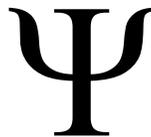




**DET PSYKOLOGISKE FAKULTET**



***Immaterial Bliss: On the relationship between subjective well-being  
and green behaviour***

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# SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

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### **Abstract**

Protecting the environment and enjoying a high quality of life are two pursuits often viewed as being in conflict with each other, although this assumption is largely based on conventional wisdom rather than science. In the last decade the relationship between them has received increasing attention from researchers, and there has been published a number of studies investigating it. In this article, we investigate the relationship between green behaviour (GB) and subjective well-being (SWB) by reviewing the existing empirical literature on the subject. The article is divided into two reviews. In the first review we examine studies investigating the relationship between GB and SWB directly and identify variables that may explain the relationship. In the second review we examine studies that investigate relations between each of these variables and GB or SWB. Contrary to conventional wisdom, the overall finding is a positive relationship between GB and SWB, and this relationship is partially mediated by value orientation and mindfulness. Additionally, connection to nature is positively related to both GB and SWB.

## Sammendrag

Å verne om miljøet og å nyte høy livskvalitet er to målsetninger som ofte blir ansett å være i konflikt med hverandre, selv om denne antagelsen hovedsakelig er basert på allmenne oppfatninger heller enn vitenskap. I løpet av det siste tiåret har forholdet mellom dem fått økende oppmerksomhet fra forskere, og det har blitt publisert et antall studier som undersøker det. I denne artikkelen undersøker vi forholdet mellom grønn adferd (GB) og subjektivt velvære (SWB) ved å lage en oversikt over eksisterende empirisk litteratur på emnet. Artikkelen består av to oversiktsstudier. I den første ser vi på studier som undersøker forholdet mellom GB og SWB direkte, og identifiserer variabler som kan tenkes å forklare forholdet. I den andre oversiktsstudien tar vi for oss vi studier som undersøker forholdene mellom hver av variablene og GB eller SWB. I strid med allmenne oppfatninger viser funnene generelt et positivt forhold mellom GB og SWB, og dette forholdet medieres delvis av verdiorientering og oppmerksomt nærvær. I tillegg er tilknytning til naturen positivt forbundet med både GB og SWB.

### **Immaterial bliss: On the relationship between subjective well-being and green behaviour**

The world is currently facing an environmental crisis that is mainly caused by unsustainable human activity (IPCC, 2014). The crisis includes overexploitation of non-renewable resources and water (Jury & Vaux Jr, 2007), and overexploitation of the soil, leading to increased rates of erosion of the land needed for growing crops (Pimentel, 2006; Rickson et al., 2015). Importantly, it also includes the vast emissions of greenhouse gases that are causing a spectrum of adverse effects collectively known as climate change (IPCC, 2014).

In the discourse surrounding the environmental crisis, suggested strategies to mitigate it include two broad classes of solutions to reduce environmental impact. The first is ways to reduce consumption, while the second is to develop more efficient technological solutions (often referred to as “green growth”). The first type of solution is arguably the safest, as, for instance, there is little doubt that this approach, if implemented early and intensely enough, will allow greenhouse gas emissions to be reduced enough to be kept within the limits of a 2°C rise in average global temperature (IPCC, 2014). The second type of solution may, however, be easier to favour by politicians, as they do not entail sacrifices of the material comforts of voters, such as big houses, new cars, red meat dinners, and frequent flying. The technological approach promises that people will be allowed to keep on consuming at ever increasing levels, while simultaneously lowering the environmental impact of this consumption.

However, the technological approach has a major drawback as its effect is much more uncertain than that of reduced consumption. It involves solutions that have not yet been sufficiently tested - like carbon capture and storage (Haugan, 2009) - and technologies that have not yet been developed - like nuclear fusion power (World Nuclear Association, 2015). In addition to this, increased efficiency thanks to technological innovation does not necessarily lead to reduced emissions, as consumers often compensate for increased efficiency by consuming more; a phenomenon known as the *rebound effect* (Herring & Roy, 2007; Polimeni, Mayumi, Giampietro & Alcott, 2008).

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The projected climate models show that significant emission reductions will have to come in the next few years if the two-degree target is going to stay within reach (IPCC, 2014). Because of the limited time, reliance on the technological approach alone, with all its uncertainty, is quite risky. As failure to sufficiently reduce greenhouse gas emissions likely would be irreversible and catastrophic (IPCC, 2014), application of the precautionary principle is called for in accordance with the Rio Declaration (United Nations, 1992). Therefore, the innovative green growth solution should not be the only approach used to solve the climate change problem and other ecological crises when more certain means of emission reduction – like efforts to reduce consumption – are also available.

Reduced consumption is doubtlessly a harder sell than technological innovations, as it generally is construed as a cost - something undesirable, a necessary sacrifice of individual well-being that needs to be made in order to maintain the health of the planet that all humans depend on. But is framing the problem as a trade-off between well-being and sustainability realistic? Will reduced consumption necessarily reduce people's enjoyment of their lives? Or is it possible to act and live pro-environmentally, and at the same time be *more* happy and satisfied in life, rather than less happy and satisfied? The answer to this question may have important implications for efforts to reduce detrimental human impacts on the environment. The question has received increasing attention in recent years, and there is today a blooming of research into this area. However, there has to our knowledge not been published a comprehensive review of the research so far, and this makes it hard for both researchers and policymakers to gain an overview of the topic. This is this gap in the literature that we, with the present paper, aim to close.

In the following, we attempt to answer two questions: 1) are *subjective well-being* (SWB) and *green behaviour* (GB) related to each other?, and 2) if so, what mechanisms can explain this relationship, and how? To answer these questions we conducted two review studies of the relevant academic literature to date.

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The first review study was aimed at answering the first research question, and was based on a literature search for empirical studies that combine search terms encompassing GB and SWB. From this search, potential mechanisms explaining the relationship between GB and SWB were noted. The potential mechanisms were identified as variables related to both GB and SWB, either as moderators or mediators of a direct relation between GB and SWB or as variables that are correlated with both. Based on the results from the first review, the second review consisted of separate literature searches into the most important of the identified mechanism variables. The aim of the second review was to answer our second research question; that is, to gain more insight into the explanatory power of the mechanisms and how they work.

While Review 1 is intended to be exhaustive, as the aim is to map a field of research, Review 2 is more limited, aiming to explore the significance of the mechanism variables beyond the findings of Review 1, while at the same time keeping from overextending the scope of this paper. Review 2 was therefore limited to meta-analyses from the last five years, and only in cases where meta-analyses were found were all empirical articles to date included.

Each review is treated separately with its own introduction, method, results and discussion sections. After this, there is a general discussion of the overall findings, where we make a whole of the different threads we have spun. Implications for society and future research will also be discussed.

### **Review 1: Subjective well-being and green behaviour**

As mentioned, Review 1 is aimed at answering our first research question: are SWB and GB related to each other? In addition to reviewing studies of direct covariation between the two concepts, we also note potential mechanism variables to be explored further in Review 2. We begin, however, by introducing the main variables with some background information and description of how they are measured.

### **Subjective well-being**

Well-being is an umbrella term consisting of a variety of concepts, including life satisfaction, happiness, vitality and felt meaning in life. Traditionally, there have been two approaches to the study of well-being: the hedonic, focusing on positive feelings like joy and happiness as well as general life satisfaction (Diener, 2000); and the eudaimonic, focusing on the feeling of meaning and purpose in life (Ryff & Keyes, 1995). These approaches are closely related; for example, positive moods may promote the feeling that life is meaningful (King, Hicks, Krull, & Del Gaiso, 2006). It has been argued that even though different kinds of well-being have been identified, it is most likely a multidimensional phenomenon consisting of both eudaimonic and hedonic components (Ryan & Deci, 2001; Seligman, 2002).

Most psychological well-being research focuses on subjective well-being (SWB). SWB is a combination of life satisfaction and a higher frequency of positive than negative emotions (Diener, 2000; Diener, Suh, Lucas & Smith, 1999), and as such it falls within the hedonic tradition of well-being. SWB is the term we will use in this paper, as most of the articles we have looked into have focused on SWB. However, as the concepts are closely related, we have not excluded studies within the eudaimonic tradition from our review. When considering studies using eudaimonic measures, we will point this out.

As SWB per definition is subjective, it is traditionally measured through self-report. Usually this is done by administering a combination of questionnaires tapping life satisfaction (for example, the five-item Satisfaction with Life Scale; Diener, Emmons, Larsen, & Griffin, 1985) and positive affect (for example, the 20-item Positive and Negative Affect Schedule; Watson, Clark, & Tellegen, 1988). Self-report measures of SWB have demonstrated convergent, discriminant and predictive validity (Sandvik, Diener, & Seidlitz, 1993). However, self-report measures are prone to be somewhat influenced by mood at the time of judgments (Schwarz & Strack, 1999), as well as to be affected by memory bias (Kahneman, 1999) and preceding questions (Schwarz & Strack, 1999). To avoid these limitations, newer measures of SWB such as

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daily diaries (Kahneman, Krueger, Schkade, Schwartz, & Stone, 2004) or experience sampling through pagers (Schimmack, 2003; Scollon, Kim-Prieto, & Diener, 2003) are increasingly used. These measures may get closer to the real-life experience of SWB, as they tap current emotions over a period of time and then average these, instead of asking respondents to generate this average from own memory. However, these approaches are time-consuming both for participants and researchers. In larger surveys such as the Gallup poll, SWB is often instead measured through single-item questions such as the Cantril ladder (Cantril, 1965), where respondents are asked to place themselves on a ladder from the worst possible to the best possible life imaginable.

In the current reviews we have included studies using all the above approaches to measuring SWB, because even though measures such as the Cantril ladder do not capture all there is to the experience of subjective well-being, all of them fall within the *spectrum* of experienced well-being. On the other hand, we have excluded studies that use objective proxies for well-being, such as income or average length of life. Though related to SWB, the relationship is not strong (see, e.g., Diener & Biswas-Diener, 2002; Diener & Chan, 2011), and we have therefore considered them less relevant. For the same reason, we have also excluded studies that use well-being measures dominated by physical health items, and studies using an average of objective and subjective measures, so that the subjective component is not possible to differentiate.

### **Green behaviour**

Green behaviour (GB) is a concept denoted through a multitude of terms; environmentally friendly behaviour, ecologically responsible behaviour, sustainable behaviour and conservation behaviour can all be used as synonyms. GB include a variety of different actions, such as recycling, energy and water conservation, and choosing low-emission transport alternatives such as bicycle or train instead of driving a car. Buying environmentally friendly produce and used products instead of new can also be termed “green”. All of these actions have in common that

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they are assumed to contribute to the preservation of natural resources and/or the lowering of greenhouse gas emissions.

In research, different measures are used to capture GB. Direct observation is sometimes applied, although this can be difficult to arrange. The most common measure is self-report. Participants are typically asked to note how many times in the past few days, weeks or months they have performed a variety of different behaviours. Self-report measures have the advantage of making it possible to measure several behaviours at once, while direct measures usually are limited to single behaviours. Several self-report measures for GB have been developed, including the Eco-Friendly Behavior Scale (Mayer & Frantz, 2004) and the General Ecological Behavior Scale (Kaiser, 1998). A popular type of GB questionnaire is scales designed to produce a measure of an Ecological Footprint - an estimate of how many copies of planet Earth's would be required to support humanity if all humans were to adopt the respondent's lifestyle (Global Footprint Network, 2011). It is common, however, for researchers to construct their own scales from their own selection of behaviours. The selections of behaviours are generally quite uniform though, and most include measures of recycling, consumption, transportation choices, and energy- and water conservation.

A potential drawback of self-report measures of GB is that they might be prone to socially desirable responding, and studies on GB rarely control for this. However, in the few cases where the effect of social desirability on GB *has* been tested, only weak to non-significant effects have been found (Milfont, 2009). Unfortunately this does not completely settle the case, as existing methods for controlling for social desirability lack in precision (McCrae & Costa, 1983). It can therefore be argued that self-report measures that are subject to social desirability have this as an inherent weakness. A second drawback of self-reported GB, which might be related to the first, is that even though the association between self-reported and actual GB is nominally large, most of the variation remains unexplained (Kormos & Gifford, 2014). Because of these arguments, direct

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objective measurements of GB are to be preferred over self-reported GB. Practical considerations make this hard to achieve though, so in most studies self-report measures are used.

Sometimes proxies to GB are used, like behavioural intentions and attitudes. Such measures are valid as measures of GB to the extent that they predict GB, and both intentions and attitudes do so to an acceptable degree. Within the framework of the Theory of Planned Behaviour (Ajzen, 1991), attitudes, moral norms and perceived behavioural control have been found to collectively predict 52% of the variation in behavioural intention, while behavioural intention again predicts 27% of the variance in actual behaviour (Bamberg & Möser, 2007). Behavioural intention is as such more closely related to actual behaviour than attitudes are. Additionally, attitudes have been found to be slightly more prone to social desirability (Milfont, 2009). In order to ensure a high construct validity in our review, we have included only studies using measures of actual GB and behavioural intention, while excluding studies where attitudes is the closest proxy.

### Method

**Search strategy.** The databases PsycINFO and Web of Science were used to find relevant articles in English up until October 2015. Two groups of terms, denoting SWB and GB, were combined with the operator *AND* (see Table 1). In Web of Science the search was conducted by topic; in PsycINFO it was conducted by keyword. A total of 419 articles were found in the databases.

**Selection criteria.** The relevance of the articles was decided from title and abstract. To be deemed relevant, articles had to investigate one of the following: 1) covariation between SWB and GB, and/or 2) common predictors of SWB and GB. Purely theoretical studies were excluded. References and citing articles were also checked. After removal of duplicates, we had a total of 18 articles (see Table 2) that we read in full. For the sake of covering the field as well as possible, we chose not to exclude studies that we found to have major weaknesses, but rather to comment on methodological weaknesses in the results section.

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Table 1

*Groups of GB and SWB terms used in all database searches*

Green behaviour (GB)	Subjective well-being (SWB)
Carbon footprint	Joy
Conservation behavior*	Happiness
Eco-behavior*	Life quality
Eco-friendly behavior*	Life satisfaction
Ecological behavior*	Quality of life
Ecological footprint	Wellbeing
Ecologically responsible behavior*	Well-being
Energy use	
Environmental behavior*	
Environmental footprint	
Environment* friendly behavior*	
Green behavior*	
Recycling	
Sustainable behavior*	
Sustainable consumption	

*Note.* Each term in each group was combined with the operator *OR*, and then both groups were combined with the operator *AND*.

Table 2

*Number of results in Review 1*

Database	Results	Relevant articles	Relevant articles after checking 'cited by' and references	Total relevant articles after removal of duplicates
PsycINFO	163	10	11	18
Web of Science	326	11	14	

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**Interpretation of effect sizes.** For sake of the overview, we interpreted results in terms of effect size, according to appropriate conventions. Effect sizes are often divided into two groups: those that capture linear relationships, and those that capture group differences (Huberty, 2002; McCartney & Rosenthal, 2000). Cohen (1988) has developed conventions for both groups. These conventions have been criticized for being somewhat arbitrary (Huberty, 2002; McCartney & Rosenthal, 2000), but they are still widely applied. As use of effect size conventions makes it easy to compare magnitude of findings across studies, we have chosen to use Cohen's (1988) conventions in our review.

Thus, for linear relationship coefficients, including correlation coefficients such as Pearson's  $r$ , Spearman's rho ( $r_s$ ) and phi ( $r_\phi$ ), effect sizes of .10 to .29 were considered small, .30 to .49 were considered moderate, and .5 and above were considered large. As simple linear regression coefficients (with one dependent variable and one independent variable) are equivalent to  $r$  (Gordon, 2015), these have been interpreted according to the same conventions. For squared linear relationship coefficients, such as  $r^2$  and partial eta squared ( $\eta_p^2$ ), .01 to .08 was considered a small effect size, .09 to .24 was considered medium, and .25 and above was considered large. For group difference measures, such as Cohen's  $d$  and Hedge's  $g$ , effect sizes of .20 to .49 were considered small, .50 to .79 were considered medium, and .80 and above were considered large.

There are also some unstandardized coefficients ( $b$ ) among our results; as these are unstandardized they cannot be judged for effect size based on conventions. Similarly, multiple regression coefficients (with two or more independent variables), even though standardized, are not commonly interpreted in terms of effect size. Therefore, when we discuss findings using such coefficients, we only refer to the existence and direction of relationships (not magnitude).

When several analyses were run on the same data, only one coefficient was used to avoid single data samples being overrepresented in our results. In such cases, correlation coefficients

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(including squared coefficients like  $r^2$ ) were preferred over regression coefficients, as correlations are less controversial to interpret as effect sizes. All coefficients are found in Table 3 (see Appendix A).

