even though this relation differs between studies (Jansen et al., 2021; Siebertz et al., 2022).

## 1.2 Mindfulness and Sustainability

Mindfulness is defined as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p. 145). Current research discusses the concept of mindfulness as a potential mechanism to promote sustainable consumption behavior and lifestyle (Ericson et al., 2014; Fischer et al., 2017; Geiger et al., 2020). However, there is no broad agreement on the different aspects of mindfulness (Van Dam et al., 2018).

The multidimensionality of mindfulness is reflected in the measurement of dispositional mindfulness. The Comprehensive Inventory of Mindfulness Experience (CHIME; Bergomi et al., 2014) allows a detailed differentiation. It contains the subscales inner awareness, outer awareness, acting with awareness, openness, acceptance, decentering/nonreact, insight, and relativity of thoughts. The subscale acting with awareness describes conscious behavior and presentness; openness means an open, non-avoidant attitude and acceptance, being open to things as they occur in the present without having the intention to change them. Decentering/nonreact measures a non-reactive, decentered orientation; insight means an insightful understanding, and relativity of thoughts refers to an awareness of the relativity of all thoughts as they come and go. The CHIME is the first questionnaire that differentiates awareness into two aspects: inner and outer awareness. While inner awareness focuses on the inner, bodily-based processes, outer awareness describes the awareness of the surroundings, like the environment. The recent study of Jansen et al. (under review) showed that this differentiated consideration of awareness should be considered. Their structural equation model revealed that sustainable attitudes were predicted by the indirect effects of inner awareness, outer awareness, and insight via prosocialness and by outer awareness and insight via

connectedness to nature. These findings emphasize once again the possible role of different aspects of mindfulness regarding attitudes toward sustainability.

Several approaches state how mindfulness can contribute to more sustainable behavior. Rosenberg (2004) proposes enhanced awareness of automatic behavior as one possible mechanism. Due to routines and advertising, people are used to behaving in the same, familiar manner and hence, to buying the same advertised products. According to Fischer et al. (2017), mindfulness could make underlying cognitive-behavioral processes more available and facilitate more deliberate choices by disrupting routines. Furthermore, "mindfulness might re-install a sense of interconnectedness and interrelatedness between people as a genuine (or synergetic), non-consumerist satisfier of the need for fulfillment" (Fischer et al., 2017, p. 546). Geiger et al. (2019) name at least five potential areas for promoting sustainable consumption behavior through mindfulness: (1) disruption of routines, (2) congruence of attitude and behavior, (3) prosocial behavior and connectedness to nature and others, (4) non-material values, and (5) well-being. Only partly consistent with this classification, Thiermann and Sheate (2021) suggest six key factors for the relation between mindfulness and sustainability on the individual level. In contrast to Geiger et al. (2019), they identified the connection to nature and prosocial behavior as separate factors, whereas Geiger et al. (2019) put both aspects together as one mechanism. The six key aspects are as follows: (1) increased awareness, (2) improved personal health and subjective well-being, (3) higher levels of connectedness to nature, (4) stronger prosocial tendencies, (5) stronger intrinsic values, and (6) greater openness to new experiences. Wamsler et al. (2018) postulate that mindfulness should be considered a core concept in sustainability research. Besides looking at the effect of intervention studies, they claim it is worth including the individual mindfulness disposition and linking it to sustainability. This study adds to this while focusing on the warm quality of mindfulness – heartfulness -, and attitudes toward sustainability.

### 1.3 Heartfulness and Sustainability

Jon Kabat-Zinn (2003) stated that mindfulness, in addition to its qualities of awareness, has a gentle emotional quality that can be described as heartfulness. This heartfulness aspect can be investigated with the concepts of self-compassion (Neff, 2003), which is a measure of heartfulness toward the own person, and gratitude (Emmons & McCullough, 2003), which is an indicator of heartfulness toward others (Voci et al., 2019). The concept of self-compassion can be differentiated into the aspects of self-kindness vs. self-judgment, mindfulness vs. over-identification, and common humanity vs. isolation (Neff, 2003). Gratitude is defined as the recognition to respond to others with grateful emotion due to their benevolence (McCullough et al., 2002).

It has been shown that gratitude promotes sustainable resource extraction under the condition of rapidly depleting resources (Kates & DeSteno, 2021). A generally positive emotional state could not explain this effect; therefore, gratitude might help producing sustainable behavior. Furthermore, a statistically significant and moderate

positive correlation between gratitude and prosocialness was demonstrated (Ma et al., 2017).

#### 1.4 Connectedness to Nature, Prosocialness, and Sustainability

Connectedness to nature comprises a stable state reflected by a sustained awareness of the interrelatedness between the own person and the rest of nature (Thiermann & Sheate, 2021). A positive correlation exists between connectedness to nature and mindfulness (Schutte & Malouff, 2018) and to sustainable behavior (Whitburn et al., 2020). Prosocial behavior or prosocialness describes the behavior which benefits others at the individual or group level but can be costly to the individual (Böckler et al., 2018). It can be differentiated into altruistically motivated, norm-motivated, and self-reported prosocial behavior, which can be improved by distinct mental training (Böckler et al., 2018). There is evidence that sustainable behavior is often linked with prosocial behavior (de Groot & Thøgersen, 2018). The study of Richter and Hunecke (2022) showed a relationship between mindfulness and pro-environmental behavior, mediated by connectedness to nature and personal ecological norms. In addition, in the study of Jansen et al. (under review), a relation between prosocialness and both, connectedness to nature and sustainable attitudes was identified.

The importance of connectedness to nature and prosocialness for sustainable behavior is described in the framework of the two-pathway model of pro-environmental behavior (Thiermann & Sheate, 2021). In this model, besides a normative pathway, a relational pathway is included, which is based on connectedness to nature on the one hand and empathy and compassion on the other hand (which can be considered as two aspects of prosocial behavior). If someone increases the relational pathway through mindfulness practice, for example, the motivation to act pro-environmental becomes more internalized (Thiermann et al., 2020).

#### 1.5 The Goal of this Study

The present study investigates the explicit and, as a new aspect, the implicit attitudes toward different aspects of sustainability and their related factors. Previous research suggests prosocialness and connectedness to nature as main factors referring to the potentials of mindfulness for sustainability (Fischer et al., 2017; Geiger et al., 2019). In the recent study of Jansen et al. (under review), prosocialness was shown to be a mediator between the mindfulness facets inner and outer awareness, and insight and sustainable attitudes. Connectedness to nature, on the other hand, was found to be a mediator between the mindfulness facets outer awareness and insight and sustainable attitudes. Therefore, the indirect paths of the specific mindfulness facets through the mediators prosocialness and connectedness to nature shall be investigated in this study. Furthermore, since the “warmth quality” of mindfulness is not included in any dispositional mindfulness measurement, two aspects of heartfulness will be incorporated: gratitude and self-compassion. As an extension to the studies of Jansen et al. (2021) and Siebertz et al. (2022), more aspects of sustainability than mobility and food will be considered. The following hypotheses were investigated:

H1) Participants have a more positive explicit affective attitude toward terms of sustainable concepts compared to terms of non-sustainable ones. This differentiation cannot be shown within the implicit attitudes since we expect an “individual green-washing effect” regarding the explicit attitudes. If explicit and implicit attitudes correlate, there might only be a small effect.

H2) It is assumed that the mindfulness dimensions inner awareness, outer awareness, and insight are positively related to prosocialness. Prosocialness, in turn, is assumed to be related to a more positive explicit and implicit attitude toward sustainability.

H3) It is assumed that the mindfulness dimensions outer awareness and insight are positively related to connectedness to nature. Connectedness to nature, again, is supposed to be positively related to explicit and implicit attitudes toward sustainability.

H4) A positive relation of the heartfulness aspect gratitude and prosocialness is expected. As stated in Hypothesis 2, prosocialness, in turn, is assumed to be related to a more positive explicit and implicit attitude toward sustainability.

In an exploratory part of the analysis, the possible relation that self-compassion and the mindfulness aspects of decentering, acceptance and acting with awareness share with prosocialness, connectedness to nature, and explicit and implicit attitudes toward sustainability will be investigated. Also, exploratorily, we investigate the direct and indirect relations via prosocialness and connectedness to nature of the mindfulness dimensions inner awareness, outer awareness, and insight with the explicit and implicit attitudes. In addition, the direct and indirect relations via prosocialness and connectedness to nature of gratitude and the two self-compassion dimensions with the explicit and implicit attitudes toward sustainable concepts will be explored.

## 2 Materials and Methods

### 2.1 Participants

We calculated the required sample size prior to the collection of data. Concerning the first hypothesis, with a small effect size of  $d=0.30$ , an alpha-level of  $\alpha=0.05$ , and a power of  $1-\beta=0.95$ , a power analysis with G\*power for the dependent t-test resulted in  $N=122$  to detect significant differences in the explicit and implicit affective attitudes toward sustainable and non-sustainable concepts (Faul et al., 2007). For Hypotheses 2 to 4, a Monte Carlo power analysis for structural equation modeling (SEM) resulted in a sample size of 460 to detect standardized regression effects of  $\beta=0.30$  with a power of 0.90.

