Good Intents, but Low Impacts:

Diverging Importance of Motivational and Socio-Economic Determinants

Explaining Pro-Environmental Behavior, Energy Use, and Carbon Footprint

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Abstract

Earlier research has yielded contradictory results as to the main drivers of environmentally significant behavior. Intent-oriented research has stressed the importance of motivational aspects, while impact-oriented research has drawn attention to people's socio-economic status. In this study, we investigated the diverging role of a pro-environmental stance under these two research perspectives. Data from a German survey ($N = 1{,}012$) enabled assessment of per capita energy use, and individual carbon footprints (impact-related measures), pro-environmental behavior (an intent-related measure), and behavior indicators varying in environmental impact and intent. Regression analyses revealed people's environmental self-identity to be the main predictor of pro-environmental behavior; however, environmental self-identity played an ambiguous role in predicting actual environmental impacts. Instead, environmental impacts were best predicted by people's income level. Our results show that individuals with high pro-environmental self-identity intend to behave in an ecologically responsible way, but they typically emphasize actions that have relatively small ecological benefits.

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Industrialized and emerging countries continue to emit high levels of greenhouse gases based on their consumption of fossil energy sources, which is alarming in light of associated climate change risks (Intergovernmental Panel on Climate Change [IPCC], 2014). Household-driven greenhouse gas emissions represent a major share of overall total emissions (e.g., European Environment Agengy [EEA], 2013; United Nations Environment Program [UNEP], 2010). Thus, changing individual and household-level consumption is crucial for conservation of natural resources in general and for combatting fossil energy-related climate risks in particular (UN General Assembly, 2015).

The specific household-level energy-consumption domains that appear to have an especially high emissions-related environmental impact are housing, transportation, and nutrition (EEA, 2013; Tukker & Jansen, 2006). However, the emission contributions of these domains vary strongly between households depending on, for example, household size, income, or geographic location (e.g., Jones & Kammen, 2011). Policies and interventions to reduce individual and household-level carbon footprints are more effective if they are tailored to different energy-relevant behaviors and to different population segments. To enable such tailored policies and interventions, we require sound knowledge of what determines and motivates people's consumptive decisions and practices.

Identifying motivational factors influencing environmentally significant behavior and fostering pro-environmental behavior are key objectives of environmental psychological research (e.g., Kastner & Matthies, 2014). In investigating pro-environmental behavior, environmental psychologists have primarily been interested in their subjects' underlying motivational and intentional behavior structure, that is, what individuals *intend* to do to

protect the environment as seen through their own eyes (e.g., Kastner & Matthies, 2014; Stern, 2000; 2011).

In recent years, however, this sort of *intent-oriented* research perspective has been criticized for ignoring the actual environmental impact of people's behavior, whatever their intent (Csutora, 2012; Kastner & Matthies, 2014; Stern 2000, 2011). Some researchers have argued that environmentally significant behavior should be understood and measured according its environmental impact, namely "the extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself" (Stern, 2000, p. 408). In the resulting *impact-oriented* research perspective, environmentally significant behaviors are distinguished and rated according to different measurable material criteria. These might include, for example, the amount of energy needed (directly or indirectly) to produce, transport, use, and dispose of equipment deployed in connection with a particular behavior, or the carbon dioxide equivalents emitted as a result of the same. In complement to the intent-oriented perspective, this impact-oriented perspective reveals that intention-driven pro-environmental behavior can sometimes fail to have significant beneficial environmental impacts (Stern, 2000). Further, and just as important, it also reveals that environmentally significant behavior does not always follow directly from people's expressed or personally held intent. Although intent-oriented and impact-oriented behavior frameworks may overlap in some cases, the two perspectives have been used separately by researchers to operationalize environmentally significant behavior in distinct ways. As we shall see, researchers from the two strands tend to disagree about the importance of underlying behavioral determinants. While intent-oriented behavior research emphasizes people's motivations to protect the environment, it is well known from impact-oriented behavior research that factors such as income, household size, or geographic location strongly determine people's lifestyles and resulting environmental impacts.