### Results

We found 18 articles that fit our criteria, totalling 22 studies on separate samples (see Table 3 for descriptive data). The studies vary somewhat in the way constructs are defined and measured. Measures of SWB include, with few exceptions, a measure of life satisfaction, but vary in number of items used to measure it, and in the extent to which additional SWB-components are measured. Measures of GB vary more than those of SWB. Almost half of the studies measure GB as self-reported frequencies of deliberate actions to reduce one's environmental impact, such as recycling, choosing low-impact means of transportation, and buying organic or locally produced food. These studies vary however, in how many different behaviours they include. Other studies use more distant proxies, such as objective greenhouse gas emissions.

Though the articles all present empirical research demonstrating links between SWB and GB, they differ in the research questions they address and also in the way they connect SWB with GB. Some of the studies ask whether or not there is covariation between SWB and GB as their central research question. In other articles the finding of this covariation is more peripheral to the main objective of the study, and some studies do not measure the covariation directly, but instead look at factors that are positively related to both SWB and GB. These are factors that can reasonably be hypothesized to be causal factors, though evidence of causality is not presented in any of the studies. In the following, we present common themes and divergent results. We start with direct covariation and prediction findings, and then move on to the findings where SWB and GB are connected via common correlates. Some of the articles assess both connection through

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covariation and via one or more common correlates. These articles are mentioned in all sections where they apply.

### **Studies directly assessing covariation between GB and SWB**

Fourteen cross-sectional survey studies directly assess covariation between GB and SWB, and 10 of these found a significant relationship. Of these, six studies found small, positive effect sizes (Brown & Kasser, 2005, studies 1 & 2; Corral-Verdugo, Mireles-Acosta, Tapia-Fonllem, & Fraijo-Sing, 2011; Jacob, Jovic, & Brinkerhoff, 2009; Snell & Simmonds, 2015; Xiao & Li, 2011). The four remaining studies found GB to significantly predict SWB using multiple regression (Corral-Verdugo et al., 2013; Mzoughi, 2014; Tapia-Fonllem, Corral-Verdugo, Fraijo-Sing, & Duron-Ramos, 2013; Welsch & Kühling, 2010). It needs to be noted that the findings from three of these studies differ somewhat from the rest:

Jacob et al. (2009) found only one of three scales measuring GB to be significantly related to SWB. This makes this finding weaker than the other findings in this section. It deserves mention though, that the whole sample belonged to a Buddhist community that highly values GB, and the GB-scores of this group were very much skewed toward the high end of the scales. It is therefore possible that the result is weak due to a ceiling effect.

Mzoughi (2014) studies the effect of organic versus conventional farming on SWB. We have equated organic farming practice with GB and listed it along with the other studies in this section. Farming practice is a very narrow behavioural dimension that pertains only to small subsets of most populations. We still decided to list this study next to the other GB-studies because choosing organic over conventional farming is a pro-environmental choice, and the analysis controls well for other possible factors that may or may not benefit organic over conventional farmers.

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Xiao and Li (2011) use a GB-measure with questionable validity: Each of the three subscales contain very few items, and two of them include primes reminding the respondents of how their choices affect their personal finances and social responsibilities. This might have influenced responses. As the survey was conducted in Chinese and the study was published in English, there is of course the possibility that the survey items have been somewhat distorted when translated.

Four of the 14 survey studies assessing covariation between GB and SWB found no significant association (Andersson, Nässén, Larsson, & Holmberg, 2014; Kaida & Kaida, 2015; Suarez-Varela, Guardiola, & Gonzalez-Gomez, 2014; Wilson, Tyedmers, & Spinney, 2013). Out of these studies, two did not measure GB directly, but used greenhouse gas (GHG) emissions as a proxy (Andersson et al., 2014; Wilson et al., 2013). They are the only two studies in this section to have used this proxy, and it is therefore reasonable to assume that GB and GHG emissions are less closely related than they may appear at face value. Perhaps, for instance, GB has only a small or non-existent effect on GHG emissions, and perhaps behaviours other than those typically measured as GB are more important for determining GHG emissions.

Suarez-Varela et al. (2014) used a measure for GB that narrowly focused on water-saving efforts – an issue of particular importance in the district where the survey was carried out. Their result was only significant for one of six items – *Water-saving device installed in taps: yes/no* - an item that has less to do with day-to-day GB and is more of a long-term environmentally friendly investment. All the items tapping day-to-day behaviour showed no significant relation with SWB and we therefore regard the results of this study as a non-significant finding in the context of this review.

In sum, we find that the evidence presented here supports there being a relation between GB and SWB, as 10 of the 14 articles that investigate it, show a significant positive association.

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We consider the importance of two of the positive findings to be relatively low because one study only found significant results for one of three subscales (Jacob et al., 2009), and the other one include survey items with questionable validity (Xiao & Li, 2011). We also consider the importance of three of the negative findings to be of limited importance, as two of them use GHG emission as a proxy, which may not be appropriate, and one of them uses a very narrow operationalization of GB (Suarez-Varela et al., 2014). Among the articles that used standard measures and had no apparent validity issues, seven yielded positive findings (Brown & Kasser, 2005, study 1 & 2; Corral-Verdugo et al., 2011; Corral-Verdugo et al., 2013; Snell & Simmonds, 2015; Tapia-Fonllem et al., 2013; Welsch & Kühling, 2010), while one yielded null results (Kaida & Kaida, 2015).

### **GB-SWB connection via common correlates**

Twelve of the articles connect SWB and GB by investigating how both relate to common correlates, or mechanism variables. All studies are cross-sectional, so there is no evidence of causality, but the assumption is that these third variables are factors jointly affecting both SWB and GB. The question of causality is investigated further in Review 2. Among our findings we identified five different mechanism variables connecting GB with SWB. These are connection to nature (four studies), value orientation (four studies), mindfulness (two studies), voluntary simplicity lifestyle (three studies), and mystical experiences in nature (one study). All mechanism variables will be explained very briefly before the results are presented.

**Connection to nature.** Four survey studies found an individual's experience of connection to nature to be positively correlated with both GB and SWB (Mayer & Frantz, 2004; Nisbet & Zelenski, 2013, studies 1, 3, & 4). Connection to nature (CN) is a construct encompassing both thoughts and feelings surrounding one's subjective relationship with nature (Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009). Those who are strong on trait CN

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more often agree to statements like “I feel at one with nature” and “I feel part of nature” (Tam, 2013a).

In this review, the evidence is strongest of the relation between CN and GB, as all four of the survey studies showed medium correlations significant at the .01 level. For well-being, measured as both SWB and eudaimonic well-being, the results are mixed. The correlations are in the small to medium range, and three of the studies (Nisbet & Zelenski, 2013, studies 1, 3, & 4) have some non-significant subscales among their measures, one of them being life satisfaction, which is central to the SWB construct. Life satisfaction is however significantly correlated in the fourth study (Mayer & Frantz 2004). None of the studies assess direct covariation between SWB and GB, so they give no hints as to whether CN could be a moderator or mediator of the SWB-GB-relation in the general population.

**Value orientation.** Value orientation (VO) refers to whether one is extrinsically oriented, that is, whether one highly values external or materialistic aspects of life, such as financial success and admiration from others; or whether one is intrinsically oriented, that is, whether one highly values more intrinsically rewarding aspects of life, such as close social relationships and self-acceptance (Grouzet et al., 2005; Schwartz, 1992).

In this review, three survey studies found VO to be significantly associated with both GB and SWB: Andersson et al. (2014) found a small negative correlation between an extrinsic VO and SWB, while Brown and Kasser (2005, studies 1 & 2) found an intrinsic VO to significantly predict both GB and SWB. One study (Villacorta, Koestner, & Lekes, 2003) found an autonomous orientation toward the environment, a construct closely related to an intrinsic value orientation, to be positively correlated with both GB and SWB (small effect sizes in both cases). Just as intrinsic values are characterized by their ability to satisfy the basic human need for autonomy, autonomous orientation toward the environment is a measure of perceived internal

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versus external control of behaviour. It is also positively correlated with intrinsic values and uncorrelated with extrinsic values. In sum, these findings suggest that a VO where intrinsic values are favoured over extrinsic values is favourable for both GB and SWB. Two of these studies found VO to partially mediate the positive relationship between GB and SWB (Brown & Kasser, 2005, studies 1 & 2), suggesting that VO could be a partial mediator of this relationship in the general population.

**Mindfulness.** The third mechanism variable found in this review, mindfulness, can be described as “non-judgmental awareness in the present moment” (Jacob et al., 2009, p. 276). Two survey studies found mindfulness to be positively associated with both SWB and GB (Brown & Kasser, 2005, study 2; Jacob et al., 2009). The strongest relation seems to be the one between mindfulness and SWB, as Jacob et al. (2009) here found a moderate sized correlation, while they found a small correlation for the mindfulness-GB-link. However, the small size of this effect may be explained by the whole sample being skewed toward the high end of the GB-scales, indicating a ceiling effect. Brown and Kasser (2005, study 2) found mindfulness to significantly predict GB and SWB. Both studies additionally found covariation between SWB and GB, and one (Brown & Kasser, 2005, study 2) found this relationship to be partially mediated by mindfulness (when entered into the model with VO), suggesting that mindfulness might be a partial mediator of this relationship in the general population.

**Voluntary simplicity.** Three survey studies investigated the relationship between voluntary simplicity and SWB and GB (Brown & Kasser, 2005; Kennedy, Krahn, & Kroghman, 2013; Monopolis, 2011). Voluntary simplicity (VS) can be defined as a lifestyle characterized by low consumption and material self-dependency (Iwata, 1997). The *voluntary* aspect of VS is of absolute importance, as VS is a lifestyle chosen by free will, not dictated by circumstance. The *simplicity* component has a more shifting quality, as the degree of simplicity varies between

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individuals who define themselves as voluntary simplifiers; in general, however, this is a lifestyle of sufficiency or having simply enough.

Only one of the studies in our review (Monopolis, 2011) found VS lifestyle to be positively associated with both GB and SWB. The findings for the VS-SWB-link are the strongest, suggesting a highly significant medium-large correlation. This study has one important weakness however, namely that it fails to control for likely systematic differences between VS-practitioners and the general population, such as education and income. The VS-GB-link is only weakly supported, as it was measured separately from the main survey on a small subsample of only VS-practitioners who reported their present, and in retrospect their past ecological footprint. The second study (Brown & Kasser, 2005, study 2) found VS to significantly predict GB, but not SWB.

The third study examined how downshifting - a concept related to VS - was related to GB and SWB (Kennedy, Krahn, & Krogman, 2013). Downshifting refers to choosing to work less hours in order to have more leisure time (Etzioni, 2003). The study yielded no significant results for SWB, but downshifting significantly predicted (small effect size) one of two scales from the GB measure: sustainable household practices. Looking closer at this scale, however, six out of seven items saves money as well as reduces environmental impact. Considering that downshifter have reduced their incomes, the behaviour may just as easily be motivated by financial concerns. If saving money and sparing the environment would always go hand in hand, this need not be a problem, but in many instances less expensive choices are worse for the environment (non-organic food, non-renewable energy, imported rather than locally produced goods, etc.). We therefore question the validity of the GB measure used in this article and put little weight on this result. Another weakness in this study is that the respondents were asked to report whether anyone in their household had downshifted within the last five years, while reporting their own

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personal SWB. A possible explanation why they found no relation between SWB and downshifting may be because the people reporting their SWB were not necessarily the same people who did the downshifting.

In sum, the evidence from the three above studies is strongest for the VS-GB-relation, as all show positive results, although the methodology is weaker in one of the studies. The VS-SWB-relation is only weakly supported, as two of the studies yielded no result, and the third has questionable validity. One of the studies (Brown & Kasser, 2005, study 2) also found direct covariation between GB and SWB, but there is no indication that VS would play a mediating role in this relation, as VS was associated only with GB. The survey on downshifting (Kennedy et al., 2013) could have added nuance to the evidence by separating the voluntary reduction of working hours and income of VS from its moral stance, but because of methodological weaknesses the results are of limited value.

**Mystical experiences in nature.** The last mechanism variable found in this review was mystical experiences in nature. “Mystical experiences” include such as a loss of self, a loss of space and time, a sense of oneness, sacredness or holiness, and an acknowledgement that the experience brings with it a new sense of reality (Stace, 1960). Mystical experiences can occur in various environments, but there is some evidence that natural environments may elicit such experiences more easily than human-built settings (Fredrickson & Anderson, 1999; Keutzer, 1978; Williams & Harvey, 2001).

In this review, one survey study (Snell & Simmonds, 2015) found mystical experiences in nature to explain a small amount of the variation in SWB, while controlling for contact with nature and demographic variables. It also found a small correlation between mystical experiences in nature and GB.

### **Discussion**

Summing up the results from Review 1, we can say that there is good support for a positive relation between SWB and GB. Among the studies we have reviewed, different measures of SWB and GB have been used, as well as different methodologies and statistical procedures. This increases the likelihood that the studies are capturing real constructs. There are some null results, but these are few compared to the positive findings, and none of the findings indicate a negative association between SWB and GB. This contradicts the idea that there is a conflict between GB and SWB. This could be concluded whichever the direction of causality may be in the GB-SWB relation: happiness does not cause people to be less considerate toward the environment, nor does consideration for the environment make people less happy.

Overall, the relationship between GB and SWB appears to be of a small size, when interpreted according to conventions (Cohen, 1988). However, it should be noted that this is similar to the size of more traditionally acknowledged relationships between SWB and other variables, such as marital status (Diener, Gohm, Suh, & Shigehiro, 2000; Haring-Hidore, Stock, Okun, & Witter, 1985), education (Witter, Okun, Stock, & Haring, 1984), religiosity (Diener, Tay, & Myers, 2011; Hackney & Sanders, 2003; Witter, Stock, Okun, & Haring, 1985), volunteering (Thoits & Hewitt, 2001), physical attractiveness (Diener, Wolsic, & Fujita, 1995; Plaut, Adams, & Anderson, 2009), personal income within countries (Diener, Sandvik, Seidlitz, & Diener, 1993; Haring, Stock, & Okun, 1984), and personality traits such as agreeableness (DeNeve & Cooper, 1998; Steel, Schmidt, & Schultz, 2008). Thus, when compared to existing social research the relationship between SWB and GB proves more substantial than conventions would indicate. SWB is likely related to a large number of variables, of which GB appears to be of equal importance to others.

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One potentially important point however, is that the only two studies to assess a relation between SWB and measures of GHG emissions did not find any significant association. At present, GHG emissions is arguably among the top threats to the environment, and when studies specifically investigating the relationship between GHG emissions and SWB comes up with different results from studies investigating the relationship between GB and SWB, this is concerning. It could be that GB as it is typically assessed - as day-to-day consumer choices - does not have a significant effect on GHG emissions. Indeed, there seems to be areas of daily life where many consumers don't have green options available, and therefore end up failing to make significant GHG cuts despite being environmentally responsible in most of the domains included in typical GB measures. There is evidence for this, particularly regarding transportation (Barr, Shaw, & Coles, 2011; Gjerland, 2015). Choosing means of transportation other than car is very demanding, if not impossible for many people, depending on their family and work situations as well as transport infrastructure. The null results between GHG emissions and SWB could indicate that there are other factors that account for individual differences in GHG emissions over and above GB. Important to point out, however, is that high GHG-emissions also did not affect SWB, so in sum it seems that in terms of happiness, polluting a lot does not make people any better off than polluting little. This incongruence between GB and GHG emissions in predicting SWB raises important questions for future research, for instance: What effect does GB have on reducing GHG emissions? And, what other factors account for individual differences in GHG beside GB?

Due to the cross-sectional nature of the studies in the review that found significant results and had acceptable validity, we have no evidence on the direction of causality. It is not hard to imagine it going either direction. It could be that SWB causes GB, as happiness often involves increased energy and vitality. This could make it easier to perform behaviours that less happy

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individuals may experience as burdensome and therefore be reluctant to do. Equally it could be that GB causes SWB, for example based on self-perception theory (Bem, 1967); a person observing herself recycling and then bicycling to work might deduce that “Hey, I must be a good person to be doing all this, and how great that makes me feel”. However, none of the studies in our review support either of these explanations. Instead, several of the studies suggest different mechanism variables that could help explain the relation between SWB and GB.

In our review, five potential mechanism variables were identified: connection to nature, value orientation, mindfulness, voluntary simplicity, and mystical experiences in nature. Findings are fairly strong for the first three variables, while support for the fourth is more mixed, as voluntary simplicity is not always related to higher levels of SWB (e.g., see Brown & Kasser, 2005). The fifth variable is also preliminary, as there was only one study investigating it. Further investigation of the role of mystical experiences in nature is needed; it would for example be interesting to know whether it is related to connection to nature - are people higher in nature connection more likely to have mystical experiences in nature?

The reason for the mixed results regarding voluntary simplicity might be that, rather than being a direct moderator of the relationship between SWB and GB, it is a lifestyle that corresponds well with the more internal variables of connection to nature, intrinsic values and mindfulness. The motivations to engage in a lifestyle of voluntary simplicity often qualify as intrinsic values, and a simple life might well be conducive to mindful awareness, as there likely will be fewer distractors than in a more mainstream lifestyle. Also, a reason to choose a lifestyle of simplicity might be to be closer to nature. In short, voluntary simplicity might be a lifestyle where the other mechanism variables easily can be combined - perhaps, even, the lifestyle that results when one tries to live according to one's inner values, nature connection, and mindfulness.