Participants were recruited via an online newsletter from the institute, in the context of a class of the master’s program, and in the personal circle of friends and family of the attending students. They had to be at least 18 years old and not older than 60 years and received either 4€ or a student course credit for their participation. The study was conducted according to the ethical guidelines of the Helsinki

declaration and preregistered prior to data collection at OSF: <https://osf.io/h2fd4>. Overall, 590 participants completed the online study. Due to preregistered criteria, we excluded 116 participants because they answered either too fast (below 100 ms, see Whelan, 2008), had more than 50% error trials in the affective priming task, or did not answer sufficiently many items of the questionnaires (more than 10% missing answers). Two further participants had to be excluded from the analysis because they were older than 60 years, and fourteen further participants, as they did not provide their age, so the required age range (18–60 years) could not be assured. The final sample population ( $N=458$ ) consisted of 279 women ( $M$  age = 23.64 years,  $SD=7.14$ ), 177 men ( $M$  age = 23.24 years,  $SD=5.26$ ), and two non-binary persons ( $M$  age = 18.50 years,  $SD=0.71$ ). Most of the participants indicated high school diploma as their highest school degree (77.7%) and academic studies as their regular occupation (89.5%). Average meditation practice of the whole sample was 36.98 min per month ( $SD=122.39$ ) and 36.7% indicated to meditate on a regular basis while 16.2% have never and 47.2% only meditated once. The average monthly yoga practice was 99.42 min ( $SD=312.2$ ), with 48.3% of the participants practicing yoga regularly, 38.9% having tried yoga once and 12.7% never.

## 2.2 Material

We collected demographic data and measured mindfulness, connectedness to nature, prosocialness, and heartfulness—by gratitude and self-compassion—with questionnaires. Furthermore, we measured the implicit and explicit affective attitudes toward sustainable and non-sustainable concepts with the implementation of the respective tasks. We included a personal evaluation of the sustainability of these concepts to ensure that the participants perceived the specific terms as sustainable or non-sustainable, respectively. As stimulus material, we chose five terms of sustainable concepts (bicycle, solar energy, second hand, reusable bag, vegetable) and five matched terms of non-sustainable concepts (cruise ship, coal-fired power station, fast fashion, disposable plastic, sausages). Each term pair was derived from the following categories: mobility, nutrition, packaging, energy, and clothing. Both groups of terms were matched based on a preliminary survey. In this survey, 39 words selected based on the authors' considerations were rated by 32 participants in terms of their perceived sustainability on a 5-point Likert scale ranging from (1) = *not at all sustainable* to (5) = *fully sustainable*. Finally, we chose ten terms based on the highest and lowest mean in each category, respectively. However, in two categories (food and mobility), the second most sustainable word was used due to better comparability of the word characteristics.

McDonald's Omega was used to calculate the internal consistency of the questionnaires. Omega is a model-based and factor analytic coefficient to estimate reliability (true variance relative to observed variance). All modelled sources of common variance influence its value.

**Demographic Questionnaire** Demographic questions were asked concerning gender, age, education state, mother tongue, regular occupation, and family status. Furthermore,



the frequency and average minutes of practicing meditation and yoga (never, once, sometimes in the year, sometimes in a month, sometimes in a week, daily) were registered.

**Mindfulness Measurement** The Comprehensive Inventory of Mindfulness Experience (CHIME; Bergomi et al., 2014) measures eight aspects of mindfulness based on 37 items that are answered on a 6-point Likert scale ranging from (1) = *almost never* to (6) = *almost always*. It comprises the following subscales: inner awareness (e.g., “I clearly notice changes in my body, such as quicker or slower breathing”), outer awareness (e.g., “I notice sounds in my environment, such as birds chirping or cars passing”), acting with awareness (e.g., “In everyday life, I get distracted by memories, images or reverie” (reverse score)), openness (e.g., “I try to distract myself when I feel unpleasant emotions” (reverse score)), acceptance (e.g., “Even when I make a big mistake, I treat myself with understanding”), decentering/nonreact (e.g., “When I experience distressing thoughts or images, I am able just to notice them without having to react immediately”), insight (e.g., “I need to smile when I notice how I sometimes see things as more difficult than they actually are”), and relativity of thoughts (e.g., “It is clear to me that my evaluations of situations and people can easily change”). Bergomi et al. (2014) reported acceptable reliability and validity of the questionnaire. In the present study, internal consistencies were as follows: inner awareness  $\omega = 0.70$ , outer awareness  $\omega = 0.79$ , acting with awareness  $\omega = 0.68$ , openness  $\omega = 0.69$ , acceptance  $\omega = 0.87$ , decentering/nonreact  $\omega = 0.79$ , insight  $\omega = 0.71$ , and relativity of thoughts  $\omega = 0.62$ . In line with the preregistered exclusion criteria based on the results of Jansen et al. (under review), we eliminated openness and relativity of thoughts from further analyses because of their low internal consistencies ( $\omega < 0.70$ ). Because it was not preregistered, we decided to keep acting with awareness in the analysis. A confirmatory factor analysis (CFA) with the six remaining factors revealed the test statistic  $\chi^2 = 6268.65$ ,  $df = 3243$ ,  $p < .001$  and the following fit indices (Kline, 2016): CFI = 0.798, RMSEA = 0.046, 90%CI [0.044, 0.047], SRMR = 0.059. According to Hu and Bentler (1999), RMSEA < 0.06 and SRMR < 0.08 show a good model fit, whereas a CFI < 0.9 is not acceptable. However, because the relevance of thresholds for the indices is discussed controversially (Hayduk et al., 2005), the model fit seems overall acceptable.

**Connectedness to Nature Measurement** We used the reduced version of the Connectedness to Nature Scale (CNS; Pasca et al., 2017) to assess connectedness to nature. The items must be answered on a 5-point Likert scale ranging from (1) = *strongly disagree* to (5) = *strongly agree*. An example is, “Like a tree can be part of a forest, I feel embedded within the broader natural world”. The seven-item questionnaire based on the item response theory (IRT) has appropriate discrimination and difficulty indices. Adequate reliability ( $\alpha = 0.87$ ) and validity of the reduced scale have been reported by Pasca et al. (2017). The internal consistency of McDonald’s Omega for the present study was 0.87.



**Prosocialness Measurement** The Prosocialness Scale for Adults (Caprara et al., 2005) measures prosocial behavior by 16 items that must be answered on a 5-point Likert scale ranging from (1)=*never/almost never true* to (5)=*almost always/always true*. An example is, "I try to console those who are sad". The questionnaire is based on the IRT. Reliability ( $\alpha=0.91$ ), difficulty, and discrimination parameters were good, and the results of IRT analyses support effectiveness and sensitivity (Caprara et al., 2005). The German version of the questionnaire was generated and validated by a forward and backward translation. A CFA with mean- and variance-adjusted weighted least squares (WLSMV) estimation following Brauer et al. (2023) showed factor loadings above 0.3 for all items. In the SEM however, Items 1, 2, 3, 4, 9 and 14 are removed because of factor loadings below 0.3. A CFA with WLSMV-estimation for this reduced model resulted in an acceptable fit, considering the sample size dependent sensitivity of the  $\chi^2$ -test:  $\chi^2(35)=205.69, p < .001, CFI=0.965, RMSEA=0.103, SRMR=0.081$ . McDonald's Omega was 0.87.

**Heartfulness Measurement** We measured heartfulness by the aspects of gratitude and self-compassion.

The Gratitude Questionnaire (GQ-6; McCullough et al., 2002) consists of six items in its original version (e.g., "I have so much in life to be thankful for"), which must be rated on a 7-point Likert Scale ranging from (1)=*strongly disagree* to (7)=*strongly agree*. Cronbach's alpha was found at 0.82 (McCullough et al., 2002). However, since the validation study of Hudecek et al. (2020) revealed that the model-fit of the GQ-6 was significantly improved after eliminating one item, we used the German 5-item version GQ-5-G (Hudecek et al., 2021) to measure gratitude. The present study revealed an internal consistency of McDonald's Omega of 0.83.

For measuring self-compassion, the Self-compassion Scale (SCS; Neff, 2003) was used in its German version (Hupfeld & Ruffieux, 2011). The SCS comprises positive elements of self-kindness ("I'm kind to myself when I experience suffering"), common humanity ("I try to see my failings as part of the human condition"), and mindfulness ("When I am feeling down, I try to approach my feelings with curiosity and openness") on the one side. On the other side, it includes the negative aspects of self-judgment ("I can be a bit cold-hearted toward myself when I'm experiencing suffering"), isolation ("When I'm feeling down, I tend to feel like most other people are probably happier than I am"), and over-identification ("When something upsets me, I get carried away with my feelings").

The conceptual differentiation between mindfulness as it is measured by the CHIME and in the SCS subscale should be highlighted as the items of the latter all revolve around interpersonal relationships and therefore capture a different mindfulness aspect. Responses must be given on a scale from (1)=*almost never* to (5)=*almost always*. The negative items were reverse coded for the analysis, so a higher value in the negative scale indicates a higher level of self-compassion. According to the recommendation of Coroiu et al. (2018), the positive and negative scales were used separately in the analysis. The internal consistency of McDonald's Omega of the negative and positive scale was both 0.87.

**Explicit Affective Attitudes Measurement** To measure the explicit affective attitudes, we included an explicit affective evaluation task in which the five terms of sustainable and five terms of non-sustainable concepts (as described above) were presented in random order. The participants were asked the following question: “What is your attitude toward this object/concept?”. They had to answer on a 7-point Likert scale ranging from (1)=*very negative* to (7)=*very positive*. To provoke a spontaneous reaction, participants had 5000 ms to respond. The mean score for the explicit affective rating for each category (sustainable vs. non-sustainable concepts) was calculated.

**Implicit Affective Attitudes Measurement** We measured implicit affective attitudes through an affective priming paradigm (De Houwer et al., 2002; Fazio et al., 1986; Spruyt et al., 2002) using the same terms as displayed in the explicit affective evaluation task. After a short practice trial with terms of neutral connotation, the central part of the task followed. At each trial’s beginning, an initial fixation point was shown for 500 ms. After that, a term of either a sustainable or non-sustainable object/concept appeared briefly for 200 ms, followed by another fixation point for 50 ms. Subsequently, a word out of a pool of four positive (e.g., honest) and four negative words (e.g., cruel) chosen from the Berlin Affective Word List (BAWL-R; Vö et al., 2009) was shown. The participants indicated whether the word was positive or negative via the keyboard’s arrow keys. Since the word disappeared after 2000 ms, they had to react as quickly as possible. Trials in which no answer was given within the 2000 ms were repeated at the end of the task. Each term of the sustainable or non-sustainable concepts was combined with each positive and negative word, resulting in a total of 80 trials. All trials were in random order. Figure 1 shows the sequence of the task.