Intents vs. Impacts: Two Complementary Research Perspectives on Environmentally Significant Behavior

Intent-Oriented Perspective

Intent-oriented research has only recently broadened its focus from researching specific pro-environmental actions to researching more comprehensive, overall pro-environmental behavior patterns and environmentally friendly lifestyles. Researchers have sought to reveal cross-behavioral, cross-situational predictors that reflect a more abstract, overall pro-environmental motivation or environmental stance (Thøgersen & Ölander, 2006; Whitmarsh & O'Neill, 2010). In so doing, social environmental researchers adapted the concept of identity from cognitive sociological and social psychological research by claiming that people differ in the degree to which they hold a "green" or environmental self-identity.

Self-identity signifies who a person is and may become, and who he/she is not and wants to avoid becoming. An identity-based motivation corresponds with readiness to engage in different, identity-congruent actions, such as the purchase of congruent products or lifestyle choices (Oyermann, 2009). People hold multidimensional social and personal identities (Brekhus, 2008). The behavioral relevance of a particular identity depends on the decision context (whether a given identity is activated by situational cues) as well as the degree to which a particular action contributes to the sense of identity (Oysermann, 2009). Identities emerge and shift over longer time periods through biographical and identity changes (Brekhus, 2008).

Translated into the context of pro-environmental behavior, self-identity has been understood as the extent to which an individual views him- or herself as the type of person who behaves in an environmentally friendly manner, i.e., whether one self-identifies using labels such as "eco-conscious" (Cook, Kerr, & Moore, 2002; Steg, Bolderdijk, Keizer, & Perlaviciute, 2014; van der Werff, Steg, & Keizer, 2013a). Environmental self-identity has been empirically tested in previous studies under the intent-oriented perspective. It has been

shown to predict various pro-environmental behaviors in a cross-situational way (Gatersleben et al., 2014; van der Werff, Steg, & Keizer, 2013b; Whitmarsh & O'Neill, 2010) and to mediate the relationship between values or environmental concerns, on the one hand, and a variety of general pro-environmental behaviors (Gatersleben et al., 2014; Whitmarsh & O'Neill, 2010) or energy-saving behaviors, on the other (van der Werff et al., 2013a, 2013b). Moreover, environmental self-identity has been shown to explain variance in pro-environmental behavior better than behavior-specific factors (Cook et al., 2002; Fielding, McDonald, & Louis, 2008; Gatersleben et al., 2014; Nigbur, Lyons, & Uzzell, 2010; Sparks & Shepherd, 1992; Whitmarsh & O'Neill, 2010). Finally, environmental self-identity has proven to be a better predictor of intent-oriented pro-environmental behavior than socioeconomic factors (Whitmarsh & O'Neill, 2010).

In sum, having a pronounced environmental self-identity ("being green") may translate into commitment to environmental goals and increased readiness to act in an identity-congruent way – for example, by consuming fewer natural resources or switching to consumption of more environmentally friendly products (Clayton & Myers, 2015) – as long as situational cues activate the "green" identity and it is not negated by competing identities (e.g., that of being wealthy).

Impact-Oriented Perspective

Research from an impact-oriented perspective has produced insights about behavioral determinants that diverge from those of the intent-oriented perspective. Studies of impact-oriented behavior measures – e.g., people's ecological footprint, overall energy consumption, or greenhouse gas emissions – have cast doubt on the predictive power of pro-environmental motivational variables. These studies consistently point to people's income level as the most significant determinant of their environmental impact. In this way, consumers with higher incomes tend to have bigger ecological footprints, use more energy per year, and emit more greenhouse gases than consumers with lower incomes. In addition, geographical

considerations (e.g., climatic zone of residence, urban versus rural locations) and individual

socioeconomic characteristics (e.g., age, education level, gender, homeownership status) have

been shown to influence people's environmental impact (Abrahamse & Steg, 2009; Bruderer

Enzler & Diekmann, 2015; Csutora, 2012; Gatersleben et al., 2002; Holden, 2004; Kennedy,

Krahn, & Krogman, 2014; Kennedy et al., 2015; Keuschnigg & Schubert, 2013; Notter,

Meyer, & Althaus, 2013). Finally, household size has proved to be an important predictor of

environmental impact. Household-related environmental burdens tend to increase with the

number of household members, but not proportionally – i.e. the per capita rates of

environmental burdens are generally lower in households with several members than in

single-person households. Thus, studies measuring household-level environmental impacts

generally find a positive relationship between the number of household members and

household energy use or greenhouse gas emissions (e.g., Abrahamse & Steg, 2009;

Gatersleben et al., 2002; Kennedy, Krahn, & Krogman, 2014), whereas studies assessing

per capita environmental impacts on the individual level show a negative relationship (e.g.,

Bruderer Enzler & Diekmann, 2015; Holden, 2004; Keuschnigg & Schubert, 2013).