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Only one article investigated the nature of the third variables' involvement in the relation between SWB and GB: Brown and Kasser (2005). This article found VO and mindfulness to partially mediate the SWB-GB relationship, when entered into the mediation model together. It is reasonable to hypothesize CN to also be a SWB-GB mediator, increasing the explained variance of the relationship, though this has yet to be investigated by studies.

### **Review 2: Mechanisms**

Review 2 aims at answering our second research question: what mechanisms can explain the relationship between GB and SWB, and how? The review explores how the most promising mechanism variables, identified in Review 1, relate to GB and SWB. The inclusion criteria we set were that for a mechanism variable to qualify for Review 2, at least two studies from Review 1 had to present significant findings connecting the variable in question to both GB and SWB. The three mechanisms that met this criterion were connection to nature, value orientation and mindfulness. In the following we will introduce these mechanisms in greater detail.

#### **Connection to nature**

Research on connection to nature traces back to the biophilia hypothesis (Wilson, 1984). According to this hypothesis, humans have an innate need to connect with nature. This need has developed because we have evolved in natural environments and started living in cities too recently for civilization to have any evolutionary impact on our biologies (Kellert & Wilson, 1993). Our innate biophilia can for example be seen in our attraction to animals and zoos (Wilson, 1984), and our use of nature words and symbolism to describe each other (Lawrence, 1993), for example through expressions such as “quiet as a mouse” and “sly as a fox”.

The biophilia hypothesis is a central tenet of the discipline of ecopsychology, which fosters much of the research on connection to nature. Ecopsychology emerged as a reaction to the ecological crises of the modern world, with the aim of shedding light on the relationship between

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humans and nature, and specifically on how this relationship has been damaged in recent years, with degradation of human well-being and the natural environment as a result (Roszak, 1992).

Within ecopsychology, our modern separation from nature is held partly responsible for mental illnesses; this separation and illness in turn leads to further disconnect from nature and mistreatment of the natural world (Rader, 2010).

**Definitions and measurement.** The connection humans feel to nature have in recent years been conceptualized through a multitude of terms and measurement scales. These include, alphabetically sorted, *Commitment to the Environment* (Davis, Green, & Reed, 2009), *Connectedness to Nature* (Mayer & Frantz, 2004), *Connectivity With Nature* (Dutcher, Finley, Luloff, & Johnson, 2007), *Emotional Affinity Toward Nature* (Kals, Schumacher, & Montada, 1999), *Environmental Identity* (Clayton, 2003), *Inclusion of Nature in Self* (Schultz, 2001), *Love and Care for Nature* (Perkins, 2010), and *Nature Relatedness* (Nisbet et al., 2009). Though theoretically slightly different in scope and focus, all these concepts capture aspects of the relationship between humans and nature. Tam (2013a) found strong intercorrelations between these constructs, as well as highly similar correlations with the outcome variables SWB and GB. Similarities extend to a certain overlap in scale items used, with a prevalence of items tapping the experience of oneness with nature, connection to nature, being part of nature, and so on. Also, the one non-scale instrument used, a measure of overlapping circles denoting “self” and “nature”, where the respondent is asked to indicate the degree of overlap that best corresponds with his/her personal experience, is used by several of the instruments. Based on his findings, Tam (2013a) concluded that «environmental psychologists may now consider connection to nature as one broad construct that encompasses the various specific concepts examined. Also, existing findings regarding these concepts can now be discussed under one integrated framework» (p. 74). We have therefore included all the above terms in this review.

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We will in the following refer to the overall concept as *connection to nature*, or CN. Some of the above measures are focusing on specific parts of the relationship to nature (for example, Commitment to the Environment focuses on relationship commitment) while others are more multidimensional (for example, Nature Relatedness includes both cognitive, affective and experiential parts). The overall concept of CN is more similar to the multidimensional concepts than the more focused ones. As such, CN includes both affective and cognitive aspects of one's subjective relationship to nature, and perhaps also other under-explored aspects of this relationship, such as the role of collective identity or self-concept (see Tam, 2013a, for a longer discussion).

In addition to the measures above, many studies have developed their own CN measures, either adapting more established measures to specific populations such as children (e.g., Collado, Stats, & Corraliza, 2013), or developing their own instruments more or less from scratch (e.g., Beery, 2013; Brügger, Kaiser, & Roczen, 2011; Tam, 2013b). Studies using such measures have been included in our review if they were judged to fit theoretically and empirically within the overall concept. We have however excluded studies considering environmental identity or connection to be the same as environmental activism, as having a strong connection to nature does not necessarily make one an environmental activist.

**Stability over time.** CN in its different conceptualizations is considered trait-like, in that it is relatively stable over time and situations, though not entirely fixed (Mayer & Frantz, 2004; Nisbet et al., 2009; Tam, 2013b). A popular way of attempting to change CN is through nature exposure/contact, either directly by taking participants to a nearby nature area, or indirectly, by showing participants nature videos, placing plants and other natural elements in their proximity while indoors, or asking them to write about nature. These efforts have, however, produced mixed results (e.g., Davis et al., 2009; Nisbet 2011; Rader, 2010; Scott 2010; Tam, Lee, & Chao,

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2013; Zelenski, Dopko, & Capaldi, 2015). Overall, it appears possible to promote CN, but it remains to be established what kinds of manipulations are most effective, and why.

**Proposed relationships between CN, SWB and GB.** A positive relationship between CN and SWB might be expected for several reasons. First, a feeling of general connectedness is consistently associated with heightened well-being (Ryan & Deci, 2001). For example, fluctuations of social relatedness throughout the day predict changes in SWB (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), while loneliness is negatively associated with happiness (Booth, Bartlett, & Bohnsack, 1992). Based on findings such as these, *relatedness* has been counted as a basic human need (Baumeister & Leary, 1995; Ryan & Deci, 2000). However, for CN there is an effect over and beyond the effect of general connectedness; Zelenski and Nisbet (2014) found that when controlling for social connectedness, CN still significantly predicted SWB. This might be because individuals higher in CN seek out nature to a larger extent, in the form of more time spent outdoors and more frequent interactions with other living things (Nisbet et al., 2009). Such experiences have been found to lead to increased happiness (Berman, Jonides, & Kaplan, 2008; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Nisbet & Zelenski, 2011; White, Alcock, Wheeler, & Depledge, 2013). Appreciation of the beauty of nature might be of importance here; Zhang, Howell, and Iyer (2014) found CN to predict life satisfaction only in individuals who to a larger extent engaged with natural beauty.

On the other hand, CN might as well lead to decreased SWB. This is because CN consistently predicts concern about the environment (Mayer & Frantz, 2004; Nisbet et al., 2009). Considering the development of climate change and nature degradation seen today, an increased sense of CN might hinder SWB instead of promote it (Doherty & Clayton, 2011), as persons high in CN might consider the harm done to nature as harm done to themselves (Mayer & Frantz, 2004). In line with this, those most alarmed about global warming have been found to be more

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likely to feel disgusted, angry, sad and afraid (Maibach, Roser-Renouf, & Leiserowitz, 2009). According to this perspective, heightened CN might well be negatively associated with SWB.

The same argument can be used to hypothesize a positive association between CN and GB. As persons high in CN include nature in their self-concept, they might be more likely to engage in GB, to protect both themselves and nature. In the words of ecologist Leopold (1949): «We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect» (p. 21). Similarly, Roszak (1995) wrote that «if the self is expanded to include the natural world, behavior leading to destruction of this world will be experienced as self-destruction» (p. 12). It can therefore be expected that heightened CN will be associated with heightened GB.

### **Value orientation**

The second mechanism variable identified in Review 1, to be further explored in this second review, was value orientation. Unlike the research on connection to nature, the research on value orientation is not riddled with competing terms trying to capture the same concept. On the contrary, the concept of *values* is to our knowledge only referred to by this one term. This term is however often used to refer to different things, perhaps because the value-concept is quite abstract, and this can easily cause confusion and disagreement. First, there is some variation in how the concept of values is defined, and second, the term is often (wrongly) used to refer to concepts that are not values, like attitudes, norms, traits and needs. In the following we will try to clarify these areas, as well as describe ways of measuring values.

**Definitions.** Several definitions of values have been proposed through the years. Definitions of particular influence include that of Kluckhohn: “A value is a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable, which influences the selection from available modes, means, and ends of action” (1951, p. 395), and

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that of Rokeach: “enduring beliefs that a specific mode of conduct is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence” (1973, p. 5).

Schwartz and Bilsky (1987) summarized five features they found most definitions of values to have in common: “According to the literature, values are (a) concepts or beliefs, (b) about desirable end states or behaviors, (c) that transcend specific situations, (d) guide selection or evaluation of behavior and events, and (e) are ordered by relative importance” (Schwartz & Bilsky, 1987, p. 551). As such, values can be seen as closely related to the concepts of goals and motivations, as the central content of a value is the goal or motivational concern that it expresses (Schwartz & Bilsky, 1987).

There are alternative views on values that deserve a quick mention. First, Epstein (1989) suggested that there may be two separate value systems, one conscious and one unconscious, and that this can explain why people sometimes act in contradiction to their conscious values. This contradiction may, however, be explained - arguably more parsimoniously - as a conflict between values and personality traits (see below). Also, the idea of values as static mental structures has been criticized. This is the way the concept of values is most often construed in modern psychology, while the action of “valuing” actions and outcomes, arguably is being neglected (Rohan, 2000). In the remainder of this paper the term values refers to Schwartz and Bilsky’s (1987) “goal-like” definition, as this is the way the value-concept is conceptualized in the studies in our reviews.

**Related concepts.** In addition to this discussion regarding the construct of values, the term values has been used more loosely to refer to a wider variety of concepts, further obstructing a formation of a generally agreed upon definition. Whereas one may be justified in interchanging the concept “goals” with values, this is not so for the concepts of attitudes, norms, traits and

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needs (Hitlin & Piliavin, 2004). It can therefore be useful to clarify what distinguishes values from each of these.

**Values versus attitudes.** Values are considered as holding a higher place in a person's internal evaluative hierarchy compared to attitudes. Values are more abstract and focus on ideals, while attitudes are directed toward more concrete social objects (Eagly & Chaiken, 1993; Rokeach, 1973). For example, a person may be generally interested in and have positive feelings toward pursuits that lead to increased social status and influence, as well as specifically liking expensive cars, leadership positions and stock trading. The general, positive evaluation of power is a value and the specific positive evaluations of objects related to power are attitudes.

**Values versus norms.** Values transcend specific situations, whereas norms are situation based. Both norms and values are group-level phenomena, and they both require shared agreement within groups. They differ in that while norms capture an "ought" sense – a pressure to conform – values point at ideals, cultural or personal. As opposed to norms, values are also typically measured as an individual-level construct (Hitlin & Piliavin, 2004).

**Values versus traits.** Traits and values are both enduring personal properties that entail behavioural tendencies. They differ in that traits are dispositions, while values are like goals. Traits give rise to behaviour that the individual carrying those traits may or may not be happy with – it is possible for instance to have a natural disposition to be aggressive (trait) without valuing aggression very highly. Values-based behaviour appears to require more cognitive control than do trait-based behaviour (Roccas, Sagiv, Schwartz, & Knafo, 2002). This makes sense, as value-based behaviour is striving toward the person's ideals, which may not fit perfectly with his or her trait-based behavioural inclinations. Some of these may then need to be inhibited somewhat for value-directed endeavours to succeed. This difference between traits and values can perhaps account for Epstein's (1989) unconscious and conscious values.

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**Values versus needs.** Values are closely related to needs, but they are not the same. A need is a basic motivation – it has been defined as “any condition within the person that is essential and necessary for life, growth and well-being” (Reeve, 2009, p. 77). Values relate to needs as ways of articulating needs that are socially acceptable and culturally defined; for instance, the need for sex can be culturally reconstructed as the value of love (Rokeach, 1973). One can express one’s needs and satisfy them through pursuing culturally prescribed values (Hitlin & Piliavin, 2004).

**Stability over time.** As a person-level construct, values are generally believed to be relatively stable across the life course (Hitlin & Piliavin, 2004). Recent research indicates, however, that value orientations can change in response to new experiences like changes in the political system (Danis, Liu, & Vacek, 2011), traumatic events (Verkasalo, Goodwin, & Bezmenova, 2006) and educational experiences (Sheldon & Krieger, 2004). Also, value change has been demonstrated experimentally, using priming (Kasser et al., 2014; Lekes, Hope, Gouveia, Koestner, & Philippe, 2012; Maio, Pakizeh, Cheung, & Rees, 2009). However, it remains unclear how deep these changes go. The value changes observed in priming studies may be expressions of altered value priorities, lasting or transient, or they may simply be the results of selective activation of certain values. This could cause value expression to change while underlying, trait-like value priorities remain unchanged.

**Measuring values.** There is a lack of standardization of how values are measured. This is a problem, because constructs such as attitudes and traits are sometimes studied labelled as values (Hitlin & Piliavin, 2004). The most systematic and influential approaches to values research include the Rokeach Value Survey (Rokeach, 1973), the Schwartz Value Survey (Schwartz 1992), and the Aspiration Index (Kasser & Ryan, 1993). In the Rokeach Value Survey the respondents rank values from most to least important. In the Schwartz Value Survey, respondents

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rate each value on a 7-point scale, and the Aspiration Index also uses rating. There has been some controversy over whether ranking or rating is best for measuring values (e.g., Rokeach, 1973; Schwartz, 1994); however, rating of values have been found to have the highest predictive validity (Maio, Roese, Seligman, & Katz, 1996).

A further methodological issue is that values are abstract concepts that not all people consciously reflect on. Some people may not know what their values are and the way values are often treated by academics – abstract and out of context – may be hard to relate to. In response to this challenge, Schwartz has developed the Personal Values Questionnaire (Schwartz et al., 2001) that contains less abstract items designed to be more accessible to a wider population, as compared to the original Schwartz Value Survey.

**Taxonomies of values.** Research has demonstrated the existence of almost a dozen different values or general goals, organized in systems that can be presented as circumplexes (Grouzet et al., 2005; Schwartz, 1992, 1994). In these circumplexes, compatible values are placed next to each other, and conflicting values are on opposite sides. For instance, individuals who in the Schwartz circumplex place universalism among their high ranking values are likely to place power – located on the opposite side – among their low ranking values. Both models are validated in more than 15 nations around the world, including non-western countries (Grouzet et al., 2005; Kasser & Ryan, 1996; Kim, Kasser, & Lee, 2003; Ryan et al., 1999; Schmuck, Kasser & Ryan, 2000; Schwartz 1992; Schwartz & Boehnke, 2004). This suggests that the circumplexes describe a universal structure of values.

The first circumplex model, proposed by Schwartz (1992), emerged from performing a multidimensional scaling analysis on value data from samples in 20 different countries. The distances between the values in the resulting scatterplot represents their compatibility with each other, and form the basis for the circumplex. The model consists of ten values that can be divided

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into four groups: self-transcendent, self-enhancing, openness to change and conservation values (Schwartz, 1992). The newer goal circumplex developed by Grouzet et al. (2005) is in many ways similar to the Schwartz value circumplex, developed using similar methodology, and using similar constructs with different names, although they do not overlap entirely. The Grouzet circumplex consists of eleven goals, which can be divided into intrinsic, extrinsic, self-transcendent and physical goals (Grouzet et al., 2005). Intrinsic and extrinsic goals are opposite one another, as are self-transcendent and physical goals. (Note that self-transcendence here denotes a different concept; in the Grouzet model, self-transcendence comprises the goal of spiritual understanding, while in the Schwartz model, the self-transcendence values are closely related to the intrinsic goals in the Grouzet model).

The dimension in the value models that most relate to SWB and GB research, is the one between intrinsic goals/self-transcendent values, and extrinsic goals/self-enhancing values. For simplicity, we will refer to these as intrinsic values and extrinsic values. Intrinsic values include community feeling (“to improve the world through activism or generativity”), affiliation (“to have satisfying relationships with family and friends”), and self-acceptance (“to feel competent and autonomous”) (Grouzet et al., 2005, p. 802); and also universalism (“understanding, appreciation, tolerance, and protection for the welfare of all people and for nature”) (Schwartz, 1992, p. 12) and benevolence (“preservation and enhancement of the welfare of people with whom one is in frequent personal contact”) (Schwartz, 1992, p. 11). Extrinsic values include popularity (“to be famous, well-known, and admired”), image (“to look attractive in terms of body and clothing”), and financial success (“to be wealthy and materially successful”) (Grouzet et al., 2005, p. 802); and also achievement (“personal success through demonstrating competence according to social standards”) and power (“social status and prestige, control or dominance over people and resources”) (Schwartz, 1992, p. 22). When using the term value orientation (or VO) in

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the remainder of this paper, we are referring to whether one is more intrinsically or extrinsically oriented in one's personal value system.