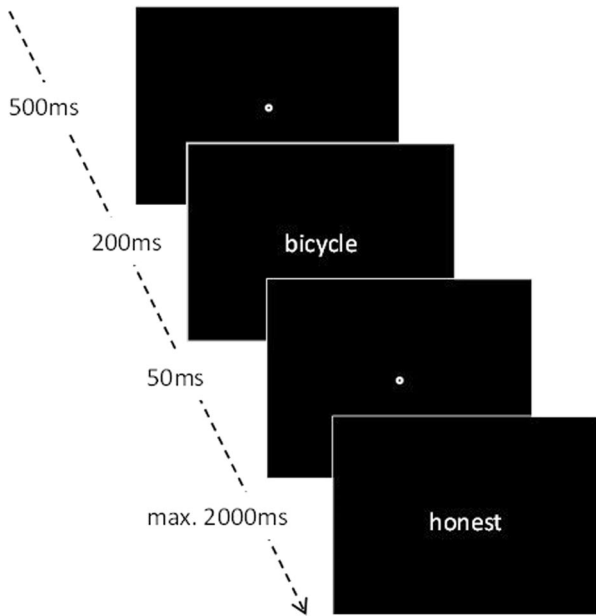
On average, over the 80 trials, the participants made  $M=4.26$  mistakes ( $SD=4.42$ ) and answered below 100 ms in  $M=0.05$  trials ( $SD=0.85$ ). We imputed these trials using the mean reaction time for the respective sustainability-affection combination. Reaction times when categorizing term-primed positive words were subtracted from reaction times when categorizing term-primed negative words. This procedure was done separately for terms of sustainable concepts and non-sustainable objects/concepts and was averaged, respectively. Hence, a higher difference score demonstrated a more positive evaluation.

**Sustainability Measurement** For assessing the personal evaluation of sustainability, the participants indicated on a 5-point Likert scale from (1)=*not at all* to (5)=*very much* how sustainable they evaluate the presented terms of sustainable/non-sustainable concepts. The terms were the same as used in the explicit affective evaluation task and the affective priming task.

### 2.3 Study Type and Design

This study is a cross-sectional survey with a correlational design that was conducted online. The order of the study was as follows: first, the explicit affective evaluation task and the affective priming task were presented. After that, the

**Fig. 1** Experimental setup of the affective priming task



participants completed the demographic questionnaire, CHIME, CNS, Prosocialness Scale for Adults, GQ-5-G, SCS-D, and the personal evaluation of the sustainability of the concepts. The study lasted about 20 minutes and was implemented online using the programs OpenSesame (Mathôt et al., 2012) and SurveyJS on JATOS (Lange et al., 2015).

## 2.4 Statistical Analysis

We specified hypotheses, as well as the analytic plan prior to data collection. The means of the personal evaluation of sustainability for both types of concepts were calculated and – in addition to the preregistered analyses – analysed for differences with a dependent t-test.

To test our central Hypothesis 1, whether the participants have a more positive explicit affective attitude toward sustainable concepts, a matched pairs t-test was conducted. Likewise, to test whether there is a difference between the implicit affective attitudes toward the terms of sustainable and non-sustainable concepts, a matched pairs t-test was conducted for the reaction time difference score between negative and positive words. Furthermore, correlations between the explicit affective evaluations and the values of the affective priming task for sustainable and non-sustainable concepts were conducted.

Hypotheses 2 to 4 were investigated through SEM. This model contains the exogenous latent variables outer awareness, inner awareness, insight, acceptance, acting with awareness, decentering, positive and negative self-compassion, and gratitude,

the endogenous latent variables connectedness to nature and prosocialness, and the observed outcomes implicit and explicit affective attitudes. The exogenous and endogenous latent variables and the observed outcomes were allowed to correlate among themselves, respectively. Analyses were performed in R using the lavaan-package (Rosseel, 2012) and missing data was accounted for using full information maximum likelihood estimation.

### 3 Results

#### 3.1 Sustainability Measurement

The paired t-test showed a significant difference between the personal sustainability rating of sustainable and non-sustainable concepts,  $t(457)=108.59$ ,  $p<.001$ , 95% CI [2.96, 3.06],  $d=5.07$ . Participants rated sustainable concepts more sustainable ( $M=4.44$ ,  $SD=0.37$ ) than non-sustainable ones ( $M=1.42$ ,  $SD=0.40$ ).

#### 3.2 Explicit and Implicit Affective Attitudes toward Sustainable and Non-Sustainable Concepts

The paired t-test revealed a significant difference between explicit affective attitudes toward sustainable ( $M=6.16$ ,  $SD=0.67$ ) and non-sustainable ( $M=2.34$ ,  $SD=0.91$ ) concepts,  $t(457)=62.97$ ,  $p<.001$ , 95% CI [3.70, 3.94],  $d=2.94$ . Another paired t-test also resulted in a significant difference between implicit affective attitudes toward sustainable ( $M=9.69$ ,  $SD=86.50$ ) and non-sustainable ( $M=-4.64$ ,  $SD=94.71$ ) concepts,  $t(457)=2.57$ ,  $p=.010$ , 95% CI [3.38, 25.26],  $d=0.12$ . Therefore, both the explicit and implicit attitudes toward sustainable concepts were more positive than those toward non-sustainable concepts. However, the effect was small for the implicit measurements but very large in the explicit affective evaluation task (Cohen, 1988).

There were no significant correlations between the explicit and implicit affective attitudes for sustainable ( $r=.05$ ,  $p=.318$ ) or non-sustainable ( $r=.02$ ,  $p=.690$ ) concepts.

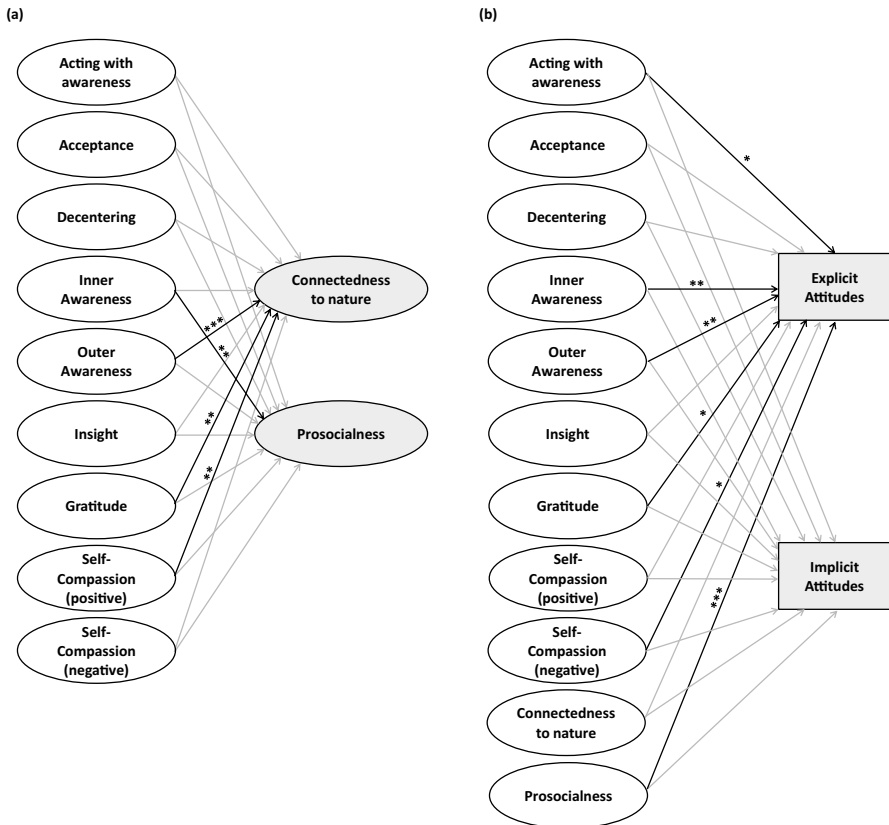
Exploratorily, we also considered possible relations between the basic demographics of age and gender of our sample and the affective attitudes. Women and men did not differ regarding their implicit affective attitudes toward sustainable and non-sustainable objects. However, as demonstrated by a Wilcoxon-Mann-Whitney test, there were gender differences regarding the explicit affective attitudes toward sustainable,  $Z=-4.45$ ,  $p<.001$ , Spearman's  $\rho=-.209$ , and toward non-sustainable objects,  $Z=-2.30$ ,  $p=.021$ , Spearman's  $\rho=.108$ . The explicit attitudes toward sustainable objects were higher on average for women ( $M=6.26$ ,  $SD=0.65$ ) compared to men ( $M=6.00$ ,  $SD=0.66$ ). Regarding the explicit attitudes toward the non-sustainable objects, it was the other way around (women:  $M=2.29$ ,  $SD=0.95$ ; men:  $M=2.44$ ,  $SD=0.84$ ). There was no correlation between age and implicit affective attitudes toward sustainable and non-sustainable objects. Regarding the explicit affective attitudes, a correlation between age and explicit attitudes toward

non-sustainable objects, Spearman's  $\rho = -.204$ ,  $p < .001$ , but not with attitudes toward sustainable objects exists.

### 3.3 Relation of Mindfulness, Heartfulness, Prosocialness, Connectedness to Nature, and Affective Attitudes

The SEM included the exogenous latent variables outer awareness, inner awareness, insight gratitude and positive and negative self-compassion, the endogenous latent variables connectedness to nature and prosocialness and the observed outcomes implicit and explicit attitudes toward sustainable objects. For results on relations specified in the directed hypotheses, the one-sided  $p$ -value is reported. Figure 2 shows all regressions specified within the SEM.