　　　　Regarding the relevance of psychological variables in explaining environmental

impact, the evidence is mixed. Several studies did not find any significant effect of

psychological variables on people's overall energy use or their different energy-relevant

behaviors after controlling for socioeconomic factors (Abrahamse & Steg 2009; Bilharz &

Schmitt 2011; Csutora, 2012; Holden, 2004; Tabi, 2013; Poortinga, Steg, & Vlek, 2004).

However, several other studies have identified psychological variables – such as

environmental concerns, environmental awareness, or moral obligation – that appear to

influence people's environmental impact, albeit with less explanatory power than

socioeconomic variables (Bruderer Enzler & Diekmann, 2015; Gatersleben et al., 2002;

Hunecke, Hauenstein, Böhler, & Grischkat, 2010; Hunecke, Haustein, Grischkat, & Böhler,

2007; Kennedy et al., 2014, 2015; Keuschnigg & Schubert, 2013; Thøgersen & Grønhøj, 2010; Whitmarsh, 2009).

A very limited number of studies have chosen to adopt a complementary, combined approach bringing together intent-oriented and impact-oriented perspectives on environmentally significant behavior, thus enabling direct comparison (Bruderer Enzler & Diekmann, 2015; Gatersleben et al., 2002; Kennedy et al., 2015; Whitmarsh, 2009). Using different psychological variables (e.g., environmental values, environmental awareness, environmental concerns, or moral obligations), these studies show coinciding evidence for a high explanatory power of psychological variables for intent-oriented pro-environmental behaviors, but a much weaker, although significant, effect of psychological variables on impact-oriented measures. In these studies, environmental impacts were best explained by people's income and other socioeconomic characteristics (except the study of Whitmarsh, 2009, which excluded income).

In sum, the results of prior studies suggest that people's pro-environmental motivational stance is strongly related to specific, intention-driven pro-environmental behaviors, but is only loosely related to their overall environmental impact. Instead, people's overall environmental impacts are best explained by socioeconomic factors, especially income level. In light of such findings, Stern (2011) has highlighted the importance of better understanding the contribution of psychological variables to explain overall environmental impact. He and others have called for more psychological research examining asymmetries in the determinants of intent-oriented versus impact-oriented behavior, with particular emphasis on high-impact behaviors (Kennedy et al., 2014; Stern, 2011; Whitmarsh, 2009).

The Present Study

In the present study, we sought to explore the diverging insights that emerge from the intent-oriented and impact-oriented research perspectives vis-à-vis environmentally

significant behavior, in particular energy use and related greenhouse gas emissions. For this purpose, we compared and contrasted socioeconomic and psychological determinants of different energy-related behaviors, which vary in terms of their explicitness of underlying pro-environmental intent (expressed by study participants) as well as in terms of their actual environmental impact. The data used in our study were derived from a larger survey conducted on behalf of the German Environment Agency (UBA), for a detailed documentation see Kleinhückelkotten, Neitzke, and Moser (2016).

First, in line with the procedure of previous studies (Bruderer Enzler & Diekmann, 2015; Gatersleben et al., 2002; Kennedy et al., 2015), we compared an intent-oriented and an impact-oriented perspective on environmentally significant behavior at an aggregated behavior level, investigating the predictive power of age, gender, education level, income, number of household members, homeownership, and residential area on yearly per capita energy use and carbon footprint, in addition to participants' self-reported pro-environmental behavior. These socioeconomic characteristics have been shown to predict impact-oriented behavior in earlier studies (e.g., Abrahamse & Steg, 2009; Bruderer Enzler & Diekmann, 2015; Csutora, 2012; Gatersleben et al., 2002; Kennedy et al., 2014, 2015; Keuschnigg & Schubert, 2013; Notter et al., 2013).