**Proposed relationship between VO and SWB.** The relation between VO and SWB is a debated one. Kasser (2002) proposed that the relationship can be understood in context of the *self-determination theory* (Ryan & Deci, 2000). According to this theory, intrinsic values are congruent with the basic psychological needs for relatedness, autonomy and competence, while extrinsic values are less so (Deci & Ryan, 2000; Kasser, 2002, Ryan & Deci, 2000). Although extrinsic motivations are also assumed to spring from basic human needs, including psychological needs, they do not cater to them directly the way intrinsic motivation does. As satisfaction of psychological needs is associated with higher well-being (Reis et al., 2000), the pursuit of intrinsic goals at the expense of extrinsic ones could be expected to be more conducive for SWB than the opposite. Indeed, a strong emphasis on extrinsic values could crowd out pursuits that are likely to lead to greater satisfaction of psychological needs and thereby greater SWB (Deci & Ryan, 2000; Kasser, 2002). A number of studies support this explanation (e.g., Kasser & Ahuvia, 2002; Kasser & Ryan 1993; 1996).

However, the VO-SWB relation can also be understood in the context of the *person-environment value congruence* hypothesis, which states that SWB is enhanced when there is a match between a person's VO and the dominant priorities of the surrounding environment. Thanks to the match there are less external sanctions for failures to conform, and less internal conflict due to value incongruence (Dittmar et al., 2014). Of importance here is a study by Sagiv and Schwartz (2000), which found the extrinsic values of power and achievement to be positively associated with SWB among Israeli business students. The authors argue that it is not differences in values per se that account for variance in SWB, but rather, it is the extent to which the

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surroundings are supportive of a person's values and the success with which an individual pursues her/his own values that matters (Sagiv & Schwartz, 2000).

**Proposed relationship between VO and GB.** The VO-GB relation is less debated. As acting in line with extrinsic values usually entails a high level of material consumption, they are often referred to as materialistic values (Kasser, Ryan, Couchman, & Sheldon, 2004; Richins & Dawson, 1992), and as such it can be expected that highly extrinsic or materialistic individuals have higher levels of consumption than more intrinsically oriented individuals. Also, concern for the environment is a facet of the intrinsic value of universalism, a value located directly on the opposite side from materialism in the Schwartz (1992) circumplex model of values. As high priority of a value on one side of the circumplex is less likely to co-occur with a value on the opposite side (Grouzet et al., 2005; Schwartz, 1992), endorsing materialism makes it hard to endorse universalism and vice versa. Assuming that concern for the environment is important for acting pro-environmentally, and concern for the environment has poor compatibility with materialism, having a materialistic value orientation would make GB less likely. In line with this thinking, Kasser (2011a) found that countries where the citizens give extrinsic values high priority have higher GHG emissions, and Maio et al. (2009) found that priming extrinsic values (such as power) not only increased the endorsement of these, but also decreased the emphasis put on universalism. Additionally, experimental studies using commons dilemma paradigms have found more intrinsically oriented individuals to act more cooperatively and to harvest less from the common resources (Kaiser & Byrka, 2011; Van Lange, 1999).

### **Mindfulness**

The third mechanism variable identified in Review 1 was mindfulness. Historically grounded in Buddhist meditation practices, mindfulness came to the attention of psychological research in the 1970's, and has since increased in popularity. A search on "mindfulness" as

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keyword in PsycINFO yields 8 articles from 1994, compared to 105 articles from 2004, and 1156 articles from 2014.

**Definitions.** Mindfulness seems to be a concept that researchers generally agree upon, as unlike CN, it is not riddled with a multitude of competing terms. We have therefore only used the term “mindfulness” to denote this concept in our literature search. There are, however, some differences between the definitions used. Jon Kabat-Zinn, the man often credited with bringing mindfulness to the attention of scientific psychological inquiry, defines mindfulness as “moment-to-moment, non-judgmental awareness, cultivated by paying attention in a specific way, that is, in the present moment, and as non-reactively, as non-judgmentally, and as open heartedly as possible” (2005, p. 108). Other definitions include “the clear and single-minded awareness of what actually happens to us and in us, at the successive moments of perception” (Thera, 1972, p. 2), and “a kind of non-elaborative, non-judgmental, present-centred awareness in which each thought, feeling, or sensation that arises in the attentional field is acknowledged and accepted as it is” (Bishop et al., 2004, p. 232). These definitions all capture different facets of mindfulness. Attempting to incorporate these facets in one formulation, Nerland, Olsen, and Mildestveit (2011) proposed that mindfulness can be defined as “non-judgemental, non-elaborative present moment awareness, with intentionally receptive or directed attention” (p. 11). Mindfulness can also be described simply as “non-judgmental awareness in the present moment” (Jacob et al., 2009, p. 276). Mindfulness has been found to be a concept distinct from other psychological constructs, such as openness to experience, reflection, self-monitoring and others (Brown & Ryan, 2003). The definitions above all describe the state of mind associated with mindfulness meditation. The term mindfulness has also been used to describe a purely cognitive process - “the process of drawing new distinctions” (Langer & Moldoveanu, 2000, p. 1). According to Langer and Moldeveanu, this process keeps the person’s awareness in the present moment, and is associated

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with favourable cognitive outcomes. Although there is likely significant overlap between this conception of mindfulness and the descriptions above, they are considered separate constructs (Bishop et al., 2004). Langer and Moldeveanu's construct is not included in the studies reviewed here.

**Stability over time.** As construed in the above definitions, mindfulness appears a state variable, most pronounced in the case of mindfulness meditation but possible to achieve in everyday awareness. Mindfulness can, however, also be considered to be dispositional, appearing at varying levels in the population (Brown & Ryan, 2003). A recent twin study found that trait mindfulness is 32% heritable and 66% due to non-shared environmental variables (Waszczuk et al., 2015). It is thus a malleable trait. Practicing mindfulness meditation is one way of strengthening trait mindfulness (Siegel, 2007). Also, therapies such as Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy have been found to affect outcome variables through increasing dispositional mindfulness (Gu, Strauss, Bond, & Cavanagh, 2015). In Review 1, the articles we found that looked into mindfulness as an explanation for the SWB-GB relationship, considered mindfulness as either a trait (Brown & Kasser, 2005) or a state (Jacob et al., 2009). In our second review we will therefore include both state and trait mindfulness.

**Measurement.** Dispositional mindfulness is measured by self-report questionnaires. Different questionnaires are suited for different purposes. For instance, some scales, like The Freiburg Mindfulness Inventory (Walach, Buchheld, Buittenmuller, Kleinknecht, & Schmidt, 2006) are best suited for respondents who have experience with mindfulness meditation, since some of the items' meaning might be unclear to people without such experience. Other scales, like the Mindful Attention Awareness Scale (Brown and Ryan, 2003), The Kentucky Inventory of Mindfulness Skills (Baer, Smith, & Allen, 2004), and The Toronto Mindfulness Scale (Lau et al.,

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2006) are well suited for the general population also. Measures of dispositional mindfulness are not to be confused with measures of mindfulness meditation - typically measured as amount of meditation practice. In intervention studies, the measure is typically completion versus non-participation in the intervention in question, for instance an MBSR-program (e.g., Davidson et al., 2003). Studies investigating the effect of more long term meditation experience have employed the measure of self-reported hours of meditation practice throughout life (e.g., Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007).

**Proposed relationship between mindfulness and SWB.** The relationship between mindfulness and positive emotions is one of the more established areas of mindfulness research. Neuroimaging studies have revealed hemispheric asymmetry in the brains of experienced mindfulness practitioners, with more left side activity as compared to the right side; the same pattern have been found in novice meditators after an eight week meditation training program (Davidson et al., 2003). This hemispheric asymmetry is associated with an approach mindset and positive affective style, while asymmetry favouring the frontal right is associated with an avoidance mindset and a negative affective style (Davidson, 1992; Davidson, Ekman, Saron, Senulis, & Friesen, 1990).

**Proposed relationship between mindfulness and GB.** Theoretically, a relationship between mindfulness and GB might be explained by increased everyday awareness, reducing the tendency to automatically process incoming stimuli. This increased awareness might among other things lead to a stronger link between intentions and actual behaviour. This is supported by Chatzisarantis and Hagger (2007), who found that people with expressed GB intentions were more likely to act on these intentions if they had a higher level of dispositional mindfulness. The reduced reliance on automatic processing might further lead to a decrease in overconsumption, as it could make one less susceptible to manipulation by commercial advertisements directed at

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people's tendency to automatically process incoming stimuli (Rosenberg, 2004). This is supported by studies showing that when people are not attentive, they respond the same way to requests (Langer, Blank, and Chanowitz, 1978) and offers (Bruce, Pollock, Smith, & Knowles, 1998), whether or not they are well justified. Rosenberg (2004) also suggests that increased awareness through mindfulness might reduce overconsumption as people realize that the fulfilment they often seek in excessive consumption can't be found there, but is available through a change in awareness. Mindfulness can help people savour their experiences as they experience them, and thereby find a deeper sense of fulfilment in daily life. Rosenberg (2004) does, however, not present any empirical evidence for this claim. Overall, current research and theorizing implies that mindfulness might increase GB through increased everyday awareness, but the evidence base is in no way conclusive.

### **The current research**

In the preceding introduction, we have presented the three most promising mechanism variables discovered in Review 1. All three variables can be considered trait variables, that is, characteristics that vary between individuals. To a smaller or larger extent, all three can also be considered state variables, and all have potential for change at the individual level. The aim of this second review is to explore how these three variables relate to SWB and GB. Theoretical and/or empirical research propose relationships between each variable and both SWB and GB. In the following, we will review the literature to date to understand these relationships better.

### **Method**

To qualify for a mechanism variable in Review 2, at least two studies from Review 1 had to demonstrate significant findings connecting the variable in question to both GB and SWB. Three variables qualified: CN, VO and mindfulness.

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**Search strategy.** The databases PsycINFO and Web of Science were used to find relevant articles in English up until October 2015. In Web of Science, the search was conducted by topic; in PsycINFO it was conducted by keyword. Three searches were thus conducted, each focusing either on CN, VO or mindfulness (see Table 4 for terms used for the different mechanism variables). For each search, one mechanism variable was combined with SWB terms and/or GB terms, using the *AND* operator (see Table 1 for SWB and GB terms used). The formula for the conducted searches was thus (mechanism variable *AND* (SWB *OR* GB)).

Table 4

*Groups of mechanism terms used in database searches in Review 2*

Connection to nature (CN)	Value orientation (VO)	Mindfulness
Commitment to the environment	Extrinsic goals	Mindfulness
Connect* to nature	Extrinsic values	
Connect* with nature	Intrinsic goals	
Environmental identity	Intrinsic values	
Inclusion of nature in self	Materialis*	
Love and care for nature	Self-enhancing values	
Nature relatedness	Self-transcendent values	
Relatedness to nature		

*Note.* All terms in each group were combined with the operator *OR*.

**Selection criteria.** The database searches focused on meta-analyses. That is, when comprehensive meta-analyses published during the last five years could answer our research question, the search was limited to these. In cases where no fitting meta-analysis was found, we reviewed all empirical articles published to date. This is different from how we conducted the first literature search, where we included all empirical articles.

The relevance of the articles was decided from title and abstract. To be deemed relevant, articles had to 1) investigate covariation between SWB/GB and mechanism variable, and/or 2)

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attempt to manipulate SWB/GB and mechanism variable through a common independent variable. Purely theoretical studies were excluded. References and citing articles were also checked; however, the database searches proved exhaustive enough that no further relevant studies were found through these means. The relevant articles were read in full.

**Interpretation of effect sizes.** We interpreted results in terms of effect size, according to appropriate conventions (Cohen, 1988), see Method section in Review 1. All coefficients and detailed findings can be found in Tables 6 (CN), 8 (VO) and 10 (mindfulness), see Appendix A.

### **Results and discussion**

This section is separated by mechanism variable. First the results from the CN-search will be presented and discussed, followed by VO, and lastly mindfulness. A general discussion of overall findings in both reviews, including limitations of the research and implications for research and society, will then follow.

#### **Connection to nature**

Our search on the CN-SWB relationship yielded one meta-analysis based on 21 separate studies (Capaldi, Dopko, & Zelenski, 2014), while no meta-analysis came up in our CN-GB search, leaving us to review a total of 38 empirical articles. See Table 5 for number of results in the search, and Table 6 (in Appendix A) for the descriptive data. Compared to the other mechanisms in this review, CN is the only one for which there is a predominance of studies inspecting the GB aspect. It is therefore surprising that the SWB aspect has been summed up with a meta-analysis, while the GB aspect has not. This is a gap in the research that will hopefully be bridged shortly, considering the increase in research attention this topic is currently receiving.

In the following, we will first clarify the relationship between CN and SWB, then the relationship between CN and GB. Theoretical explanations will be discussed where appropriate. Lastly we will summarize our overall CN findings.

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Table 5

*Number of results from the CN searches*

Subsets	Database	No. results	Relevant meta-analyses	Relevant other articles	Total relevant articles
Well-being	PsycINFO	65	0	-	1
	Web of Science	41	1	-	
Behaviour	PsycINFO	70	0	32	39
	Web of Science	56	0	24	

*Note.* Total results: Web of Science 86, PsycINFO 122.

**CN and SWB.** One relevant meta-analysis was found on the relation between CN and SWB (Capaldi et al., 2014). This meta-analysis, based on 30 samples from 21 different studies, involving 8523 individuals, found a small, significant relation between CN and SWB ( $r = .19$ ).

As CN can be measured in a variety of ways, the authors conducted separate meta-analyses into the three most commonly used measures: Connectedness to Nature (Mayer & Frantz, 2004), Inclusion of Nature in Self (Schultz, 2001), and Nature Relatedness (Nisbet et al., 2009). Inclusion of Nature in Self had the strongest relation to SWB, with a small to moderate effect size (Capaldi et al., 2014). Similarly, the authors conducted separate meta-analyses into the three main types of SWB used in this study: positive affect, life satisfaction, and vitality. Small effect sizes were found for all three, with the largest effect for vitality (Capaldi et al., 2014). The authors hypothesize that this might be explained by vitality being a traditional eudaimonic measure of well-being, as compared to positive affect and life satisfaction, which are hedonic measures. It is possible that CN shares a stronger relation to eudaimonic than hedonic well-being, due to the relationship between CN and GB, as GB can be conceived of as intrinsically meaningful pursuits, especially in individuals high in CN (Venhoeven, Bolderdijk, & Steg, 2013).

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Relatively few studies have been done on the relation between CN and eudaimonic well-being, but those that are published tend to find a positive association (see Capaldi et al., 2014).

The authors of the meta-analysis did not propose or test any mechanisms to explain the relationship between CN and SWB. However, the results are in line with the hypothesis that higher general connectedness and more frequent nature contact can lead high-CN individuals to be happier than low-CN individuals. The results do not support the hypothesis that concern about environmental degradation lead high-CN individuals to become less happy than others. However, it is still possible that higher CN could lead to decreased happiness in individuals confronted with environmental degradation; the meta-analysis did not look into this possibility.

**CN and GB.** There has as to date not been published any meta-analyses on the relationship between CN and GB. We therefore included all relevant empirical papers from the search: 52 samples from 38 papers in total (see Table 6 for detailed findings).

*Note on methods.* As many of the studies used several measures of GB and CN simultaneously, several samples found a combination of weak, moderate, strong or non-existent effect sizes for the relationships between their different measures. For example, if a study analysed the relationship between one measure of GB and five different measures of CN, that would give a total of five coefficients. We chose to include all such coefficients rather than choose between measures. However, when one sample found several coefficients in the same effect size category, all of these were counted as one. So if a study reported five coefficients, of which two were small, two were moderate and one was non-significant, then these were counted as one in each category (small, medium, no relationship). This approach was chosen to include many different measures of GB and CN, while at the same time avoid single samples being too overrepresented in our results. Note, however, that this approach also might have led to our results appearing more scattered over the effect size spectrum than they actually are.

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***Overall findings.*** The most common finding was a moderate, positive relationship between a measure of CN and a measure of GB (29 separate samples). A lower number of samples found positive strong (18) or weak (10) relationships. Seven samples found no relationship. No samples found a negative relationship. Additionally, four studies using unstandardized or multiple regression coefficients found positive, significant relationships between CN and GB.

Sample size did not seem to affect the findings, as studies with  $N > 500$  also reported more moderate than weak/large effect sizes. There were not enough studies on children or elderly to tell if age may have been a moderator of the relationship. The most frequently used behavioural measures (self-reported actual GB and GB intentions) and CN measures do not appear to moderate the relationship, as each of these measures separately produce findings scattered over the effect size spectrum in a pattern roughly similar to the overall findings. However, there are two exceptions: direct behaviour measures, and the Implicit Association with Nature measure.