Items 1, 2, 3, 4, 9 and 14 of the prosocialness scale had to be removed due to factor loadings below 0.3. Model fit indices are mixed with  $\chi^2(2773) = 5421.92$ ,  $p < .001$  and CFI = 0.817, but RMSEA = 0.046 and SRMR = 0.059. Table 1 shows



**Fig. 2** Regressions on endogenous variables Connectedness to nature and Prosocialness (a) and on the observed outcomes implicit and explicit attitudes toward sustainable concepts (b) specified within the SEM. Bold arrows = significant relationships, \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

**Table 1** Unstandardized regression coefficients of all regressions included in the SEM. Variances of latent variables are fixed to 1, hence  $b$  equals  $\beta$  for regressions with outcomes Connectedness to nature and Prosocialness and  $b_i/b_j$  equals  $\beta_i/\beta_j$  for regressions with outcomes implicit and explicit attitudes toward sustainable concepts for all pairs of predictors  $i$  and  $j$ . For regressions specified in the directed hypotheses, one-sided  $p$ -value is reported

Outcome	Variable	$b$	[95% CI]	$SE$	$\beta$	$p$
CtN	oAw	0.571	[0.253, 0.890]	0.163	0.571	<.001 <sub>one-sided</sub>
	Ins	0.119	[-0.079, 0.318]	0.101	0.119	.120 <sub>one-sided</sub>
	iAw	-0.123	[-0.470, 0.224]	0.177	-0.123	.487
	Acc	0.258	[-0.300, 0.815]	0.284	0.258	.365
	AwA	0.105	[-0.134, 0.343]	0.122	0.105	.390
	Dec	-0.147	[-0.432, 0.139]	0.146	-0.147	.314
	Gra	0.197	[0.053, 0.341]	0.073	0.197	.007
	SC <sub>p</sub>	0.521	[0.168, 0.875]	0.180	0.521	.004
	SC <sub>n</sub>	0.468	[-0.066, 1.001]	0.272	0.468	.086
	Pros	iAw	0.527	[0.165, 0.889]	0.185	0.527
oAw		0.018	[-0.275, 0.311]	0.149	0.018	.452 <sub>one-sided</sub>
Ins		0.205	[-0.004, 0.414]	0.107	0.205	.028 <sub>one-sided</sub>
Acc		-0.022	[-0.556, 0.511]	0.272	-0.022	.935
AwA		-0.125	[-0.379, 0.129]	0.130	-0.125	.333
Dec		-0.185	[-0.489, 0.119]	0.155	-0.185	.233
Gra		0.085	[-0.066, 0.236]	0.077	0.085	.135 <sub>one-sided</sub>
SC <sub>p</sub>		0.170	[-0.133, 0.473]	0.155	0.170	.271
SC <sub>n</sub>		0.160	[-0.328, 0.647]	0.249	0.160	.521
Explicit attitudes toward sustainable concepts		iAw	-0.430	[-0.699, 0.162]	0.137	-0.776
	oAw	0.367	[0.117, 0.617]	0.128	0.662	.004
	Ins	0.025	[-0.091, 0.140]	0.059	0.045	.678
	Acc	0.355	[0.000, 0.710]	0.181	0.641	.050
	AwA	0.198	[0.039, 0.357]	0.081	0.357	.014
	Dec	-0.169	[-0.34, 0.001]	0.087	-0.305	.052
	CtN	-0.011	[-0.099, 0.077]	0.045	-0.020	.401 <sub>one-sided</sub>
	Pros	0.190	[0.107, 0.273]	0.042	0.343	<.001 <sub>one-sided</sub>
	Gra	0.102	[0.01, 0.194]	0.047	0.184	.030
	SC <sub>p</sub>	0.180	[-0.032, 0.393]	0.109	0.325	.097
Implicit attitudes toward sustainable concepts	SC <sub>n</sub>	0.419	[0.070, 0.769]	0.178	0.756	.019
	iAw	17.063	[-7.931, 42.057]	12.752	0.201	.181
	oAw	-7.201	[-29.059, 14.657]	11.152	-0.085	.518
	Ins	-6.519	[-21.215, 8.177]	7.498	-0.077	.385
	Acc	2.480	[-33.212, 38.1729]	18.210	0.029	.892
	AwA	-4.474	[-22.188, 13.240]	9.038	-0.053	.621
	Dec	3.378	[-17.197, 23.953]	10.497	0.040	.748
	CtN	-5.311	[-14.717, 4.096]	4.799	-0.062	.134 <sub>one-sided</sub>
	Pros	1.822	[-7.366, 11.011]	4.688	0.021	.349 <sub>one-sided</sub>
	Gra	-4.363	[-14.669, 5.942]	5.258	-0.051	.407
SC <sub>p</sub>	4.837	[-18.568, 28.242]	11.942	0.057	.685	
SC <sub>n</sub>	4.905	[-29.171, 38.981]	17.386	0.058	.778	

Note. CtN: Connectedness to nature, Pros: Prosocialness, oAw: Outer awareness, Ins: Insight, iAw: Inner Awareness, Acc: Acceptance, AwA: Acting with awareness, Dec: Decentering, Gra: Gratitude, SC<sub>p</sub>: Positive self-compassion, SC<sub>n</sub>: Negative self-compassion

the unstandardized regression coefficients for all examined direct effects. The descriptive statistics of the variables included in the regressions within the SEM are presented in Table 2.

In accordance with Hypothesis 2, inner awareness relates positively to prosocialness ( $b=0.527$ ,  $p_{\text{one-sided}}=.002$ ) as does insight ( $b=0.205$ ,  $p_{\text{one-sided}}=.028$ ). In contrast to Hypothesis 2, outer awareness does not relate positively to prosocialness ( $b=0.018$ ,  $p_{\text{one-sided}}=.452$ ). However, prosocialness relates positively to explicit attitudes toward sustainable objects ( $b=0.190$ ,  $p_{\text{one-sided}}<.001$ ) but, contrary to our expectations, does not do so with implicit attitudes toward sustainability ( $b=1.822$ ,  $p_{\text{one-sided}}=.349$ ).

As stated in Hypothesis 3, outer awareness relates positively to connectedness to nature ( $b=0.571$ ,  $p_{\text{one-sided}}<.001$ ) but insight does not ( $b=0.119$ ,  $p_{\text{one-sided}}=.120$ ). Contradicting Hypothesis 3, connectedness to nature does not relate positively to the explicit attitudes toward sustainability ( $b=-0.011$ ,  $p_{\text{one-sided}}=.401$ ) nor to the implicit attitudes toward sustainable objects ( $b=-5.311$ ,  $p_{\text{one-sided}}=.134$ ).

In contrast to Hypothesis 4, we could not find a positive relation between gratitude and prosocialness ( $b=0.085$ ,  $p_{\text{one-sided}}=.135$ ).

For the exploratory analysis regarding prosocialness, none of the regression coefficients differed significantly from zero for acceptance, acting with awareness, decentering and positive or negative self-compassion. However, regarding connectedness to nature, gratitude ( $b=0.197$ ,  $p=.007$ ) and positive self-compassion ( $b=0.521$ ,  $p=.004$ ) show a positive relation while negative self-compassion, inner awareness, acceptance, acting with awareness and decentering did not.

For exploratory results concerning the direct relation of the mindfulness aspects, gratitude, and positive and negative self-compassion with implicit attitudes toward sustainability, none of the regression coefficients differed significantly from zero. Regarding the explicit attitudes toward sustainable objects, inner awareness ( $b=-0.430$ ,  $p=.002$ ), outer awareness ( $b=0.367$ ,  $p=.004$ ), acting with awareness ( $b=0.198$ ,  $p=.014$ ), gratitude ( $b=0.102$ ,  $p=.030$ ) and negative self-compassion ( $b=0.419$ ,  $p=.019$ ) show positive or negative relations. Acceptance ( $b=0.355$ ,  $p=.050$ ) and decentering ( $b=0.355$ ,  $p=.052$ ) approach significance.

Table 3 shows the indirect and total effects derived from the SEM. The only significant indirect effect is from inner awareness via prosocialness on explicit attitudes toward sustainable concepts and is contrary to the negative direct effect. The total effect still differs significantly from zero in the negative direction.

All predictors in the regression models explained 31.0% of the variance of explicit attitudes, 3.0% of the implicit affective attitudes toward sustainable concepts, 39.6% of the variance of connectedness to nature, and 29.0% of the variance of prosocialness.