Second, we designed our study to investigate the effects of our set of determinants on a variety of concrete, domain-specific, personal behaviors differing in terms of their environmental impact as well as assumed underlying intention. The overall environmental impact of each person is comprised of numerous individual behaviors or actions, which are in turn shaped by diverse structural, socioeconomic, and psychological variables (Gatersleben et al., 2002; Stern, 2000). One consequence of this is that self-described environmentally concerned people may try to act in an environmentally sound way, but they end up emphasizing smaller actions that do not appreciably diminish the overall environmental impact of their lifestyle. We provided detailed results regarding participants' per capita living

space, energy used for household appliances, meat consumption, car use, and vacation travel, all of which are indicators of behaviors and actions that make particularly high contributions to overall environmental impact (Girod & de Haan, 2010; Jungbluth, Itten, & Stucki, 2012; Notter et al., 2013; Tukker & Jansen, 2006). We contrasted these high-impact behaviors with indicators with lower-impact and more intent-oriented focus, such as possession of energy-efficient household appliances or purchase of environmentally friendly products. These behaviors have been linked to pro-environmental motivation in previous studies (Gatersleben et al., 2014; Gatersleben et al., 2002; van der Werff et al., 2013a, 2013b; Whitmarsh, 2009; Whitmarsh & O'Neill, 2010).

Third, we more closely explored the relationship between income, environmental self-identity, and behavior. We assumed that if self-identity does not show a direct effect of lower environmental impacts, it might play a moderating role on the relationship between income and high-impact behavior. In other words, we supposed that income predicts high-impact behavior more strongly for those people with low environmental self-identity, whereas high self-identity may counterbalance the income effect and thus the relationship between income and behavior may appear nonexistent or smaller for people with high environmental self-identity.

Method

Survey Procedure and Recruitment

Data were gathered in face-to-face interviews throughout Germany in March and April 2014 by a market research institute using computer assisted personal interviews (CAPI, e.g., Giesen, Meertens, Vis-Visschers, & Beukenhorst, 2012). German-speaking residents aged 18 years and older were recruited from the market research institute's existing participant pool with the help of quota sampling criteria including age, gender, number of households, and household size. Interviews lasted an average of 45 minutes.

Participants

A total of 1,012 interviews were completed. The mean age of participants was 49.8

years (SD = 7.6), 50.9% were females. The distribution of highest completed education level

was as follows: 39.5% of participants had completed secondary school, 32.7% had completed

intermediate school, 20.7% had a higher education qualification, and 5.6% had completed an

advanced degree (1.5% missing data). Net monthly per capita household income ranged from

€187.50 to €5,250 (M = €1,186.70; SD = €624.3); or, in US dollars, a range of $258.75 to

$7,245 ($M$ = $1,637.66, SD = $861.53[1]). For further sample characteristics see Table 1. When

compared with official German population statistics (Federal Statistical Office, 2014, 2015a),

the incomes of participants in our sample were revealed to be slightly below average among

the more highly educated, higher net earners (i.e., monthly incomes over €5,000, or $6,900),

and slightly above average among low- and medium-level education, mid-range earners (i.e.,

monthly incomes of €2,500–€3,500, or $3,450–$4,830). We refrained from weighting our

sample data for representativeness, however, as the goal of our study was more to investigate

relationships between variables than to draw conclusions about absolute levels of

distribution.

Measures

Face-to-face interviews with respondents were conducted with the help of a standardized

questionnaire. Notably, interviews with individual respondents from a household typically

generate data that is only of limited validity regarding overall household consumption

(Seebauer, Fleiss, & Schweigart, 2016). Thus, in the present study, we emphasized

assessment of natural-resource consumption at the level of the individual, wherever feasible,

rather than the household. When possible, questionnaire items were framed to assess

individual behaviors. Nevertheless, for the sake of simplicity, certain consumption-related

items – e.g., apartment size, energy-consuming appliances in household – were assessed at

the household level. In these cases, a per capita rate was calculated for further analysis by dividing the respondent's indication by the number of household members.