***Exceptions from the overall pattern.*** For two of the studies that found null results, the CN measure was Implicit Association with Nature (IAT) (Duffy & Verges, 2010; Mayer & Frantz, 2004). The IAT differs from other CN measures in that it is not a questionnaire, but a computer-based association test where the participant is asked to associate nature or non-nature words with self or non-self. Two other studies in this review also used IAT, of which one found a weak relationship between IAT and self-reported GB (Brügger et al., 2011), while the other found that IAT was strongly associated with directly measured GB (Geng, Xu, Ye, Zhou, & Zhou, 2015). The latter study also found that explicit and implicit CN were independent of each other, and predicted different outcomes, an observation that might explain the weak to non-existent results in the other articles. As findings from studies using the IAT measure differ so

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much from studies using other CN measures, it should probably be considered a distinct aspect of CN, and held separate from the rest of the results.

Only three of the reviewed studies measure behaviour directly. Geng et al. (2015) asked participants whether they wanted a plastic bag to carry some wafers they got a as a gift for participating, and interpreted bag usage as not GB. Davis et al. (2009) asked participants whether they wanted to participate in a river clean-up project, ostensibly unrelated to the study. Agreeing to do this was interpreted as GB. Zelenski et al. (2015) measured sustainable fishing in computer game as GB. The external validity of these measures is likely not large, but that is an unavoidable cost of employing direct GB measures, as it is hard to measure more than one specific behaviour at once. What is interesting is that while two of these studies found weak (Davis et al., 2009) to non-existent (Zelenski et al., 2015) relationships between their direct GB measures and CN, Geng et al. (2015) found a large effect - but only for the relationship between plastic bag usage and IAT. They also analysed the relationship between plastic bag usage and connectedness with nature, a more traditional CN measure, but here they found no relationship. In combination with the findings noted in the previous paragraph, this indicates that IAT and directly measured GB might be more strongly related to each other than IAT and self-reported GB, or explicit CN and directly measured GB. However, as this assumption is based on observations from a single study, it needs to be subjected to more research before it can be assumed valid. For the purpose of this review, it is sufficient to note that IAT and directly measured GB produce findings that differ from the overall pattern. When these two measures are excluded from the review, four of seven non-significant findings are removed, as well as one large and one small effect size. This makes the overall pattern of effect sizes slightly less scattered, with 17 large effect sizes, 29 moderate sizes, nine small sizes and three non-significant findings.

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*Experimental findings.* Of the studies reviewed, nine employed an experimental or quasi-experimental design to manipulate CN and GB (Collado et al., 2013; Davis et al., 2009, study 2; Nisbet, 2011; Poon, Teng, Chow, & Chen, 2015; Rader, 2010; Scott, 2010, study 3; Tam et al., 2013; Zelenski et al., 2015, study 1 & 3). The results were mixed. Four of the studies did not manage to increase CN through their interventions. These interventions were generally attempts to expose participants for nature without actually taking them outdoors, instead using writing exercises about nature (Davis et al., 2009; Nisbet, 2011), nature documentary viewing (Zelenski et al., 2015, study 1), or indoor nature exposure (Scott, 2010, study 3). It might be that for nature exposure or nature contact to be successful in increasing CN, participants have to be in physical, sensorimotor contact with nature. This is supported by the findings from the two studies that did employ physical outdoor nature contact as intervention (Collado et al., 2013; Rader, 2010); these both found increased CN in their participants. It is not clear why actual nature contact seemingly has an effect on CN while indoor visual and imaginary contact seem not to, but it might have to do with the restorative effect of natural areas (Berman et al., 2008; Mayer et al., 2009; Nisbet & Zelenski, 2011; White et al., 2013). It could also be that other, unrelated aspects of the first four interventions prevented them from working as intended, as a later study by Zelenski et al. (2015, study 3) weakly increased CN through use of nature video material (in contrast to their first study, which did not). Also, two studies successfully increased CN without using nature contact at all. Tam et al. (2013) asked experimental participants to assess the quality of posters where Earth was given human-like qualities (controls assessed non-human-like posters of Earth), while Poon et al. (2015) used an ostracism intervention (physical pain as control condition). Though none of these manipulations included nature contact, both of them led to increased CN. Both manipulations are arguably related to social or general connectedness, which is part of the overall experience of CN. Overall, then, it seems CN might be successfully increased through outdoor

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nature exposure or interventions touching on general connectedness. In contrast to these mixed findings regarding CN, the studies had greater success in increasing GB. All of the studies (except Nisbet, 2011) found increased GB intentions, regardless of type of intervention and regardless of CN increase. However, the studies that *did* manage to manipulate CN, found the GB increase to be mediated by increased CN. Further research is needed to explain these findings.

In sum, the evidence points towards a consistently positive relationship between GB and CN; people who are more connected to nature also report engaging in more pro-environmental behaviours. On average this relationship is of a moderate size, though it is liable to some variation across studies. Also, experimental evidence suggests that CN is the variable influencing GB, not the other way around, though more research is needed to ascertain this relationship. This is in line with the hypothesis that high-CN individuals to a larger degree perceive themselves as part of nature, making GB an act of self-preservation and love (see Leopold, 1949; Roszak, 1995).

**Bringing it all together: CN, SWB and GB.** Summarized, the review points toward a significant, positive relationship between CN and both SWB and GB. The association with GB is generally stronger than the association with SWB. No theoretical explanations are explicitly tested, but overall, the results are in line with the biophilia hypothesis (Wilson, 1984): humans have evolved to live in and with nature, and this human-nature relationship is intrinsically satisfying because of the sense of general connectedness and the nature experiences themselves, which can explain the SWB connection. And as with other healthy relationships, you do not want to harm those who are close to you or part of you, explaining the GB connection (Roszak, 1995).

### **Value orientation**

Our search yielded one meta-analysis on the relation between VO and SWB (Dittmar, Bond, Hurst, & Kasser, 2014) and one meta-analysis on the relation between VO and GB (Hurst,

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Dittmar, Bond, & Kasser, 2013), see Table 7 (below) and Table 8 (in Appendix A). In both papers VO is conceptualized as the extrinsic value of materialism; however, studies using measures of intrinsic values are also included, and reversed or compared to the extrinsic values to find the overall effect size score. The operationalization of the VO-dimension of intrinsic versus extrinsic values used in these papers can therefore be considered valid. The VO-SWB-paper was considerably more comprehensive than the VO-GB-paper, aggregating the findings from 259 independent samples (753 effect sizes) compared to the latter's 9 (15 effect sizes). Both meta-analyses showed significant negative correlations, with a small average effect size for the materialism-SWB-relation ( $r = -.19$ ) and a medium average effect size ( $r = -.32$ .) for the materialism-GB-relation.

Table 7

*Number of results from the VO searches*

Subsets	Database	No. results	Relevant meta-analyses	Relevant other articles	Total relevant articles
Well-being	PsycINFO	437	1	-	1
	Web of Science	361	1	-	
Behaviour	PsycINFO	40	0	-	1
	Web of Science	52	1	-	

*Note.* Total results: Web of Science 395, PsycINFO 468.

All studies included in the meta-analyses are correlational, so they do not provide any evidence of causality. They do however provide support for some theoretical explanations for the relations between VO, SWB and GB, while not supporting others. The mechanisms that were explicitly tested were proposed by the authors themselves. This of course limits the possible outcomes to the pre-existing knowledge and imagination of the researchers, and naturally there

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may be other mechanisms at work which were left out, or which has not yet been contemplated.

In the following, we describe supported moderators and theoretical explanations of the relationships.

**VO and SWB.** In the VO-SWB-paper, three types of moderators were investigated: study, society, and participant characteristics (Dittmar et al., 2014). In sum, what was found was that the negative relationship between the extrinsic value of materialism and well-being was significant regardless of how surveys were carried out; however, studies using face-to-face interviews found slightly smaller effects compared with studies using questionnaires. The negative relationship was similarly found across the various types of societies, but it was strongest in countries with more equal income distribution and slower economic growth. Lastly, the negative relationship was found across various population subgroups, but it was weaker in groups with a high proportion of men, in groups consisting of people younger than 18 years of age, and in groups where many individuals work or study in environments supportive of materialistic values (such as economics, business, marketing).

Judging from these findings, it seems the VO-SWB relationship might be explained by both the person-environment value hypothesis and self-determination theory, presented in the VO introduction earlier. Of these, self-determination theory can most comprehensively explain the results. According to self-determination theory, pursuing extrinsic values such as materialism leads to lower satisfaction of psychological needs - the needs for autonomy, competence and relatedness (Kasser, 2002; Ryan & Deci, 2000). In the meta-analysis, this hypothesis was explicitly tested, and supported, as small negative correlations were found between materialism and satisfaction of the needs for competence, autonomy and relatedness. This effect was found to partially mediate the negative relation between materialism and well-being. As expected, there was also a moderate positive relationship between satisfaction of these needs and well-being

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(Dittmar et al., 2014). The person-environment value hypothesis, on the other hand, can explain the moderating effect of whether a person studies a subject or works in a profession that supports a materialistic orientation. Unlike what was the case in the findings by Sagiv and Schwartz (2000) however, in the meta-analysis this effect only moderates the connection between VO and SWB. It seems that overall, extrinsic/materialistic values negatively influence well-being across populations, but it does so to a lesser degree if the environment around the person is supportive of those values.

We would also like to make a note on causality here. Although the meta-analysis by Dittmar et al. (2014) did not present evidence of causality between VO and SWB, there is evidence from longitudinal studies suggesting a causal link. Niemiec, Ryan, and Deci (2009) found in their 1-year longitudinal study that post-college attainment of intrinsic aspirations related positively to psychological health, whereas attainment of extrinsic aspirations related positively to indicators of ill-health; this association was mediated by change in the satisfaction of the basic psychological needs for autonomy, competence and relatedness. Kasser et al. (2014) similarly found, in their 2-year longitudinal study, that increases or decreases in orientation toward materialistic aspirations were accompanied by corresponding decreases or increases in satisfaction of their psychological needs for autonomy, competence, and relatedness, and the changes in need satisfaction fully accounted for the reported changes in well-being. It thus seems that an intrinsic VO leads to higher levels of SWB, and that this can be explained by self-determination theory.

An additional theoretical explanation that Dittmar et al. (2014) tested, was also supported. According to this explanation, the negative relationship between SWB and materialism can be explained by negative self-appraisals. People risk feeling insufficient and thereby less happy when exposed to advertising messages that suggest they are not meeting the prescribed standard.

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Through upward comparisons, the discrepancy between their current and ideal selves can increase. Previous research has shown that women with strong materialistic values experience larger self-discrepancies compared with less materialistic women after being exposed to advertisements featuring models with expensive goods (Ashikali & Dittmar, 2012). Evidence from the meta-analysis supports this explanation (Dittmar et al., 2014).

**VO and GB.** In the VO-GB-paper, one moderator variable was identified: population (community vs. students). On average, the VO-GB-relation was slightly stronger among students than among community members, something that indicate that the connection between VO and GB should be toned down somewhat if generalized to the general population, as student samples may not be entirely representative. This effect is however hard to interpret, as only four of the samples were from the community and one of those were the study's only sample from a non-western country. This limits the generalizability of the finding, as cultural differences may well act as a confounding variable. Neither gender, age, nor publication year influenced the result, although the researchers note that the mean ages of the samples range between 14 and 45, and thus the studies lack older cohorts. Income and education are factors that have previously been related to willingness to make sacrifices for the environment and to act pro-socially (Clark, Kotchen, & Moore, 2003; Kemmelmeier, Krol, & Young, 2002), but too few of the studies included in the VO-GB meta-analysis included measures of these factors for the researches to assess whether or not they are moderators of the VO-GB-relation. Also, all but one sample was from a non-western country, and therefore the results of the study cannot be generalized outside western cultures.

Hurst et al. (2013) did not directly investigate how the VO-GB relation can explained, but the authors note that their overall results fit with the hypothesis that materialism is incompatible with intrinsic values like universalism, of which concern for the environment is a facet.

**Bringing it all together: VO, SWB and GB.** Summarized, the review points toward a significant, positive relationship between VO and both SWB and GB. The association with GB is of a moderate average effect size, while the association with SWB has a small average effect size. Moderators include study, participant and society characteristics. Notable is the finding that populations situated in environments supportive of extrinsic values have a slightly weaker relationship between VO and SWB, which might be explained by the person-environment value hypothesis. The reviewed meta-analyses do not provide evidence of causality; however, longitudinal studies suggest that an intrinsic VO over time might lead to increased SWB.

The results are in line with several theoretical explanations. The negative relationship between materialism and GB is in accordance with the hypothesis that materialism is incompatible with intrinsic values like concern for the environment; however, the authors did not explicitly test this idea (Hurst et al., 2013). The negative relationship between materialism and SWB can be partly explained by insufficient satisfaction of the psychological needs for autonomy, competence and relatedness, arguably as a consequence of materialistic pursuits diverting time and attention from more psychologically satisfying pursuits (Dittmar et al., 2014). Also, more materialistic individuals may have a tendency to experience larger self-discrepancies and thereby lower well-being, in response to advertisement and other messages communicating that the lives of the receivers are incomplete and inadequate (Dittmar et al., 2014).

All in all, extrinsic values appear to be a negative influence on the people who endorse them. Those who do can expect to be less happy and to be responsible for more damage to the environment as compared with people who are more intrinsically oriented.

### **Mindfulness**

The search on mindfulness and SWB yielded four meta-analyses of treatment studies using mindfulness-based interventions (Eberth & Sedelmeier, 2012; Gotink et al., 2015; Goyal et

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al., 2014; Khoury, Sharma, Rush, & Fournier, 2015), totalling 8549 participants. The search on mindfulness and GB yielded no meta-analyses, but four individual survey studies of which two were also parts of Review 1 (Amel, Manning, & Scott, 2009; Barber & Deale, 2014; Brown & Kasser, 2005; Jacob et al., 2009), totalling 1892 participants. See Table 9 (below) for number of results, and Table 10 (in Appendix A) for detailed findings.

Table 9

*Number of results from the mindfulness searches*

Subsets	Database	No. results	Relevant meta-analyses	Relevant other articles	Total relevant articles
Well-being	PsycINFO	1383	3	-	4
	Web of Science	1061	4	-	
Behaviour	PsycINFO	11	0	4	4
	Web of Science	10	0	3	

*Note.* Total results: Web of Science 1064, PsycINFO 1388.

There are obvious contrasts between the results of the two searches. First, the difference in number of studies: it is clear that mindfulness meditation as a means of improving well-being is a far greater field of research than the investigation of how mindfulness relates to GB. Second, there is a difference in types of studies. In the SWB-studies, what is measured is the effect of mindfulness intervention on well-being, whereas in the GB-studies there are no interventions - instead, the level of mindfulness reported by respondents is compared with their self-reported GB.

**Mindfulness and SWB.** The four meta-analyses connecting mindfulness-based interventions with SWB show mixed results. Three of them report medium-sized positive effects (Eberth & Sedelmeier, 2012; Gotink et al., 2015; Khoury et al., 2015), while the last one reports

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low evidence of improved mental health-related quality of life and insufficient evidence on positive mood (Goyal et al., 2014).

Only two of the studies report measures of changes in self-reported dispositional mindfulness resulting from the intervention, both of them reporting effects in the medium-large range. Dispositional mindfulness is the variable suggested to be involved in the SWB-GB-link in Review 1, and the relation between dispositional mindfulness and SWB and GB is therefore more relevant in this second review than the direct effect of mindfulness-based interventions on the same outcome variables. Improving dispositional mindfulness is however the means through which mindfulness-based interventions are believed to be effective at improving well-being; a recent meta-analysis of mediation studies also supports this claim (Gu et al., 2015). Although we cannot know for sure, it is therefore natural to assume that dispositional mindfulness was improved among participants also in the studies assessed by the two meta-analyses that do not report on this variable.

None of the four meta-analyses tested theoretical explanations for the relationship between mindfulness and SWB. Eberth and Sedelmeier (2012) merely suggest that well-being can be seen as a by-product of mindfulness. This is consistent with results from neuroimaging studies on mindfulness meditation (Davidson, 1992; Davidson, 2003; Davidson et al., 1990).

**Mindfulness and GB.** The four survey studies connecting dispositional mindfulness with GB all found significant, positive relations, of which two had medium (Amel, Manning, & Scott, 2009; Barber & Deale, 2014) and two had small effect sizes (Brown & Kasser, 2005; Jacob et al., 2009). A few issues should be mentioned about these studies. The two studies showing the smallest effect sizes were also included in Review 1. In one of these (Jacob et al., 2009) the GB-scores are, as mentioned earlier, skewed toward the high end of the scales, so the low scores could be the result of a ceiling effect. This study actually aims to assess the effect of mindfulness

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meditation rather than dispositional mindfulness, but the mindfulness measure used in this study assesses the respondents' current level of mindfulness, and not the amount of meditation they have engaged in. We therefore view the results of this study as effects of dispositional mindfulness, irrespective of meditation practice. Of the studies showing the medium effect sizes, one (Amel et al., 2009) only found a significant relationship between GB and one of two mindfulness scales. Acting With Awareness was significantly related to GB, while Observing Sensations was not.