## 4 Discussion

First, the results demonstrate more positive explicit and implicit affective attitudes toward sustainable compared to non-sustainable concepts as operationalized here in five dimensions, though the effect size implies a rather small effect for the implicit



**Table 2** Descriptive statistics of the variables included in the regressions within the SEM. Explicit and implicit attitudes are observed variables while the other variables included in the regression models are latent factors with means set to zero and variances set to one. Descriptive values for latent factors are based on estimated latent factor scores hence descriptive statistics for manifest mean scale scores are provided auxiliary for comparison to previous research

	M	SD	Skew	Kurtosis	Correlations														
					1	2	3	4	5	6	7	8	9	10	11	12			
1 Acc	0.00	0.96	-0.01	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 AwA	0.00	0.85	0.08	2.36	0.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3 Dec	0.00	0.92	0.05	2.96	0.78	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-
4 iAw	0.00	0.90	-0.37	3.33	0.33	0.28	0.49	-	-	-	-	-	-	-	-	-	-	-	-
5 oAw	0.00	0.92	-0.41	2.95	0.26	0.10	0.39	0.83	-	-	-	-	-	-	-	-	-	-	-
6 Ins	0.00	0.89	-0.30	2.61	0.55	0.26	0.70	0.44	0.30	-	-	-	-	-	-	-	-	-	-
7 Gra	0.00	0.95	-1.20	4.33	0.37	0.25	0.34	0.37	0.37	0.46	-	-	-	-	-	-	-	-	-
8 SC <sub>p</sub>	0.00	0.96	-0.05	2.88	0.90	0.39	0.78	0.46	0.32	0.61	0.41	-	-	-	-	-	-	-	-
9 SC <sub>n</sub>	0.00	0.96	-0.08	2.48	-0.93	-0.53	-0.68	-0.24	-0.20	-0.43	-0.38	-0.83	-	-	-	-	-	-	-
10 CiN	0.00	1.22	-0.05	2.56	0.37	0.14	0.39	0.51	0.57	0.41	0.42	0.47	-0.27	-	-	-	-	-	-
11 Pros	0.00	1.10	-0.55	3.28	0.09	-0.04	0.14	0.55	0.43	0.32	0.25	0.20	0.00	0.42	-	-	-	-	-
12 Exp	6.16	0.67	-1.26	6.86	0.15	0.05	0.09	0.09	0.28	0.17	0.27	0.18	-0.07	0.27	0.34	-	-	-	-
13 Imp	9.69	86.50	0.30	4.17	0.00	-0.03	0.01	0.10	0.02	-0.03	-0.06	0.02	0.03	-0.05	0.05	-0.05	-	-	-
Acc <sub>man</sub>	3.32	1.08	0.01	2.43															
AwA <sub>man</sub>	3.31	1.06	0.09	2.28															
Dec <sub>man</sub>	3.38	0.84	0.09	3.03															
iAw <sub>man</sub>	4.42	0.77	-0.39	3.30															

Table 2 (continued)

	Correlations															
	M	SD	Skew	Kurtosis	1	2	3	4	5	6	7	8	9	10	11	12
oAw <sub>man</sub>	4.39	0.99	-0.43	2.85												
Ins <sub>man</sub>	4.06	0.92	-0.36	2.71												
Gra <sub>man</sub>	5.89	0.96	-1.06	4.19												
SC <sub>p man</sub>	3.05	0.67	-0.08	2.82												
SC <sub>n man</sub>	3.17	0.77	-0.06	2.51												
CIN <sub>man</sub>	3.01	0.88	-0.03	2.62												
Pros <sub>man</sub>	3.96	0.57	-0.40	3.02												

Note. CIN: Connectedness to nature, Pros: Prosocialness, oAw: Outer awareness, Ins: Insight, iAw: Inner Awareness, Acc: Acceptance, AwA: Acting with awareness, Dec: Decentering, Gra: Gratitude, SC<sub>p</sub>: Positive self-compassion, SC<sub>n</sub>: Negative self-compassion, Exp: Explicit attitudes toward sustainable concepts, Imp: Implicit attitudes toward sustainable concepts, subscript (man): Manifest scale score

**Table 3** Indirect and total effects on explicit and implicit attitudes toward sustainable concepts via Connectedness to nature and Prosocialness with 95% CI

	indirect effects						total effects	
	on Exp		on Imp					
	via CtN	via Pros	via CtN	via Pros	on Exp	on Imp		
iAw	-	0.106* [0.004, 0.195]	-	0.96 [-3.893, 5.813]	-	-0.330* [-0.583, -0.078]	18.023 [-5.709, 41.756]	
oAw	-0.006 [-0.058, 0.045]	0.003 [-0.051, 0.058]	-3.035 [-8.644, 2.575]	0.033 [-0.527, 0.593]		0.364** [0.148, 0.580]	-10.203 [-30.394, 9.988]	
Ins	-0.001 [-0.012, 0.010]	0.039 [-0.004, 0.081]	-0.633 [-2.066, 0.800]	0.374 [-1.554, 2.302]		0.062 [-0.051, 0.175]	-6.778 [-21.369, 7.812]	
Gra	-0.002 [-0.020, 0.015]	0.016 [-0.013, 0.015]	-1.046 [-3.120, 1.028]	0.155 [-0.666, 0.976]		0.116* [0.021, 0.211]	-5.254 [-15.302, 4.794]	
SC <sub>p</sub>	-0.006 [-0.052, 0.041]	0.032 [-0.024, 0.088]	-2.769 [-8.114, 2.575]	0.310 [-1.300, 1.920]		0.207* [0.014, 0.400]	2.378 [-19.482, 24.237]	
SC <sub>n</sub>	-0.005 [-0.049, 0.038]	0.030 [-0.058, 0.119]	-2.483 [-7.774, 2.808]	0.291 [-1.373, 1.955]		0.444** [0.112, 0.777]	2.713 [-30.493, 35.919]	

Note. \* $p < .05$ , \*\* $p < .01$ . CtN: Connectedness to nature, Pros: Prosocialness, oAw: Outer awareness, Ins: Insight, iAw: Inner Awareness, Acc: Acceptance, AwA: Acting with awareness, Dec: Decentering, Gra: Gratitude, SC<sub>p</sub>: Positive self-compassion, SC<sub>n</sub>: Negative self-compassion, Exp: Explicit attitudes toward sustainable concepts, Imp: Implicit attitudes toward sustainable concepts

attitudes. As expected, the implicit and explicit affective attitudes did not correlate for either sustainable or non-sustainable concepts. Second, Hypotheses 2 and 3 could only partly be confirmed: Regarding prosocialness, the mindfulness facets inner awareness and insight but not outer awareness show significant positive relations. Also, prosocialness shows a positive connection to explicit but not implicit attitudes toward sustainable objects (Hypothesis 2). Outer awareness was—as expected—positively related to connectedness to nature but the relation of insight was not significant. There were no relations of connectedness to nature with the explicit nor the implicit affective attitudes toward sustainability (Hypothesis 3). Hypothesis 4 must be rejected due to the absent positive relation between gratitude and prosocialness. Third, the exploratory results in the SEM show a negative direct relation of inner awareness and the explicit attitudes and a significant positive indirect effect from inner awareness via prosocialness on the explicit attitudes toward sustainability. Regarding the two heartfulness aspects of gratitude and self-compassion, gratitude and negative self-compassion show positive direct relations to the explicit affective attitudes toward sustainable objects. There were positive total effects of gratitude and both positive and negative self-compassion on the explicit affective attitudes toward sustainability.

#### 4.1 Explicit and Implicit Affective Attitudes toward Sustainability

The affective attitudes in the explicit affective evaluation task were more positive toward sustainable compared to non-sustainable objects and concepts. A more positive explicit attitude toward sustainability has already been demonstrated for specific sustainable concepts, for example, electro-mobility (Jansen et al., 2021) and vegetarian compared to meat-based nutrition in a non-omnivore population (Siebertz et al., 2022). Furthermore, this difference holds true for the implicit attitudes, since the more positive evaluation of sustainable compared to non-sustainable objects was found in the implicit affective rating task as well, even though the effect was minimal. This finding is in line with the study of Siebertz et al. (2022), in which omnivore as well as non-omnivore participants rated vegetarian food implicitly more positive, but in contrast to the results of Jansen et al. (2021) that could not confirm such an implicit affective preference for electric in comparison to gasoline cars. The smaller effect sizes of implicit attitudes could be partly due to the general variance of reaction times. More measurements or participants could be necessary to reliably detect such effects (see Brysbaert & Stevens, 2018).

In the present study, no specific field of sustainability, but distinct categories of sustainable concepts were used for a broad implementation. The participants of this study rated the selected terms as more sustainable than the non-sustainable terms, indicating that attitudes toward sustainability could indeed be explored. However, one must be cautious when generalizing the findings of the present study beyond the specific aspects included in the paradigm to other fields of sustainability. Future research in attitudes and sustainability can profit from focusing on areas of pro-sustainable behavior in which the consumer can make a change with his own decision, e.g., nutrition or clothing. Other areas like power generation might instead

be considered on a collective, governmental level since the individual person often does not have the full power of decision here.

As expected, the explicit and implicit measurements did not correlate for either the sustainable concepts or the non-sustainable ones. This implies a low congruence between these two dimensions of attitudes, in line with the findings of the study of Steiner et al. (2018). Both explicit and implicit aspects must be considered while investigating attitudes toward sustainability and, furthermore, the attitude-behavior gap in sustainable behavior. The different effect sizes of the implicit and explicit attitudes and the low congruence between both types of measurements can be considered as an “individual green-washing effect” (Jansen et al., 2021) or as the difference between social and authentic responsibility (Steiner et al., 2018). In sustainability, an explanation for the absent correlation between explicit and implicit attitudes might be the factor of self-representation and social desirability, respectively, since sustainable behavior is highly favoured. Beside that, another reason for inaccurate explicit ratings could be a lack of awareness of one’s attitudes and a poor ability to introspection (Steiner et al., 2018). Therefore, it is inevitable to bring awareness to the underlying attitudes toward sustainability issues to explain the reason for choosing specific (possibly non-sustainable) goods and encourage the willingness to consider more sustainable alternatives. Even though implicit measurement methods might not function as a lie detector that reveals more truthful attitudes than explicit self-report data (Nosek et al., 2007), they can still contribute to a better understanding of human attitudes and choices and, thus, promoting sustainability. In this context, future research should address the following points: First, the interplay between implicit and explicit attitudes should be considered. As Steiner et al. (2018) noted, this will narrow a critical knowledge gap regarding internal and external learning processes in sustainability research and, therefore, will be necessary for behavioral change in organizations and society. It is not known whether one measurement is a better predictor of actual behavior and until such results are available, both should be considered. Second, the measurement of explicit and implicit attitudes toward sustainable concepts differs in previous studies, which makes it difficult to compare the results directly. For example, the Implicit Association Test (IAT; Greenwald et al., 1998) focuses on the cognitive aspects of attitudes, whereas the affective priming paradigm emphasizes the implicit affective attitude (Brand & Ekkekakis, 2018). In general, priming procedures suffer from lower reliability (e.g., Cameron et al., 2012), which may contribute to the fact that none of the relations to the implicit affective attitudes reached significance in this study. However, if different measurements of the same mechanisms produce contrary results, the mechanisms might not be as general as proposed but could rather be limited to the specific measurement.