Pro-environmental behavior

General pro-environmental behavior was operationalized according to participants' self-reported estimations of their own efforts to save natural resources. This was done based on the following two survey items: "I organize my daily life so as to use as few natural resources as possible"; and, "I even try to use as few natural resources as possible when it requires substantial extra costs and effort'. Responses were measured on a 5-point scale, ranging from 1 = "I totally agree" to 5 = "I totally disagree". The items displayed adequate reliability (Cronbach's α of .76). For subsequent analysis, the mean of the two items was used ($M = 2.94$; $SD = .90$, cf. Table 2). In assessing explicit self-estimations of resource use, we referred to the procedure used by Whitmarsh (2009) and refrained, due to interview duration limitations, from asking about the frequency of different environmentally significant behaviors as has been commonly done to operationalize pro-environmental behavior in other studies (e.g., Bruderer Enzler & Diekmann, 2015; Gatersleben et al., 2002; Kennedy et al., 2015).

Per capita energy use and carbon footprint

For the present study, we used assessments of annual per capita energy consumption and greenhouse gas emissions (also referred to as "carbon footprint") as proxies for impact-oriented environmentally significant behavior. We assessed the two variables according to commonly used procedures for calculation of ecological footprints. To enable exploration of inter-individual differences, we implemented a so-called bottom-up assessment method based on process analyses. This entails calculating per capita impacts using data from individual respondents and weighting them with insights derived from independent impact assessment studies, rather than simply estimating per capita impact based on population-level averages

(the so-called top-down method; Galli et al., 2012; Weidema, Thrane, Christensen, Schmidt, & Løkke, 2008; Wiedmann & Minx, 2008). While a variety of footprint calculators exist that have proven successful as tools for public communication and awareness building, several of them display inconsistencies and insufficient transparency regarding underlying methods and estimates (Čuček, Klemeš, & Kravanja, 2012; Weidema et al., 2008). We therefore adapted and supplemented existing calculation methods in an effort to obtain more reliable footprint results; a detailed description of our procedure is documented in Kleinhückelkotten and Neitzke (2016). Our assessments drew on a combination of survey responses and interviewer observations. In addition, we attempted to obtain information from respondents' actual energy bills; unfortunately, less than half of the respondents were able to provide their energy bills, so we ultimately refrained from using these data in further analysis. We weighted the data based on indications from existing impact assessment studies focused on Germany (e.g., International Institute for Sustainability Analysis and Strategy [IINAS], 2012; Kutzner, Hertle, & Lambrecht, 2014; Max Rubner Institute [MRI], 2008; Peters, 2010; German Environment Agengy [UBA], 2014; 2012). Per capita energy use (in Kilowatt hours per year, or kWh/a) and carbon footprint (in kilograms CO_2 emitted per year, or $kgCO_2e/a$) were calculated for the subdomains of housing, transportation, and food. While our assessments of energy use for housing and transportation focused solely on direct use, our assessments of energy use for food included estimates of indirect energy use (e.g., energy used to produce and transport food). Overall environmental impacts were calculated by combining these various measures, properly weighted according to their energy impacts. In online Appendix A, we illustrate how overall energy use was derived from different sources, and how specific survey questions contributed to the assessment.

The average per capita energy use in our sample was 13,677 kWh per year. Apart from the high variance ($SD = 7,130$), what is particularly noticeable is the positive skewness (see Table 2). This means that the energy level consumed by the decile of respondents with

the highest consumption level equals the one of the 40% with the lowest consumption level.

Because of differences in accounting methods, it is not possible to directly compare our

per capita energy use estimates with those of official national statistical agencies. For

example, official national statistics allocate mobility-related energy use (e.g., personal

vehicle use) to a separate transportation category, not to households themselves as was done

in our study. Nevertheless, in terms of the housing domain, if we weight our per capita

average for household size, our calculations appear to be very consistent with official

national energy accounting statistics in this domain (Federal Statistical Office, 2015b; n.d.).

The average per capita carbon footprint in our sample was 4,547 kgCO$_2$e per year

($SD = 2,189$; again displaying positive skewness). Similar to energy use, direct comparisons

to official national emissions statistics are difficult. Our partial sums in different domains

(e.g., home heating) are comparable to those found in a study of a suburban area near

Dortmund (Kutzner et al., 2014), but are slightly higher than those found in a study of an

urban area in Munich (Keuschnigg & Schubert, 2013). In our subsequent analysis, we used

log-transformed measures of per capita energy use and carbon footprints because of their

initial positive skewness.