These findings, and particularly the last, lend strength to the hypothesis that mindfulness supports GB through increased awareness. It might be that because mindfulness entails increased awareness of one's actions and of contingencies in the world, as opposed to "running on autopilot", more mindful people would be more likely to be aware of their impacts on and their responsibilities in the world, and therefore act more ecologically responsible. The moderate relationship between GB and the Acting With Awareness-scale supports this idea (Amel et al., 2009).

**Bringing it all together: Mindfulness, SWB and GB.** In sum, the support for a relation between mindfulness and SWB is fairly strong, with three of four meta-analyses showing medium-sized effects. The size of the relationship between mindfulness and GB also seems to be in the small to medium range; however, the evidence for this relation is weak, as there are only four studies assessing it.

The relationship between mindfulness and GB might be explained by increased awareness, assumed to decrease the everyday "autopilot". This could make people more aware of their personal responsibilities and intentions and more likely to act in line with these (Amel et al., 2009). Well-being is simply regarded as a by-product of mindfulness (Eberth & Sedelmeier, 2012), as suggested by neuroimaging studies.

### **General discussion**

The ecological crisis and rising threat of climate change have put modern humans in a dire situation - either we cut emissions and stop our overexploitation of the Earth, or we risk making our home planet uninhabitable in the span of few generations (IPCC, 2014). As definite technological solutions to the problem have yet to be developed and implemented, we are in a position where direct reduction of consumption and emissions is the only fail-safe strategy available. However, in the public discourse this is typically construed as a sacrifice. If we reduce our material consumption, won't that make us less happy? This assumption is arguably an important reason why many people are reluctant to change their behaviour. As demonstrated by the two reviews in this paper, however, the construal of green behaviour as a sacrifice of well-being is challenged by findings from psychological research.

In Review 1, we found that in most studies to date, there is a significant, positive relationship between GB and SWB; increased levels of GB are found to be associated with increased levels of SWB. This relationship is generally found to be of a small effect size. A few of the studies did not find such an effect, but no studies found a negative effect. This last point is important, as it largely undercuts the hypothesis that there is a trade-off between GB and SWB. Five explaining variables or mechanisms were proposed by the literature, of which the three most strongly supported (connection to nature, value orientation and mindfulness) were explored further in Review 2. In this second review, all three mechanisms were supported, in that all were found to have positive relationships to both SWB and GB. More specifically, CN and VO were both found to have a small relationship to SWB and a moderate relationship to GB, while mindfulness was found to have a small to moderate relationship to both SWB and GB. Note that these are just estimates of effect sizes, based either on meta-analyses or averages across empirical studies. Evidence of causality is generally weak, but there is some evidence indicating that CN

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influences GB, and that both VO and mindfulness influence SWB. See Figure 1, 2 and 3 (in Appendix B) for visualizations of the relationships between each of the three mechanisms and SWB and GB.

Overall, our review findings can be seen as good news for the effort for sustainability. Contrary to mainstream assumptions that protecting the environment has a cost that must be paid for in way of reduced well-being, environmentally friendly conduct emerges as conducive for happiness and well-being. The relationship between GB and SWB is not very large, but it is positive in most and negative in none of the studies reviewed. Also, the size of the relationship is equivalent to that of more established SWB associations, such as marital status (see Discussion in Review 1). This should indicate that living in an environmentally friendly way is likely to either improve a person's well-being somewhat, or to leave the person's well-being unaffected. There is no indication that protecting the environment would reduce anyone's well-being. Still, the scientific evidence is not definite, and there are several weaknesses in our reviews and our findings, as we will elaborate below. But first, we will discuss similarities and differences between CN, VO and mindfulness.

### **Similarities and differences between the mechanism variables**

As CN, intrinsic values, and mindfulness all are associated with both SWB and GB, there is a possibility that they might map part of the same construct. Indeed, there are also a few common denominators between them. For example, in the Schwartz circumplex, "Unity with Nature" is a lower-level value within the more general universalism value, which again is part of the intrinsic values spectrum. It is likely that this value is related to CN. For instance, it could be that CN is simply a part of the intrinsic values spectrum. On the other hand, as CN is a broad concept encompassing both the thoughts and feelings that people have about their relationship with nature (see Tam, 2013a), labelling it as a value is most likely not adequate. A more fitting

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relationship between VO and CN might be that they are overlapping constructs, with the value of Unity with Nature as the point of overlap. However, as of today the research into CN and into VO are separate fields of inquiry; a search in Web of Science on the combination of these groups of terms yields only three results. So the relationship between these concepts remains practically unexplored.

Mindfulness practice might conceivably improve both CN and intrinsic value orientation, as it encourages a mental shift toward greater awareness in life. A central benefit of regular mindfulness meditation is a greater appreciation of everyday experiences - a phenomenon that could be explained by increased CN and strengthened intrinsic values. However, this remains hypothetical, due to the limited research that has been done. A search in Web of Science on the group of CN terms and mindfulness yields a total of five results, while a similar search on VO terms and mindfulness yields eight results. However, even if research should reveal a significant overlap between mindfulness and either CN or intrinsic values, we do not expect mindfulness to be synonymous with either. This is because one of the central tenets of mindfulness is that it is non-judgmental, while CN and value orientation both are at least partly defined by what the individual judges to be good and important in life.

In sum, there are commonalities between the three mechanism variables that would benefit from a more thorough exploration. An interesting topic for further research is whether individuals high on one of these variables also will be high on the two others. However, despite similarities and likely overlaps, the three mechanisms are with all likelihood distinct entities that cannot replace each other.

### **Limitations**

Limits to our two reviews include weaknesses in the review process itself, potential publication bias, and flaws in the research fields and individual studies reviewed.

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**The review process.** As mentioned earlier, for the purpose of keeping within the limits of a Master's thesis, while still being able to explore the three main mechanism variables, Review 2 is more explorative and less comprehensive than Review 1. For the connections between mechanism variables and GB / SWB where we found comprehensive meta-analyses published within the last five years, the reviews were limited to these, and although the meta-analyses presumably covered most research available when they were written, there may be important research published after the periods covered by meta-analyses that is not included in our review. This is the case for the connections between VO and both GB and SWB, the connection between CN and SWB and the connection between mindfulness and SWB. Two connections were not covered by meta-analyses however – CN-GB and mindfulness-GB – and our reviews of these are therefore equally comprehensive as Review 1.

**Publication bias.** All the articles we have reviewed are published, peer-reviewed papers. We do not know how many unpublished studies exist and how the overall findings would look, if unpublished work were included. Therefore there is a risk that our conclusions are subject to publication bias. This issue was addressed by five of seven of the meta-analyses presented in Review 2, and none of them found evidence of publication bias affecting their conclusions. This implies that the less comprehensive parts of our reviews - the connections covered by meta-analyses – are largely unaffected by publication bias, while the more comprehensive sections, including Review 1, may or may not be affected.

**The research field.** Considering the studies reviewed collectively, we can sum up what we perceive as limitations in the research across the field: The vast majority of studies are correlational, so although covariations between several of the variables discussed in this paper are examined well, there is limited evidence of causality. In other words, there is good evidence that there *is* a connection between GB and SWB, and that CN, VO and mindfulness have roles to play

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in this connection. What we lack is evidence for *how* they are interconnected. There are few longitudinal and experimental studies that examine these connections, and among those that exist, we found many to have methodological flaws.

The majority of the studies use samples from western societies, and they very often consist of students. This arguably limits the generalizability of the findings, as the samples are not perfectly representable for the global population and also not for the societies from which they are sampled. The majority of the studies also rely entirely on self-report as source of data, and this is associated with biases like social desirability, which can be difficult to eliminate or control for.

### **Implications for future research**

There are parts of the research field that are less well covered than others, and where more research is required. This includes the connection between mindfulness and GB where there are very few studies available. The connection between CN and GB has been investigated in numerous studies, but a meta-analysis aggregating the findings is still missing.

In general, definite evidence of causality is lacking, both between GB and SWB, and in most of the links between the mechanism variables and GB/SWB. Promising results have been found for causality in the CN-GB relation (e.g., Collado et al., 2013; Poon et al., 2015; Tam et al., 2013), the VO-SWB relation (e.g., Kasser et al., 2014; Lekes et al., 2012; Maio et al., 2009), and the mindfulness-SWB relation (Eberth & Sedlmeier, 2012; Gotink et al., 2015; Khoury et al., 2015), but more experimental and longitudinal studies are still needed.

There is also a need for more experimental research on interventions targeting the mechanism variables. As an example, take CN, where the present research is particularly inconclusive: are nature interventions effective, and if so, what kinds of interventions? Direct nature exposure, outdoor or indoor? Nature-inspired design in buildings and public spaces?

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Priming exercises through writing or other tasks? Watching nature movies or images? Education on the interconnectedness between humans and nature? Or would interventions targeting general connectedness be more effective, or a combination of nature contact and general connectedness? Clarifying which interventions are effective and which are not, is vital to be able to effectively apply the findings from the reviewed research in society at large.

There is also need for more studies measuring GB directly. As seen in the studies on the CN-GB relationship, the results might differ depending on whether GB is measured directly or through self-report (e.g., see Geng et al., 2015).

Finally, a meta-analysis on the connection between GB and SWB is needed to aggregate the findings in a more statistically coherent way than we have been able to do by simply reviewing them. Structural modelling studies including all three mechanisms would also add some insight into how they each contribute to the GB-SWB connection and whether they overlap or interact in their contributions.

### **Implications for society**

As more knowledge accumulates on the connection between GB and SWB and on how this is influenced by CN, VO, mindfulness, and possibly more mediating/moderating variables like voluntary simplicity and mystical experiences in nature, we suggest that efforts should be made to communicate this knowledge to the public. Currently, the positive link between SWB and GB is not readily apparent in the official discourse, and next to the more common trade-off framing of environmental problems, the GB-SWB connection may easily seem rather counter-intuitive. It must be pointed out though, that GB is *voluntary behaviour* and that implications for society are limited to this. Therefore, only interventions aimed at promoting voluntary GB are supported by the findings above. We do not expect the findings to be generalizable to interventions that involve coercion or imposing of forced restrictions on people's behaviours or

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lifestyles. To make good use of the findings, we believe that clear, unbiased information on the GB-SWB relationship would be a good way to strengthen awareness and motivate change.

Further, we suggest that efforts be made to try and strengthen CN, intrinsic values and mindfulness in the population. We believe their potential for increasing SWB make them attractive and uncontroversial both for policy makers and the general population, while the potential for increasing GB can be viewed as an extra bonus. In the following we propose ideas for such interventions.

**Promotion of connection to nature.** According to the studies reviewed here, it seems that CN might best be promoted through physical outdoor contact with nature (e.g., see Collado et al., 2013). It can therefore be recommended that children get to spend time in nature from an early age, for example through class excursions and the like. This bears with it an argument for preservation of natural environments so there is some wilderness to be visited. Also, efforts to “bring nature to town” could be recommended. It is hardly controversial that “green lungs” like parks add pleasure to, and are important parts of any urban environment. Nature-inspired architecture may be recommended for the same reason, both in schools and workplaces.

**Promotion of intrinsic values.** Reflection and writing exercises have been shown to be effective at increasing intrinsic values (Kasser et al., 2014; Lekes et al., 2012; Maio, Pakizeh, Cheung, & Rees, 2009), and such exercises could therefore be used to compensate for the pull towards extrinsic values found in much of western society. Educating young people on the effects of advertising and sales tactics to inoculate them to exploitation could go along with teaching knowledge about values, how they relate to each other and to SWB, and how they can be affected by the media and social environments. In this context reflection and writing exercises could be offered as a way of nurturing healthy values that may receive little nurturing otherwise. Through popularizing knowledge about values there is hope that it may become possible to implement in

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government policies, for instance through new regulations on content and distribution of advertising.

The results from the VO research also have larger implications at the societal and political level, as the link between VO and SWB have proven stronger in more equal societies with limited growth rates (Dittmar et al, 2014). Also, studies have found that in societies that embrace a deregulated, free-market economy, a larger amount of the population tend toward an extrinsic value orientation (Kasser, 2011b; Schwartz, 2007). This suggest that all else equal, implementing a significant degree of market regulations, working toward greater economic equality, and aiming for low rates of economic growth should lead to a strengthening of intrinsic values, increased well-being, and more sustainable conduct among members of society. Knowledge from studies on value change could be of use here, as they can support arguments to regulate forces that promote materialism, on the grounds that VO is more easily influenced than might be expected and that materialism as a prioritized value is detrimental both to the happiness of the population and to the environment we all depend on.

**Promotion of mindfulness.** As mindfulness is currently acknowledged to have a positive effect on well-being and mental health, there are already good arguments for adding mindfulness practice to school curriculum. Health benefits and increased productivity due to stress reduction are also good arguments for promoting mindfulness to workplace managers, suggesting they organize mindfulness courses for their staff, or implement “mindful zones” in the work environment. Such mindful zones can include physical locations like meditation rooms or calming views through windows, as well as an established meditation time during the workday. The UK can be looked to as an example, as they recently have published a report on national recommendations for implementing mindfulness interventions in schools, workplaces and the

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criminal justice system, as well as strengthening the role of mindfulness-based interventions in healthcare (MAPPG, 2015).

As implied earlier, the three mechanisms may facilitate each other, and we believe it is conceivable to develop interventions that aim at improving two, or all three of them, simultaneously. The answer to whether this would be more or less effective than promoting each on their own, can however not be derived from the findings in our reviews.

Lastly, although it is reasonable to be optimistic about the effects of promoting GB through the outlined means, it will likely not be sufficient for reducing people's GHG to sustainable levels. This is apparent from the studies on GHG-reduction, which found no relation to SWB.

### **Conclusion**

In this paper we have reviewed existing research that examines the relation between GB and SWB. The majority of the studies found, demonstrate a positive relation between these two constructs. We have then reviewed research looking into how this relationship might be explained. Knowing how the mechanisms work may enable decision makers to apply the research findings in society, for example by implementing mindfulness education, nature excursions and intrinsic values writing exercises as part of the school curriculum for children. These kinds of interventions could have the potential of increasing children's SWB, as well as shaping them to be more environmentally responsible citizens. The idea that people who voluntarily engage in GB are happier compared with people who do not, contradicts mainstream assumptions, but this is what the empirical literature suggests. It seems that if downscaling our consumption is done in a sensible way, it may be a source of increased, rather than decreased well-being.

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## Appendix A

Table 3

*Descriptive findings of all relevant articles found in Review 1*

Article	Method	N	Main findings	Limitations
Andersson et al. (2014)	Survey data combined with objective measures	1002 Swedish citizens	Weak correlation between GHG emissions and SWB ( $r = .14, p < .01$ ), which disappeared when respondents who did not work or study were excluded from the sample. Respondents scoring high on SWB and low on GHG emissions were slightly less materialistic (mean: 2.03, SD: 1.77) than respondents showing the opposite pattern of scores (mean: 2.86, SD: 1.83), $r = .23^a, p < .001$ .	Correlational; did not control for social desirability; based on self-report data. Sample somewhat higher educated than the general population.
Brown & Kasser (2005), study 1	Survey	206 US middle and high school students	SWB and ecologically responsible behaviour were weakly correlated ( $r = .17, p < .02$ ). Value orientation mediated the relationship.	Correlational; based on self-report data. Only indirect control for social desirability.
Brown & Kasser (2005), study 2	Survey	400 US citizens, of which 200 VS practitioners and 200 'mainstream' individuals	Positive affect was related to lower ecological footprint ( $r = .19$ ) and more environmental behavior ( $r = .23$ ); similarly, life satisfaction was related to lower ecological footprint ( $r = .20$ ) and more environmental behaviour ( $r = .23$ ). All $p$ 's $< .0001$ . Using SEM modeling, found overall SWB and GB to be associated ( $\beta = .44, t = 4.01, p < .001$ ). The combination of value orientation and dispositional mindfulness was found to mediate the relationship. Voluntary simplicity did not mediate the relationship.	Correlational; based on self-report data. Only indirect control for social desirability.
Corral-Verdugo et al. (2011)	Survey	606 Mexican students	Happiness was weakly related to pro-ecological behaviour ( $r = .18, p < .05$ ), but not related to frugality/low consumption ( $r = .04, ns$ ).	Correlational; did not take social desirability into account; based on self-report data.
Corral-Verdugo et al. (2013)	Survey	120 Mexican citizens	Sustainable behaviour predicted positive well-being ( $\beta = .49, p < .05$ ) and negative well-being ( $\beta = -.61, p < .05$ ).	Correlational; did not take social desirability into account; based on self-report data; small sample; might not be peer reviewed.

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 3 (Cont.)