#### **4.2 Mindfulness, Prosocialness, Connectedness to Nature, and Explicit Affective Attitudes toward Sustainability**

Our results revealed a positive relation between inner awareness and prosocialness and of prosocialness and explicit affective attitudes toward sustainability. Interestingly,

our exploratory analyses showed that the direct and total effect of inner awareness and the explicit affective attitudes toward sustainable concepts were negative. The study of Bergomi et al. (2015) found a strong correlation between meditation practice and inner awareness, indicating that inner awareness captures the awareness of the own bodily processes and an inward focus of consciousness. In addition, Hazem et al. (2018) showed that social interactions or social contact could enhance self-awareness. Combining these findings, a connection between inner awareness and prosocialness may exist, implying that prosocialness toward others might be linked to the acting person and the awareness of the own processes. Our study provides evidence for this connection since it showed that the higher the inner awareness, the higher the score of self-reported prosocialness. In addition, it emphasizes the relevance of this relation, especially for the positive relation to the explicit affective attitudes toward sustainability. The reasons for the adverse direct and total effects of inner awareness and explicit attitudes toward sustainability are speculative. One explanation might be that enhanced inner awareness, and therefore an inward focus of consciousness, leads to putting oneself and one's own needs first. In the context of sustainability, prosocialness could be crucial in facilitating this shift away from self-centeredness and associated non-sustainable attitudes.

In our study, connectedness to nature was not related to insight as expected, but indeed related to outer awareness, meaning the awareness toward external experiences, thus the surroundings, such as nature (Bergomi et al., 2015). Our results show that the higher the value of outer awareness, the higher the self-reported connectedness to nature, whereas a significant relation between connectedness to nature and the explicit attitude toward sustainable concepts could not be confirmed. At first glance, this finding seems to contradict the meta-analysis of Whitburn et al. (2020). However, their meta-analysis showed that the relation was moderated using sustainable (pro-environmental) behavioral measurements. In our study, we did not measure pro-environmental behavior but attitudes toward sustainable concepts. Furthermore, we have not investigated how much time participants spend in nature in general and in the last months, but only their self-reported feeling of connectedness to nature. This could have influenced the results since, for example, there is evidence that the amount of time spent in nature as a 6-years old is related to environmental attitudes and pro-environmental behavior later in life (Evans et al., 2018). The observed relationship between outer awareness and connectedness to nature is in line with the meta-analytic review of Schutte and Malouff (2018), which provides evidence that this relationship varies with the chosen measurement method for mindfulness and the investigated participants, with a weaker relation among students. However, in their meta-analytic review, there was no distinction regarding the different aspects of mindfulness. Our study adds to this research gap and demonstrates that the mindfulness aspect of awareness should be considered with caution.

Our findings support the differentiation of connectedness to nature and prosocial behavior into two separate mediating factors, as proposed by Thiermann and Sheate (2021). The different relation of inner and outer awareness on prosocialness and connectedness to nature also provides evidence for using the CHIME (Bergomi et al., 2014) for measuring the trait of mindfulness. Our study suggests that the distinction in different components of awareness is crucial for

investigating trait mindfulness and attitudes toward sustainable concepts. Furthermore, the general relation between mindfulness and sustainability needs to be questioned, as the two subcomponents of awareness show opposite relationships. Especially meditation-based interventions focusing on inner awareness could show a negative relationship to sustainability.

### **4.3 Heartfulness, Prosocialness, Connectedness to Nature, and Explicit Affective Attitudes toward Sustainability**

One of the new aspects of this study was to investigate the effect of heartfulness in pro-environmental research, especially regarding the attitudes toward sustainability since most of previous research was limited to the cognitive aspects of mindfulness.

The relation of gratitude and prosocialness failed to reach significance and contradicts the results of the study by Ma et al. (2017). However, the exploratory SEM results showed a positive direct relation to the explicit affective attitudes and a positive total effect of gratitude, prosocialness, connectedness to nature, and explicit attitudes toward sustainability.

Regarding both aspects of self-compassion, we found a positive direct relation of negative self-compassion as well as a positive total effect for both positive and negative self-compassion on the explicit affective attitudes toward sustainability. This finding can be seen in line with a recently published study by Loy et al. (2022). Mind–body practice (MBP) participants of meditation and yoga reported higher levels of self-compassion and global identity. The MBP was indirectly related to stronger pro-environmental behavior and climate policy support through higher global identity and partly through higher self-compassion. The missing relation between gratitude and prosocialness in this study might be due to the investigation of the trait instead of the state of gratitude, which may lead to a weaker relation between both concepts (Ma et al., 2017). Also, self-reported prosocialness has been investigated instead of actual expenditure of effort or money as an objective measurement. Besides those methodological issues, this is the first study demonstrating the importance of considering the aspects of heartfulness, which will lead us to a further controversial point.

The intention of using the concept of heartfulness is to emphasize the warmer aspect of mindfulness. In our study, heartfulness was investigated in line with the study of Voci et al. (2019), in which the relation of gratitude and self-compassion on well-being has been demonstrated. However, these aspects are only two mechanisms of heartfulness, and others might give further insights. Several other aspects of heartfulness are worth considering, for example, the Brahmaviharas as the four Buddhist virtues of love, compassion, empathetic joy, and equanimity. To live a lifelong virtuous life from the heart through kindness and equanimity are prime qualities for a person living in heartfulness (Kwee, 2021). In addition, previous research emphasizes the meaning of eudaimonic values but also motives for happiness for a sustainability-oriented way of living (Sagiv et al., 2015; Shin et al., 2022). Having the long-term goal of a meaningful life can motivate



pro-environmental behavior. However, eudaimonic values may function as predictors of biospheric, altruistic, egoistic, and hedonic values, which in turn, can influence behavior (Shin et al., 2022).

#### 4.4 Limitations

One central area for improvement is that our results could not confirm any of the relations of the investigated variables with the implicit affective attitudes toward sustainable concepts. As mentioned above, priming procedures suffer from lower reliability, and there is a broad range of different measurement methods. Future research should address this problem and improve priming procedures to facilitate interpretation.

Further, this study has a cross-sectional and non-experimental design, which does not allow causal conclusions, and the interpretation of the direction of the effects is based on theoretical frameworks and previous research. For this, intervention studies, e.g., with a gratitude and self-compassion intervention, with longitudinal assessments of the outcomes must be conducted. Another limitation of our study design is the choice of questionnaires and, thus, only self-reported information of the participants and no objective data such as actual behavior was measured. We only considered attitudes and not actual engagement for sustainability. In future research, behavioral measurements could supplement self-reported data of questionnaires and thus contribute to narrowing the attitude-behavior gap.

Furthermore, we did not consider possibly relevant aspects, such as sociodemographic factors and personality, which relate to the concepts investigated here. For example, vegetarianism, as one aspect of sustainable behavior, is associated with greater openness and empathy (Holler et al., 2021). Besides, narcissism can be seen as a psychological factor related to pro-environmental behavior (Kesenheimer & Greitemeyer, 2021) and at least vulnerable narcissism is negatively related to mindfulness (Hewitt & Kealy, 2022). Our results point to the potential importance of socio-demographic factors, as there were gender differences in the explicit affective attitudes toward both sustainable and non-sustainable concepts as well as a correlation between age and explicit attitudes toward non-sustainable objects. Future studies should consider such individual characteristics as control variables. Since there may be a link between personality traits and sustainable attitudes and behaviors (Hopwood et al., 2022), including these stable variables might also help to further explore the link between mindfulness and sustainable behaviour.

## 5 Conclusions

In our study, the explicit and implicit attitudes were more positive for sustainable concepts than non-sustainable ones. However, the effect size of the implicit measurements rather indicates a negligible effect. Besides, we found no correlation between explicit and implicit attitudes, indicating a low congruence between these

two aspects of human attitudes. However, only attitudes were measured in this study, and the relation to actual sustainable behavior needs to be clarified. Therefore, it might be worthwhile to investigate the potential attitude-behavior gap for implicit attitudes to get deeper insights into their impact.

Our findings highlight prosocialness as possible mediating factor for the relation of explicit attitudes toward sustainability and mindfulness and its emotional quality heartfulness, respectively. This is in line with the assumption of Woiwode et al. (2021), describing a sense of interconnectedness, compassion and equity and human-nature connectedness as two relevant concepts regarding the elements and mechanisms through which inner dimensions and sustainability are related. However, this connection might be more complex, and therefore, the differentiation into the two aspects of inner and outer awareness seems insightful and should be considered even more in further research. In addition, since our study could not find any related factors to implicit attitudes, future research should address this issue to investigate other potential underlying mechanisms.

**Acknowledgements** We want to thank the students of the master's program "Motion and Mindfulness" who helped during data acquisition.

**Author Contributions** All authors contributed to the study conception and design. Responsible for the organization of the project was Annica Winkelmaier. Leonardo Jost and Franziska Anna Schroter programmed and implemented the study; Christopher Timm Johannes created the stimulus material. Markus Siebertz and Leonardo Jost processed the data and performed the analyses together with Petra Jansen. Petra Jansen designed and supervised the study, developed the theoretical framework, and wrote the manuscript's first draft. All authors commented on previous versions of the manuscript and have approved the final version of the article.

**Funding** Open Access funding enabled and organized by Projekt DEAL.

**Availability of Data and Material** Raw data and material, such as analysis scripts, are stored at OSF: [https://osf.io/5urjb/?view\\_only=302ea054aa474118bf9830f812a6a79b](https://osf.io/5urjb/?view_only=302ea054aa474118bf9830f812a6a79b).