*Descriptive findings of all relevant articles found in Review 1*

Article	Method	N	Main findings	Limitations
Jacob et al. (2009)	Survey	829 members of Buddhist Peace Fellowship	Overall GB weakly predicted SWB ( $r^2 = .06, p < .01$ ). Of three GB measures, only one predicted SWB by itself: sustainable food practice (4 item scale, SD 2.26) ( $b = .76, p < .01, \beta = .21$ ). The two other GB measures - recycling behaviour and sustainable household choices - did not predict SWB. Mindfulness was weakly related to sustainable food practice ( $r = .19$ ) and sustainable household choices ( $r = .15$ ), and moderately related to SWB ( $r = .37$ ) and general happiness ( $r = .38$ ); all $p$ 's $< .01$ .	Correlational; did not take social desirability into account; based on self-report data. Limited external validity as all participants were spiritually inclined and ecologically aware.
Kaida & Kaida (2015)	Survey	300 Japanese citizens	Using SEM, anticipated future SWB was negatively related with pro-environmental behaviour ( <i>path coefficient</i> = $-.45, p < .05$ ), supporting the notion that a pessimistic perspective on the future facilitates pro-environmental behaviour. No significant association between present SWB and pro-environmental behaviour.	Correlational; possible mediators was not investigated. Self-report measures on GB.
Kennedy et al. (2013)	Survey	491 Canadian households	Downshifting did not predict quality of life or transport choice. But it weakly predicted sustainable choices at home, when controlling for various demographic variables ( $\Delta r^2 = .025, \beta = .17, p < .001$ ).	Correlational. Subjects reported their own quality of life, along with downshifting of anyone within the household.
Mayer & Frantz (2004), study 4	Survey	135 US citizens	Connectedness to nature was weakly related to life satisfaction ( $r = .20, p < .05$ ) and moderately related to ecological behaviour ( $r = .45, p < .01$ ). When controlling for environmental attitudes and beliefs, correlations remained, although somewhat smaller in size ( $r = .17, p < .05$ and $r = .28, p < .01$ , respectively).	Correlational; based on self-report data. Haphazard sampling.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 3 (Cont.)

*Descriptive findings of all relevant articles found in Review 1*

Article	Method	N	Main findings	Limitations
Monopolis (2010)	Survey	2030 US citizens, of which 1027 voluntary simplifiers and 1003 random sample	Voluntary simplifiers experienced moderately higher levels of happiness (mean = 8.148, SD: 1.346) compared to control group from the general population (mean = 6.133, SD: 2.288), $r = .47^a$ , $p < .001$ .	Correlational. Does not address the question of whether or not VS is subject to hedonic adaptation. Does not control for any possible confounding variables.
Monopolis (2010)	Survey	83 voluntary simplifiers	Retrospectively assessed ecological footprint from before adopting a VS lifestyle was larger than current ecological footprints. On average, pre-VS footprints would require 5.5 Earths if the entire population adopted their lifestyle; after adopting VS this figure dropped to 4 Earths. Effect size and $p$ value not given.	No control group and no statistics makes these results hard to interpret meaningfully.
Mzoughi (2014)	Survey	280 French farmers, of which 185 organic and 95 conventional	Organic, as compared to conventional farming practice (dummy variable: mean = .66, SD = .47), predicted life satisfaction (10-point scale: mean = 6.66, SD = 2.06), $b = .349$ , $p < .05$ .	Correlational, based on self-report data. Single-item life satisfaction measure.
Nisbet & Zelenski (2013), study 1	Survey	184 Canadian students	Nature relatedness was moderately related to GB ( $r = .42$ , $p < .01$ ), and weakly related to SWB (positive affect: $r = .29$ , $p < .01$ ; negative affect: $r = -.11$ , $ns$ ; satisfaction with life: $r = .13$ , $p < .10$ ) as well as eudaimonic well-being (autonomy: $r = .28$ , $p < .01$ ; personal growth: $r = .29$ , $p < .01$ ; purpose in life: $r = .19$ , $p < .05$ ; environmental mastery: $r = .09$ , $ns$ ; self-acceptance: $r = .18$ , $p < .05$ ; positive relations with others: $r = .10$ , $ns$ ).	Correlational; based on self-report data.
Nisbet & Zelenski (2013), study 3	Survey	354 students	Nature relatedness correlated strongly with two measures of GB: actual ecological commitment ( $r = .57$ , $p < .01$ ), and sustainable behaviour ( $r = .63$ , $p < .01$ ). Nature relatedness also weakly correlated with SWB (positive affect: $r = .25$ , $p < .01$ ; negative affect: $r = -.08$ , $ns$ ) and eudaimonic well-being (vitality: $r = .25$ ; autonomy: $r = .25$ ; personal growth: $r = .36$ ; purpose in life: $r = .19$ ; all $p$ 's $< .01$ ).	Correlational; based on self-report data.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 3 (Cont.)

*Descriptive findings of all relevant articles found in Review 1*

Article	Method	N	Main findings	Limitations
Nisbet & Zelenski (2013), study 4	Survey	207, of which 123 Canadian students and 84 worldwide citizens	Nature relatedness was strongly correlated with two measures of GB in two different populations: actual ecological commitment (community: $r = .61$ ; students: $r = .58$ ) and sustainable behaviour (community: $r = .55$ ; students: $r = .50$ ), all $p$ 's < .01. Nature relatedness also correlated, weakly to moderately, with SWB (community/students: positive affect: $r = .42/.29$ , $p < .01$ ; negative affect: $r = -.27/-.19$ , $p < .05$ ; subjective happiness: $r = .27/.19$ , $p < .05$ ; satisfaction with life: $r = .10/.13$ , <i>ns</i> ) and eudaimonic well-being (vitality: $r = .35/.24$ , $p < .01$ ; autonomy: $r = .45/.36$ , $p < .01$ ; personal growth: $r = .49/.51$ , $p < .01$ ; purpose in life: $r = .26/.26$ , $p < .05$ ).	Correlational; based on self-report data.
Snell & Simmons (2015)	Survey	305 Australian citizens	SWB and GB was weakly correlated ( $r = .12$ , $p < .05$ ). Mystical experiences in nature explained a small amount of the variation in SWB ( $\Delta r^2 = .013$ , $F_{\text{change}}(1, 301) = 4.45$ , $\beta = .12$ , $p = .036$ ) while controlling for contact with nature and demographic variables. Mystical experiences in nature, but not in human-built environments, were weakly correlated with GB ( $r = .14$ , $p < .05$ ).	Correlational; based on self-report data.
Suarez-Varela et al. (2014)	Survey	812 Spanish citizens	“Water-saving device installed in taps”, one (dummy variable) of six items in GB scale significantly predicted life satisfaction (5-point scale) ( $b = .49$ , $SD = 0.0342$ ) while controlling for demographic variables. For the remaining 5 items, there was no effect.	Correlational; based on self-report data. Only one item tapped life satisfaction. Narrow operationalization of GB. 5 of 6 items asks about water-saving behaviour.
Tapia-Fonllem et al. (2013)	Survey	807 Mexican students	Sustainable behaviour was found to predict happiness ( $\beta = .17$ , $p$ not reported but labeled “significant”).	Correlational; based on self-report data; no control for social desirability.

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 3 (Cont.)

*Descriptive findings of all relevant articles found in Review 1*

Article	Method	N	Main findings	Limitations
Villacorta et al. (2003)	Survey	165 Canadian students	Autonomous environmental self-regulation was weakly related to self-reported GB ( $r = .17, p < .05$ ), positive affect ( $r = .24, p < .01$ ), and negative affect ( $r = -.15, p < .05$ ). It was also weakly to moderately related to three intrinsic aspirations: self-acceptance ( $r = .23, p < .01$ ); affiliation ( $r = .19, p < .05$ ); community ( $r = .31, p < .01$ ), and unrelated to three extrinsic aspirations: finances ( $r = .03$ ), social recognition ( $r = .00$ ) and attractiveness ( $r = -.09$ ), all <i>ns</i> .	Correlational; based on self-report data. Homogenous sample (all students). Female to male ratio 8:2.
Welsch & Kühling (2010)	Survey (World Value Survey, 3rd wave)	23623 respondents from 27 countries	Pro-environmental behaviour (4-point scale, mean = 1.556, SD = 1.126) predicted life satisfaction (10-point scale, mean = 6.463, SD = 2.523) ( $b = .051, z = 7.29, p$ not reported, but labelled “highly significant”) while controlling for environmental attitudes and demographic variables.	Correlational; unable to completely rule out unobserved determinants of life satisfaction.
Wilson et al. (2013)	Survey data combined with objective measures	1920 Canadian households	No significant association between objective measures of GHG emissions and life satisfaction or happiness (effect sizes and $p$ values not reported).	Correlational.
Xiao & Li (2011)	Survey	3221 Chinese citizens	GB weakly predicted life satisfaction ( $r^2 = .04, p < .0001$ ).	Correlational; did not take social desirability into account; based on self-report data. Only one item tapped life satisfaction. GB measures appear flawed.

<sup>a</sup>Effect size calculated using calculator on this web page: <http://www.uccs.edu/~lbecker/>

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6

*Descriptive findings from the CN searches*

Connection to nature and SWB				
Article	Method	N	Main findings	Limitations
Capaldi et al. (2014)	Fixed-effect Meta-analysis	30 samples from 21 studies, 8523 participants	Small, significant association between CN and happiness ( $r = 0.19, p < 0.05$ ). The relationship was moderated by type of happiness (positive affect, life satisfaction or vitality, with strongest effect for vitality) and measure of CN (CNS, INS, or NR, with strongest effect for INS).	Mainly correlational studies, mostly Western samples, no longitudinal studies.
Connection to nature and GB				
Article	Method	N	Main findings	Limitations
Alisat et al. (2014)	Survey	110 Canadian citizens, half environmentalists	EID was strongly associated with self-reported GB frequency ( $r = .53, p < .001$ ).	Correlational, based on self-report data.
Andrejewski (2011)	Survey	218 US fifth grade students	Children's CNS was strongly associated with self-reported GB last week ( $r = .52, p < .01$ ).	Correlational, based on self-report data. Low reliability for stewardship scale ( $\alpha = .63$ ).
Beery & Wolf-Watz (2014)	Survey	1792 Swedish citizens	Environmental connectedness had a small relationship to a variety of self-reported GBs performed for environmental reasons ( $r = .09-.20, p < .008$ ).	Correlational, based on self-report data.
Biga (2006), study 1	Survey	365 students	Environmental identity (not Clayton's measure) was strongly associated with a combination of self-reported GB and GB intentions ( $r = .59, p < .05$ ).	Correlational, based on self-report data.
Biga (2006), study 2	Survey	537 various North American respondents	Environmental identity (not Clayton's measure) was strongly associated with environmental activism ( $r = .54$ ), GB intentions ( $r = .58$ ), and self-reported private GB ( $r = .58$ ), all $p$ 's $< .05$ .	Correlational, based on self-report data.

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6 (Cont.)

*Descriptive findings from the CN searches*

Article	Method	N	Connection to nature and GB	
			Main findings	Limitations
Brügger et al. (2011)	Survey	1307 Swiss participants	Self-reported GB was strongly associated with EID ( $r = .54$ ), moderately related to Disposition to connect to nature ( $r = .49$ ), CNS ( $r = .40$ ) and INS ( $r = .37$ ), and weakly related to IAT ( $r = .16$ ). All $p$ 's < .001.	Correlational, based on self-report data.
Cheng & Monroe (2012)	Survey	5500 fourth-graders	Children's connection to nature predicted their interest in performing GB's ( $\beta = .30, p < .05$ ).	Correlational, based on self-report data.
Chochola (2009)	Survey	245 US citizens	CNS was moderately associated with two measures of self-reported GB frequency ( $r = .40$ and $r = .45$ ; both $p < .001$ ).	Correlational, based on self-report data. Convenience sampling. Homogenous sample with many caucasian, female, well-educated participants.
Collado et al. (2013)	Quasi-experiment	397 children at summer camps	Increased EAN (due to participation in nature-based summer camp) predicted increased willingness to carry out daily GBs ( $\beta = .25, p < .05$ ) and citizenship GBs ( $\beta = .40, p < .001$ ). Increased EAN partially mediated the relationship between nature camp and GBs ( $p < .05$ ).	Lacks randomization.
Davis et al. (2009), study 1	Survey	71 students	Self-reported GB was strongly associated with COM ( $r = .60, p < .001$ ) and moderately related to INS ( $r = .49, p < .001$ ). In hierarchical multiple regression modeling, when controlling for attitudes and social desirability, COM and INS predicted GB (respectively: $\beta = .36, p < .01$ ; and $\beta = .27, p < .02$ ; together: $\Delta r^2 = .25$ ).	Correlational, based on self-report data.
Davis et al. (2009), study 2	Experiment	70 students	Priming with COM through writing exercise led to moderately higher levels of GB intentions ( $t(68) = -3.19, r = .36a, p < .002$ ), as well as a marginally greater likelihood of agreeing to perform local GB ( $\chi^2(1, N = 70) = 3.73, r\phi = .23b, p < .05$ ), as compared with controls. However, the manipulation did not significantly affect participants' COM, and because of this a mediational test was not conducted.	

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6 (Cont.)

*Descriptive findings from the CN searches*

Article	Method	N	Connection to nature and GB	
			Main findings	Limitations
Davis et al. (2011)	Survey	248 students	Self-reported GB was strongly related to EID ( $r = .51$ ) and COM ( $r = .50$ ), and moderately related to CNS ( $r = .46$ ) and INS ( $r = .33$ ). Willingness to sacrifice for the environment was strongly related to all CN measures: EID ( $r = .66$ ), COM ( $r = .67$ ), CNS ( $r = .60$ ) and INS ( $r = .51$ ). All $p$ 's < .001.	Correlational; based on self-report data.
Dresner et al. (2015)	Survey	165 park volunteers	EID had a weak association with private pro-environmental gardening behaviours ( $r = .27, p = .000$ ).	Correlational; based on self-report data. Limited external validity. Behaviour measure tapped mainly green gardening behaviour.
Duffy & Verges (2010)	Survey	220 students	IAT did not correlate with self-reported GB ( $r = .06, ns$ ).	Correlational; based on self-report data.
Dutcher et al. (2007)	Survey	563 US landowners	CWN accounted for a moderate amount of the variation in self-reported GB ( $\Delta r^2 = .10, p < .001$ ).	Correlational; based on self-report data.
Fröhlich et al. (2013)	Survey	176 fifth graders	INS was weakly associated with GB intentions ( $r = .22, p < .01$ ).	Correlational; based on self-report data.
Geng et al. (2015)	Survey	113 Chinese students	Explicit connectedness to nature (CNS) was moderately associated with self-reported GB ( $r = .39, p < .001$ ), but implicit connectedness (IAT) was not ( $r = -.14, p = .13$ ). Implicit connectedness was strongly associated with spontaneous, actual GB in the form of plastic bag usage ( $r = .56, p < .001$ ), but explicit connectedness was not ( $r = -.12, p = .22$ ). Explicit and implicit connectedness were independent of each other.	Measure of plastic bag usage is binary and might be oversimplified.
Gosling & Williams (2010)	Survey	131 farmers	CNS was weakly associated with vegetation protection ( $r_s = .27, p < .01$ ) and intention to replant in the future ( $r_s = .23, p < .05$ ), but not with past replanting ( $r_s = .17, p = .06$ ).	Correlational, based on self-report data.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6 (Cont.)

*Descriptive findings from the CN searches*

Article	Method	N	Connection to nature and GB	
			Main findings	Limitations
Hoot & Friedman (2011)	Survey	202 patrons at farmers market	CNS was moderately associated with self-reported GB ( $r = .37, p < .01$ ).	Convenience sampling. Correlational, based on self-report data.
Lee et al. (2015)	Survey	324	CNS was moderately associated with self-reported GB ( $r = .37$ , significance not given).	Correlational, based on self-report data.
Lokhorst et al. (2014)	Survey	94 farmers	Connectedness to nature (not Mayer & Frantz' scale) was moderately related to general intention to conserve nature ( $r = .38, p < .01$ ).	Correlational, based on self-report data. CN measure has not been validated in multiple settings.
Markowitz et al. (2012), study 2	Survey	113 US students	CNS strongly associated with self-reported GB ( $r = .52, p < .001$ ).	Correlational, based on self-report data. Behaviour measure has not been tested for reliability and validity.
Matsuba et al. (2012)	Survey	110, half environmentalists	EID was strongly related to self-reported frequency of GB ( $r = .50, p < .01$ ), weakly related to list of public GB that the participants themselves came up with ( $r = .29, p < .01$ ), and not related to list of private GB that the participants themselves came up with ( $r = .16, ns$ ).	Snowball sampling. Correlational, self-report data.
Mayer & Frantz (2004), study 2	Survey	65 students	CNS was moderately related to self-reported GB ( $r = .44, p < .01$ ).	Correlational, self-report data.
Mayer & Frantz (2004), study 4	Survey	135 community participants	CNS was moderately related to self-reported GB ( $r = .45, p < .01$ ).	Convenience sampling, correlational, self-report data.
Mayer & Frantz (2004), study 5	Reaction-time measure and survey	46 students	Self-reported GB was moderately related to CNS ( $r = .39, p < .01$ ), and weakly related to INS ( $r = .28, p < .05$ ), but not related to IAT ( $r = .19, ns$ ).	Small sample. Correlational, based on self-report data for all measures except IAT.
Nisbet (2011)	Experiment (RCT)	207, of which 123 student and 84 community participants	Writing about nature did not increase NR.	High attrition rate. Uneven gender distribution. Study conducted in late fall (not a conducive time for well-being or nature contact). Control participants occasionally wrote about nature, even though not asked to do this.

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6 (Cont.)

*Descriptive findings from the CN searches*

Connection to nature and GB				
Article	Method	N	Main findings	Limitations
Nisbet (2011)	Survey	207, of which 123 student and 84 community participants	Two different measures of self-reported GB were strongly associated with NR ( $r = .60$ and $r = .52$ ), and moderately associated with INS ( $r = .49$ and $r = .43$ ). All $p$ 's < .01.	Correlational, based on self-report data.
Nisbet & Zelenski (2013), study 1	Survey	184 students	Nature relatedness was moderately related to GB ( $r = .42$ , $p < .01$ ).	Correlational, based on self-report data.
Nisbet & Zelenski (2013), study 3	Survey	354 students	Nature relatedness correlated strongly with two different GB measures ( $r = .57$ and $r = .63$ ; both $p$ 's < .01).	Correlational, based on self-report data.
Nisbet et al. (2009), study 1	Survey	184 students	NR correlated strongly with self-reported GB ( $r = .53$ , $p < .01$ ).	Correlational, based on self-report data.
Parker (2013)	Survey	162 students	Self-reported GB was strongly associated with CNS ( $r = .53$ , $p < .01$ ).	Correlational, based on self-report data.
Perkins (2010), study 4	Survey	210-245 tourists	Love and care for nature was moderately to strongly associated with a variety of self-reported GB frequencies ( $r$ 's = .32-.51, all $p$ 's < .001).	Correlational, based on self-report data. Convenience sampling.
Poon et al. (2015), Experiment 3	Experiment	67 US citizens	As part of a bootstrapping mediation analysis, found that increased CNS predicted higher willingness to engage in GBs ( $\beta = .60$ , $p < .001$ ).	Based on self-report data.
Rader (2010)	Quasi-experiment	50 US citizens	Increased CNS (due to nature exposure) was associated with weakly increased willingness to engage in GBs ( $r = .26$ , $p < .05$ ). Mediation test not conducted.	Correlational, based on self-report data. No control group. Homogenous sample who self-selected to participate in nature immersion.
Scott (2010), study 1	Survey	51 female students	EID correlated moderately with general ( $r = .49$ ) and specific ( $r = .47$ ) self-reported GB. Both $p$ 's < .001.	Correlational, based on self-report data. Small sample size.
Scott (2010), study 2	Survey	199 women	Both EID and CNS correlated moderately with general ( $r = .35$ ; $r = .44$ ) and specific ( $r = .44$ ; $r = .35$ ) self-reported GB. All $p$ 's < .001.	Correlational, based on self-report data.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6 (Cont.)

*Descriptive findings from the CN searches*

Article	Method	N	Connection to nature and GB	
			Main findings	Limitations
Scott (2010), study 3	Experiment	60 female students	Indoor nature exposure moderately increased GB intentions ( $r = .32^a, p < .04$ ), weakly increased INS ( $r = .24^a, p < .04$ ), but did not significantly affect CNS ( $r = .12^a, ns$ ).	Small sample size.
Scott et al. (2014)	Survey	50 participants in earth-living skill gathering	EID was moderately associated with self-reported general GB ( $r = .34, p < .05$ ), while INS and CNS was not (both $r = .24, ns$ ).	Correlational; based on self-report data. Small sample size with limited external validity.
Silvas (2013), chapter 2	Survey	266 fifth graders	Children's emotional connection to nature predicted willingness to protect the environment ( $\beta = .49, p < .001$ ); this effect was fully mediated by attitudes toward nature.	Correlational; based on self-report data. Convenience sampling. Willingness to protect environment not the same as actual behaviour frequency. Did not control for social desirability.
Stets & Biga (2003)	Survey	365 US students	Environmental identity (not Clayton's scale) was strongly associated with GB ( $r = .59, p < .05$ ).	Correlational; based on self-report data.
Tam (2013a), study 1	Survey	322 Hong Kong students	Self-reported GB was moderately associated with COM ( $r = .36$ ), CNS ( $r = .35$ ), EID ( $r = .36$ ), NR ( $r = .34$ ), and weakly associated with CWN ( $r = .23$ ), EAN ( $r = .28$ ), and INS ( $r = .13$ ). All $p$ 's $< .05$ .	Correlational; based on self-report data. Many similar questions in a short period of time can have caused response bias, f.ex fatigue.
Tam (2013a), study 2	Survey	185 US community participants	Self-reported GB was strongly associated with COM ( $r = .62$ ), CNS ( $r = .62$ ), CWN ( $r = .52$ ), EAN ( $r = .54$ ), EID ( $r = .66$ ), INS ( $r = .52$ ), NR ( $r = .60$ ), and Love and care for nature ( $r = .62$ ). All $p$ 's $< .05$ .	Correlational; based on self-report data. Many similar questions in a short period of time can have caused response bias, f.ex fatigue.
Tam (2013b)	Fixed-effect meta-analysis	5 studies, 817 participants	Dispositional empathy with nature correlated moderately with environmental movement support ( $r = .44, p < .001$ ) and self-reported GB frequency ( $r = .35, p < .001$ ).	All studies correlational, based on self-report measures.
Tam et al. (2013), experiment 3	Experiment	73 Hong Kong students	CNS (14-item scale, each with 7 likert options) was related to self-reported GB intentions (10-item scale, each with 7 likert options) ( $b = .48, p < .01$ ).	Self-report measures.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 6 (Cont.)

*Descriptive findings from the CN searches*

Article	Method	N	Connection to nature and GB	
			Main findings	Limitations
Watson et al. (2015)	Survey	243 US students, 47% living in green dorms	EID was strongly related to three types of self-reported GB: advocating environmental causes ( $r = .65$ ), conservation behaviour ( $r = .51$ ), and recycling behaviour ( $r = .62$ ). All $p$ 's < .001.	Correlational; based on self-report data.
Zelenski et al. (2015), study 1	Experiment	111 students	Watching a nature video led to moderately more sustainable in-game fishing than watching architectural video, in the form of fewer fish caught per 'season' ( $d = .60$ , $p < .01$ ), and more sustainable restraint ( $d = .75$ , $p < .01$ ). INS was measured, but was not affected by the intervention nor did affect behaviour outcomes (effect size and p value not given).	External validity unsure.
Zelenski et al. (2015), study 3	Experiment	228 students	Watching a nature video led to marginally higher willingness to engage in GBs ( $\eta_p^2 = .02$ , $p = .04$ ). This effect was mediated by INS, though significance was marginal.	Based on self-report behaviours.

*Note.* Abbreviations are used for the most frequently applied CN measures: Connectedness to nature (CNS), Environmental identity (EID), Inclusion of nature in self (INS), Connectivity with nature (CWN), Nature relatedness (NR), Emotional affinity towards nature (EAN), Implicit association with nature (IAT), and Commitment to the environment (COM). GB is green behaviour.

<sup>a</sup>Effect size calculated using calculator on this web page: <http://www.uccs.edu/~lbecker/> <sup>b</sup>Effect size calculated according to these instructions: <http://www.real-statistics.com/chi-square-and-f-distributions/effect-size-chi-square/>

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 8

*Descriptive findings from the VO searches*

Value orientation and SWB				
Article	Method	<i>N</i>	Main findings	Limitations
Dittmar et al. (2014)	Meta-analysis	753 effect sizes from 259 independent samples	Materialism associated with slightly, significantly lower well-being, average $r = -.19$ when controlled for reliability.	Mainly correlational studies, most based on self-report surveys. Lack of research on children.
Value orientation and GB				
Article	Method	<i>N</i>	Main findings	Limitations
Hurst et al. (2013)	Meta-analysis	15 effect sizes from 9 independent samples	Significant, medium-sized negative association between materialistic values and environmental behaviours ( $r = -.32, p < .05$ ), when controlled for reliability.	Few samples, and dominantly Western. Correlational literature. Based on self-report measures for behaviour.

SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

Table 10

*Descriptive findings from the mindfulness searches*

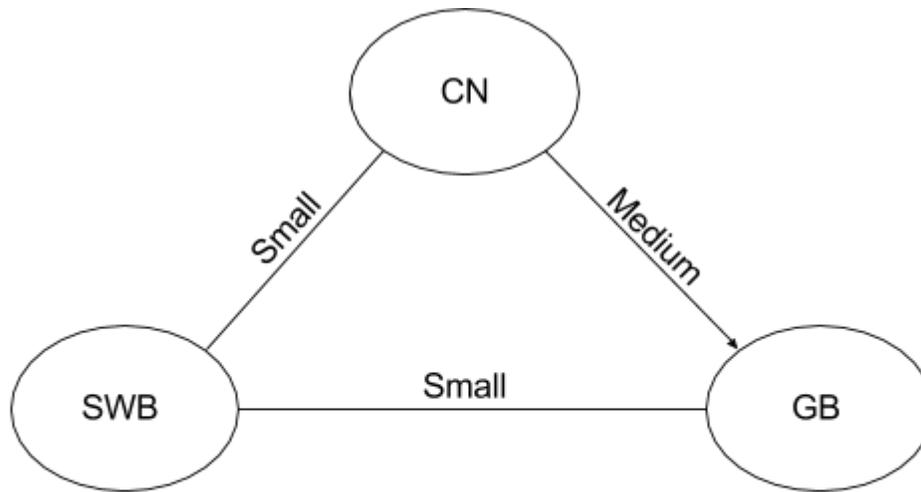
Mindfulness and SWB				
Article	Method	N	Main findings	Limitations
Eberth & Sedlmeier (2012)	Random effects meta-analysis	39 studies, 1855 healthy participants	Moderate effect of mindfulness meditation on self-attributed mindfulness ( $r = .34$ ) and well-being ( $r = .31$ ). $p$ not reported.	
Gotink et al. (2015)	Random effects meta-analysis	2 reviews of RCT studies, 511 participants	Compared to waitlist and treatment as usual, mindfulness-based therapies significantly improved quality of life ( $d = .39$ , 95% CI .08-.70).	Double blind impossible due to nature of intervention. Some overlap of studies (at most 8%). Heterogeneity of studies might be masked in the overview.
Goyal et al. (2014)	Random effects meta-analysis	47 RCT trials, 3515 participants	Mindfulness meditation programs had low evidence of improved mental health-related quality of life, and no effect/insufficient evidence on positive mood. Effect sizes not given.	Double blind impossible due to nature of intervention. High attrition. Heterogeneity of interventions.
Khoury et al. (2015)	Random effects meta-analysis	29 studies, 2668 healthy participants	Moderate to large effects of MBSR on self-reported mindfulness (within-group: $g = .60$ ; between-group: $g = .43$ ) and moderate effects on quality of life (within-group: $g = .44$ ; between-group: $g = .53$ ). All $p$ 's < .00001.	Limited number of included studies; most participants were female, Caucasian, relatively young, students or health professionals.
Mindfulness and GB				
Article	Method	N	Main findings	Limitations
Amel et al. (2009)	Survey	100 US participants at sustainability expo	Using simple linear regression, two facets of mindfulness were tested as predictors of GB. <i>Acting With Awareness</i> predicted a moderate amount of the variance in GB ( $\beta = .37$ , $p = .00$ ), whereas <i>Observing Sensations</i> did not predict GB ( $\beta = -.10$ , $p = .33$ ). The model as a whole predicted a moderate amount of the variance in GB ( $r^2 = .13$ ).	Correlational; based on self-report data. Mindfulness operationalized in cognitive terms. Convenience sampling. External validity unsure as participants were sampled from a sustainability expo.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR

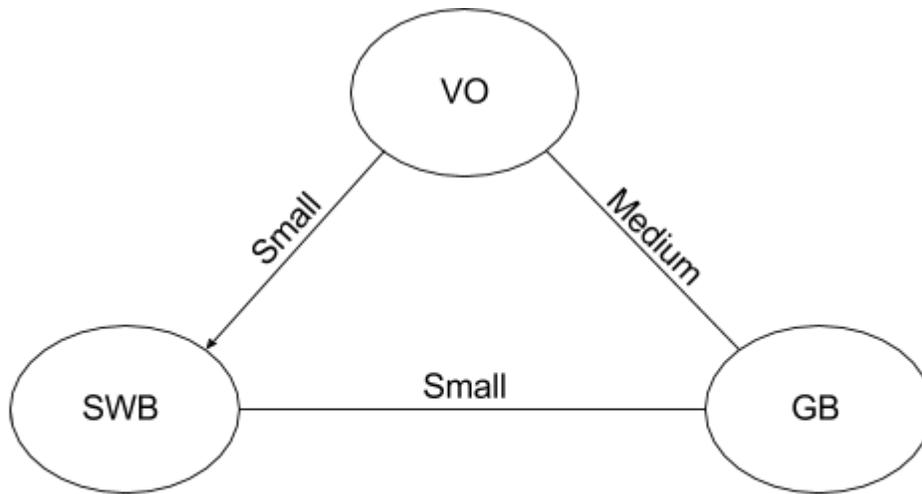
Barber & Deale (2014)	Survey	563 US hotel guests	Mindful hotel guests ( $n = 182$ ) responded to a moderately higher degree than low-mindful hotel guests ( $n = 152$ ) that they preferably choose environmentally friendly hotels ( $F(2, 560) = 19.64, d = .49^a, p < .05$ ).	No control for social desirability. Correlational, based on self-report data.
Brown & Kasser (2005), study 2	Survey	400 US citizens, half voluntary simplifiers	Greater mindfulness was weakly associated with self-reported GB ( $r = .13, p < .01$ ) and lower ecological footprint ( $r = .20, p < .001$ ).	Correlational; based on self-report behaviour. External validity unsure as half of the participants were voluntary simplifiers.
Jacob et al. (2009)	Survey	829 members of Buddhist Peace Fellowship	Mindfulness meditation was associated with sustainable household choices ( $r = .15, p < .01$ ) and food practice ( $r = .19, p < .01$ ), but not with recycling ( $r = .01, ns$ ).	Correlational, based on self-report behaviour. External validity unsure as participants were sampled from meditation network.

<sup>a</sup>Effect size calculated using calculator on this web page: [http://www.psychometrica.de/effect\\_size.html#fvalue](http://www.psychometrica.de/effect_size.html#fvalue)

**Appendix B**

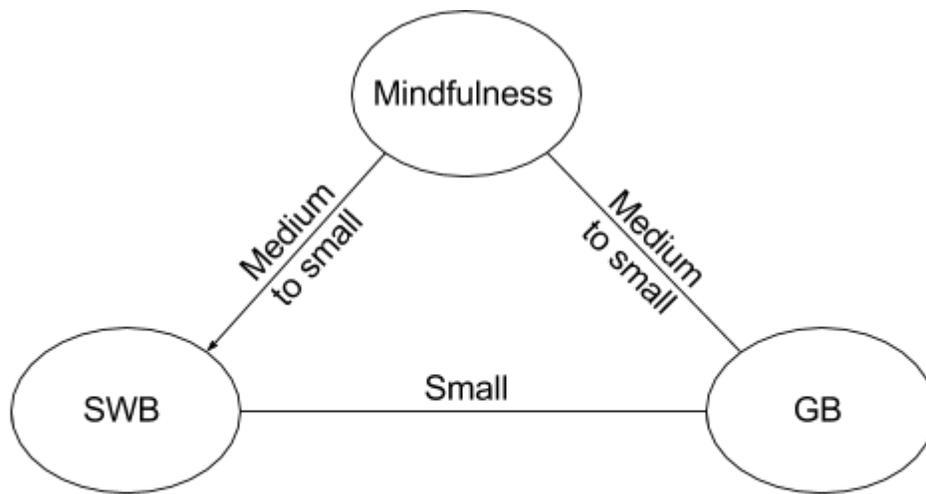


*Figure 1.* Visualization of relationships between CN, SWB and GB. Note that no studies in our reviews have tested whether CN actually mediates the SWB-GB relation, so the figure is hypothetical. Lines indicate weak/no evidence of causality; arrow indicate some evidence of causality. Words on lines indicate average effect sizes found in reviews one and two.



*Figure 2.* Visualization of the relationships between VO, SWB and GB. Note that only one study in our reviews have tested whether VO mediates the SWB-GB relation (Brown & Kasser, 2005). Lines indicate weak/no evidence of causality; arrow indicate some evidence of causality. Words on lines indicate average effect sizes found in reviews one and two.

## SUBJECTIVE WELL-BEING AND GREEN BEHAVIOUR



*Figure 3.* Visualization of the relationships between mindfulness, SWB and GB. Note that only one study in our reviews have tested whether mindfulness mediates the SWB-GB relation (Brown & Kasser, 2005). Lines indicate weak/no evidence of causality; arrow indicate some evidence of causality. Words on lines indicate average effect sizes found in reviews one and two.