## Declarations

**Competing Interests** On behalf of all authors, the corresponding author states that there is no conflict of interest.

**Ethics Approval** The study was approved by the ethical committee of the University (reference number: 20-1740\_1-101) and has been conducted conforming to the ethical standard laid down in the 1964 Declaration of Helsinki. All participants gave informed consent for participation in the study.

**Consent to Participate and Publish** Informed consent was obtained from all individual participants included in the study.

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## References

- Bamberg, S. (2013). Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change. *Journal of Environmental Psychology, 34*, 151–159. <https://doi.org/10.1016/j.jenvp.2013.01.002>
- Bergomi, C., Tschacher, W., & Kupper, Z. (2014). Konstruktion und erste Validierung eines Fragebogens zur umfassenden Erfassung von Achtsamkeit [Construction and first validation of the Comprehensive Inventory of Mindfulness Experiences]. *Diagnostica, 60*(3), 111–125. <https://doi.org/10.1026/0012-1924/a000109>
- Bergomi, C., Tschacher, W., & Kupper, Z. (2015). Meditation Practice and Self-Reported Mindfulness: A Cross-Sectional Investigation of Meditators and Non-Meditators Using the Comprehensive Inventory of Mindfulness Experiences (CHIME). *Mindfulness, 6*, 1411–1421. <https://doi.org/10.1007/s12671-015-0415-6>
- Böckler, A., Tusche, A., Schmidt, P., & Singer, T. (2018). Distinct mental trainings differentially affect altruistically motivated, norm motivated, and self-reported prosocial behaviour. *Scientific Reports, 8*, 13560. <https://doi.org/10.1038/s41598-018-31813-8>
- Böhme, J., Walsh, Z., & Wamsler, C. (2022). Sustainable lifestyles: Towards a relational approach. *Sustainability Science*. <https://doi.org/10.1007/s11625-022-01117-y>
- Brand, R., & Ekkekakis, P. (2018). Affective-Reflective Theory of physical inactivity and exercise. *German Journal of Exercise and Sport Research, 48*(1), 48–58. <https://doi.org/10.1007/s12662-017-0477-9>
- Brauer, K., Ranger, J., & Ziegler, M. (2023). Confirmatory Factor Analyses in Psychological Test Adaptation and Development. *Psychological Test Adaptation and Development, 4*(1), 4–12. <https://doi.org/10.1027/2698-1866/a000034>
- Brysbaert, M., & Stevens, M. (2018). Power Analysis and Effect Size in Mixed Effects Models: A Tutorial. *Journal of Cognition, 1*(1), 9. <https://doi.org/10.5334/joc.10>
- Cameron, C. D., Brown-Iannuzzi, J. L., & Payne, B. K. (2012). Sequential Priming Measures of Implicit Social Cognition: A Meta-Analysis of Associations With Behavior and Explicit Attitudes. *Personality and Social Psychology Review, 16*(4), 330–350. <https://doi.org/10.1177/1088868312440047>
- Caprara, G. V., Steca, P., Zelli, A., & Capanna, C. (2005). A New Scale for Measuring Adults' Prosocialness. *European Journal of Psychological Assessment, 21*(2), 77–89. <https://doi.org/10.1027/1015-5759.21.2.77>
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203771587>
- Coroiu, A., Kwakkenbos, L., Moran, C., Thombs, B., Albani, C., Bourkas, S., Zenger, M., Brahler, E., & Körner, A. (2018). Structural validation of the Self-Compassion Scale with a German general population sample. *PLOS ONE, 13*(2), e0190771. <https://doi.org/10.1371/journal.pone.0190771>
- de Groot, J. I. M., & Thøgersen, J. (2018). Values and Pro-Environmental Behaviour. In L. Steg & J. I. M. de Groot (Eds.), *Environmental psychology: An introduction* (2nd ed., pp. 167–178). Wiley-Blackwell. <https://doi.org/10.1002/9781119241072.ch17>
- De Houwer, J., Hermans, D., Rothermund, K., & Wentura, D. (2002). Affective priming of semantic categorisation responses. *Cognition and Emotion, 16*(5), 643–666. <https://doi.org/10.1080/02699930143000419>
- Emmons, R. A., & McCullough, M. E. (2003). Counting Blessings Versus Burdens: An Experimental Investigation of Gratitude and Subjective Well-Being in Daily Life. *Journal of Personality and Social Psychology, 84*(2), 377–389. <https://doi.org/10.1037/0022-3514.84.2.377>
- Ericson, T., Kjørstad, B., & Anders, B. (2014). Mindfulness and sustainability. *Ecological Economics, 104*, 73–79. <https://doi.org/10.1016/j.ecolecon.2014.04.007>
- Evans, G. W., Otto, S., & Kaiser, F. G. (2018). Childhood Origins of Young Adult Environmental Behavior. *Psychological Science, 29*(5), 679–687. <https://doi.org/10.1177/0956797617741894>
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191. <https://doi.org/10.3758/BF03193146>
- Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology, 50*(2), 229–238. <https://doi.org/10.1037/0022-3514.50.2.229>

- Fischer, D., Stanszus, L., Geiger, S. M., Grossman, P., & Schrader, U. (2017). Mindfulness and sustainable consumption: A systematic literature review of research approaches and findings. *Journal of Cleaner Production*, *162*, 544–558. <https://doi.org/10.1016/j.jclepro.2017.06.007>
- Geiger, S. M., Grossman, P., & Schrader, U. (2019). Mindfulness and sustainability: Correlation or causation? *Current Opinion in Psychology*, *28*, 23–27. <https://doi.org/10.1016/j.copsyc.2018.09.010>
- Geiger, S. M., Fischer, D., Schrader, U., & Grossman, P. (2020). Meditating for the Planet: Effects of a Mindfulness-Based Intervention on Sustainable Consumption Behaviors. *Environment and Behavior*, *52*(9), 1012–1042. <https://doi.org/10.1177/0013916519880897>
- Glasman, L., Albarracín, D., & Glasman, L. R. (2006). Forming attitudes that predict future behavior: A metaanalysis of the attitude-behavior relation. *Psychological Bulletin*, *132*(5), 778–822.
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, *74*, 1464–1480. <https://doi.org/10.1037/0022-3514.74.6.1464>
- Gustavsen, G., & Hegnes, A. (2019). Individuals' Personality and Consumption of Organic Food. *Journal of Cleaner Production*, *245*, 118772. <https://doi.org/10.1016/j.jclepro.2019.118772>
- Hayduk, L. A., Pazderka-Robinson, H., Cummings, G. G., Levers, M.-J.D., & Beres, M. A. (2005). Structural equation model testing and the quality of natural killer cell activity measurements. *BMC Medical Research Methodology*, *5*(1), 1–9. <https://doi.org/10.1186/1471-2288-5-1>
- Hazem, N., Beaudenaut, M., George, N., & Conty, L. (2018). Social Contact Enhances Bodily Self-Awareness. *Scientific Reports*, *8*, 4195. <https://doi.org/10.1038/s41598-018-22497-1>
- Heckhausen, H., & Gollwitzer, P. M. (1987). Thought Contents and Cognitive Functioning in Motivational Versus Volitional States of Mind. *Motivation and Emotion*, *11*(2), 101–120. <https://doi.org/10.1007/BF00992338>
- Hewitt, J. M. A., & Kealy, D. (2022). Pathological narcissism and psychological distress: The mediating effects of vitality, initiative, and mindfulness. *Personality and Individual Differences*, *184*, 111185. <https://doi.org/10.1016/j.paid.2021.111185>
- Holler, S., Cramer, H., Liebscher, D., Jeitler, M., Schumann, D., Murthy, V., Michalsen, A., & Kessler, C. S. (2021). Differences Between Omnivores and Vegetarians in Personality Profiles, Values, and Empathy: A Systematic Review. *Frontiers in Psychology*, *12*, 579700. <https://doi.org/10.3389/fpsyg.2021.579700>
- Hopwood, C. J., Schwaba, T., Milfont, T. L., Sibley, C. G., & Bleidorn, W. (2022). Personality change and sustainability attitudes and behaviors. *European Journal of Personality*, *36*(5), 750–770. <https://doi.org/10.1177/08902070211016260>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Hudecek, M. F. C., Blabst, N., Morgan, B., & Lermer, E. (2020). Measuring Gratitude in Germany: Validation Study of the German Version of the Gratitude Questionnaire-Six Item Form (GQ-6-G) and the Multi-Component Gratitude Measure (MCGM-G). *Frontiers in Psychology*, *11*, 590108. <https://doi.org/10.3389/fpsyg.2020.590108>
- Hudecek, M. F. C., Blabst, N., Morgen, B., & Lermer, E. (2021). Eindimensionale Skala zur Messung von Dankbarkeit (GQ-5-G). *Zusammenstellung Sozialwissenschaftlicher Items Und Skalen (ZIS)*. <https://doi.org/10.6102/zis300>
- Hupfeld, J., & Ruffieux, N. (2011). Validierung einer deutschen Version der Self-Compassion Scale (SCS-D). *Zeitschrift Für Klinische Psychologie Und Psychotherapie*, *40*(2), 115–123. <https://doi.org/10.1026/1616-3443/a000088>
- Ives, C. D., Freeth, R., & Fischer, J. (2020). Inside-out sustainability: The neglect of inner worlds. *Ambio*, *49*(1), 208–217. <https://doi.org/10.1007/s13280-019-01187-w>
- Jansen, P., Schroter, F. A., Hofmann, P., & Rundberg, R. (2021). The individual Green-washing effect in E-mobility: Emotional evaluations of electric and gasoline cars. *Frontiers in Psychology*, *12*, 1387. <https://doi.org/10.3389/fpsyg.2021.594844>
- Jansen, P., Wolff, F., & Rahe, M. (under review). *How does mindfulness relate to sustainable attitude and behavior? The role of possible mediators.*
- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, *10*(2), 144–156. <https://doi.org/10.1093/clipsy.bpg016>
- Kates, S., & DeSteno, D. (2021). Gratitude reduces consumption of depleting resources. *Emotion*, *21*(5), 1119–1123. <https://doi.org/10.1037/emo0000936>

- Kesenheimer, J. S., & Greitemeyer, T. (2021). Greenwash yourself: The relationship between communal and agentic narcissism and pro-environmental behavior. *Journal of Environmental Psychology, 75*, 101621. <https://doi.org/10.1016/j.jenvp.2021.101621>
- Kline, R. B. (2016). *Principles and Practice of Structural Equation Modeling* (4th ed.). The Guilford Press.
- Kwee, G. T. M. (2021). The Skillful Art of “Heartfulness” and “Kindfulness” in Relational Buddhism. In R. Aristegui, J. Garcia Campayo, & P. Barriga (Eds.), *Relational Mindfulness: Fundamentals and Applications* (pp. 23–49). Springer International Publishing. [https://doi.org/10.1007/978-3-030-57733-9\\_2](https://doi.org/10.1007/978-3-030-57733-9_2).
- Lange, K., Kühn, S., & Filevich, E. (2015). “Just Another Tool for Online Studies” (JATOS): An Easy Solution for Setup and Management of Web Servers Supporting Online Studies. *PLOS ONE, 10*(6), e0130834. <https://doi.org/10.1371/journal.pone.0130834>
- Loy, L. S., Clemens, A., & Reese, G. (2022). Mind-Body Practice Is Related to Pro-environmental Engagement Through Self-compassion and Global Identity Rather Than to Self-enhancement. *Mindfulness*. <https://doi.org/10.1007/s12671-021-01823-1>
- Ma, L. K., Tunney, R. J., & Ferguson, E. (2017). Does gratitude enhance prosociality?: A meta-analytic review. *Psychological Bulletin, 143*(6), 601–635. <https://doi.org/10.1037/bul0000103>
- Mathôt, S., Schreij, D., & Theeuwes, J. (2012). OpenSesame: An open-source, graphical experiment builder for the social sciences. *Behavior Research Methods, 44*(2), 314–324. <https://doi.org/10.3758/s13428-011-0168-7>
- McCullough, M. E., Emmons, R. A., & Tsang, J.-A. (2002). The Grateful Disposition: A Conceptual and Empirical Topography. *Journal of Personality and Social Psychology, 82*(1), 112–127. <https://doi.org/10.1037/0022-3514.82.1.112>
- Morwitz, V. G., Steckel, J. H., & Gupta, A. (2007). When do purchase intentions predict sales? *International Journal of Forecasting, 23*(3), 347–364. <https://doi.org/10.1016/j.ijforecast.2007.05.015>
- Neff, K. D. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity, 2*(3), 223–250. <https://doi.org/10.1080/15298860309027>
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2007). The implicit association test at age 7: A methodological and conceptual review. In: *Social psychology and the unconscious: The automaticity of higher mental processes* (pp. 265–292). Psychology Press.
- Panzone, L., Hilton, D., Sale, L., & Cohen, D. (2016). Socio-demographics, implicit attitudes, explicit attitudes, and sustainable consumption in supermarket shopping. *Journal of Economic Psychology, 55*, 77–95. <https://doi.org/10.1016/j.joep.2016.02.004>
- Park, H. J., & Lin, L. M. (2020). Exploring attitude–behavior gap in sustainable consumption: Comparison of recycled and upcycled fashion products. *Journal of Business Research, 117*, 623–628. <https://doi.org/10.1016/j.jbusres.2018.08.025>
- Pasca, L., Aragonés, J. I., & Coello, M. T. (2017). An Analysis of the Connectedness to Nature Scale Based on Item Response Theory. *Frontiers in Psychology, 8*, 1330. <https://doi.org/10.3389/fpsyg.2017.01330>
- Richter, N., & Hunecke, M. (2020). Facets of Mindfulness in Stages of Behavior Change Toward Organic Food Consumption. *Mindfulness, 11*, 1354–1369. <https://doi.org/10.1007/s12671-020-01351-4>
- Richter, N., & Hunecke, M. (2022). Mindfulness, connectedness to nature, personal ecological norm and pro-environmental behavior: A daily diary study. *Current Research in Ecological and Social Psychology, 3*, 100038. <https://doi.org/10.1016/j.cresp.2022.100038>
- Rosenberg, E. L. (2004). Mindfulness and consumerism. In T. Kasser & A. D. Kanner (Eds.), *Psychology and consumer culture: The struggle for a good life in a materialistic world*. (pp. 107–125). American Psychological Association. <https://doi.org/10.1037/10658-007>.
- Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software, 48*, 1–36. <https://doi.org/10.18637/jss.v048.i02>.
- Rydell, R. J., & McConnell, A. R. (2006). Understanding implicit and explicit attitude change: A systems of reasoning analysis. *Journal of Personality and Social Psychology, 91*(6), 995–1008. <https://doi.org/10.1037/0022-3514.91.6.995>
- Sagiv, L., Roccas, S., & Oppenheim-Weller, S. (2015). Values and Well-Being. In *Positive Psychology in Practice* (pp. 103–120). John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118996874.ch7>.
- Schäufele, I., & Janssen, M. (2021). How and Why Does the Attitude–Behavior Gap Differ Between Product Categories of Sustainable Food? Analysis of Organic Food Purchases Based on Household Panel Data. *Frontiers in Psychology, 12*, 595636. <https://doi.org/10.3389/fpsyg.2021.595636>
- Schutte, N. S., & Malouff, J. M. (2018). Mindfulness and connectedness to nature: A meta-analytic investigation. *Personality and Individual Differences, 127*, 10–14. <https://doi.org/10.1016/j.paid.2018.01.034>

- Shin, S., van Riper, C. J., Stedman, R. C., & Suski, C. D. (2022). The value of eudaimonia for understanding relationships among values and pro-environmental behavior. *Journal of Environmental Psychology, 80*, 101778. <https://doi.org/10.1016/j.jenvp.2022.101778>
- Siebertz, M., Schroter, F. A., Portele, C., & Jansen, P. (2022). Affective explicit and implicit attitudes towards vegetarian and vegan food consumption: The role of mindfulness. *Appetite, 169*, 105831. <https://doi.org/10.1016/j.appet.2021.105831>
- Soutter, A. R. B., & Möttus, R. (2021). Big Five facets' associations with pro-environmental attitudes and behaviors. *Journal of Personality, 89*(2), 203–215. <https://doi.org/10.1111/jopy.12576>
- Spruyt, A., Hermans, D., De Houwer, J., & Eelen, P. (2002). On The Nature of the Affective Priming Effect: Affective Priming of Naming Responses. *Social Cognition, 20*(3), 227–256. <https://doi.org/10.1521/soco.20.3.227.21106>
- Steiner, G., Geissler, B., Schreder, G., & Zenk, L. (2018). Living sustainability, or merely pretending? From explicit self-report measures to implicit cognition. *Sustainability Science, 13*(4), 1001–1015. <https://doi.org/10.1007/s11625-018-0561-6>
- Sustainable Food—Environment—European Commission.* (2016). <https://ec.europa.eu/environment/archives/eussd/food.htm>
- Thiermann, U. B., Sheate, W. R., & Vercammen, A. (2020). Practice matters: Pro-environmental motivations and diet-related impact vary with meditation experience. *Frontiers in Psychology, 11*. <https://doi.org/10.3389/fpsyg.2020.584353>.
- Thiermann, U. B., & Sheate, W. R. (2021). The Way Forward in Mindfulness and Sustainability: A Critical Review and Research Agenda. *Journal of Cognitive Enhancement, 5*(1), 118–139. <https://doi.org/10.1007/s41465-020-00180-6>
- Van Dam, N. T., van Vugt, M. K., Vago, D. R., Schmalzl, L., Saron, C. D., Olendzki, A., Meissner, T., Lazar, S. W., Kerr, C. E., Gorchov, J., Fox, K. C. R., Field, B. A., Britton, W. B., Brefczynski-Lewis, J. A., & Meyer, D. E. (2018). Mind the Hype: A Critical Evaluation and Prescriptive Agenda for Research on Mindfulness and Meditation. *Perspectives on Psychological Science, 13*(1), 36–61. <https://doi.org/10.1177/1745691617709589>
- Vö, M.L.-H., Conrad, M., Kuchinke, L., Urton, K., Hofmann, M. J., & Jacobs, A. M. (2009). The Berlin Affective Word List Reloaded (BAWL-R). *Behavior Research Methods, 41*(2), 534–538. <https://doi.org/10.3758/BRM.41.2.534>
- Voci, A., Veneziani, C. A., & Fuochi, G. (2019). Relating mindfulness, heartfulness, and psychological well-being: The role of self-compassion and gratitude. *Mindfulness, 10*(2), 339–351. <https://doi.org/10.1007/s12671-018-0978-0>
- Wamsler, C., Brossmann, J., Hendersson, H., Kristjansdottir, R., McDonald, C., & Scarampi, P. (2018). Mindfulness in sustainability science, practice, and teaching. *Sustainability Science, 13*, 143–162. <https://doi.org/10.1007/s11625-017-0428-2>
- Whelan, R. (2008). Effective Analysis of Reaction Time Data. *The Psychological Record, 58*(3), 475–482. <https://doi.org/10.1007/BF03395630>
- Whitburn, J., Linklater, W., & Abrahamse, W. (2020). Meta-analysis of human connection to nature and proenvironmental behavior. *Conservation Biology, 34*(1), 180–193. <https://doi.org/10.1111/cobi.13381>
- Woiwode, C., Schäpke, N., Bina, O., Veciana, S., Kunze, I., Parodi, O., Schweizer-Ries, P., & Wamsler, C. (2021). Inner transformation to sustainability as a deep leverage point: Fostering new avenues for change through dialogue and reflection. *Sustainability Science, 16*(3), 841–858. <https://doi.org/10.1007/s11625-020-00882-y>

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