Behavior indicators of energy use

Table 2 provides an overview of the descriptive statistics used for different behavior

indicators of energy use as well as the underlying intent-oriented or impact-oriented

perspective.

Living space. We asked participants to estimate the size of their main residence (excluding

the basement and attic) in square meters (m^2). Only 10 respondents claimed not to know the

size of their residence. Next, we divided the indicated measure by the number of household

members. Average per capita living space in our sample was 40.19 m^2 ($SD = 19.99$ m^2), with

a maximal value of 305 m^2. Residence size positively correlated with other housing

indicators in our study, such as number of rooms ($r = .75, p < .001$) and number of floors

($r = .59$, $p < .001$). The mean sizes per household type we found were similar to those reported by the German Federal Statistical Office (2011). Due to its positive skewness, a log-transformed measure of per capita living space was used for subsequent analysis.

Energy-efficient appliances. We surveyed participants about the presence and energy-efficiency class of the following appliances in their home: refrigerator, refrigerator/freezer (combined), freezer, washing machine, dryer, and dishwasher. Reported numbers of appliances in the highest energy-efficiency classes (A^+ to A^{+++}) were then added together and divided by the number of household members to enable per capita estimates. On average, participants owned .72 appliances in the highest energy-efficiency classes, with a maximum number of 5.

Energy consumption of appliances. Energy use for appliances was calculated by weighting the number of appliances owned with the indicated frequency of use and corresponding assumptions about energy needed based on energy class. The sum of energy used for household appliances was then divided by the number of household members to obtain per capita estimates (for details, see online Appendix A). Mean per capita consumption of household appliances was 525.60 kWh/a, with a maximum of 2954.40 kWh/a.

Meat consumption. Participants were informed that men and women in Germany eat an average of 160 g and 80 g of meat per day, respectively (based on MRI, 2008), and then were asked "How much meat or meat products do you eat per day?" Answer categories ranged from 1 = "I eat much more meat than the average consumer" to 6 = "I do not eat meat at all" ($M = 3.10$, $SD = .93$).

Organic foods. Participants were asked how much importance they attach to buying organically produced goods when purchasing the following goods (four items): vegetables and salads; fruits; milk / milk products (e.g., cheese); and meat / meat products. Mean of the four items was used for subsequent analysis: $M = 2.98$, $SD = .79$, Cronbach's $\alpha = .94$.

Car trips. Car use was assessed by asking "How many kilometers have you travelled in passenger vehicles over the last year (as driver or passenger)?" Answer categories ranged from 1 = "less than 1,000 km per year" to 8 = "more than 30,000 per year". Participants who stated never using passenger vehicles were coded as 0. The median was 3 = "5,000 to 10,000 km per year". This proxy indicator for car use was shown to be positively correlated to a more sophisticated measure for energy use in daily transportation ($r = .55$, $p < .001$), comprising questions about weekly trips for commuting, shopping, and leisure time, weighted by distance and travel mode, which was part of the assessment of the overall energy use and carbon footprint calculations (cp. online Appendix A).

Vacation trips. Holiday-related energy use was assessed with one question about the longest distance travelled for vacation purposes in the last year. Answer categories ranged from 1 = "1 to 50 km" to 8 = "more than 5,000 km"; those who did not take vacation in the last year were coded as missing. The median was 5 = "500 to 1,000 km".

Behavior determinants

Environmental self-identity was assessed using two survey items, adapted from previous studies (Gatersleben et al., 2014; Hinds & Sparks, 2008; Sparks & Shepherd, 1992; van der Werff et al., 2013a, 2013b; Whitmarsh & O'Neill, 2010), which read as follows: "I think of myself as a consumer who cares about saving natural resources"; and, "A resource-saving lifestyle is an important part of who I am". Responses were measured on a 5-point scale, ranging from 1 = "I totally agree" to 5 = "I totally disagree". The two items proved to be reliable measures (Cronbach's $\alpha = .74$). For subsequent analysis, the mean score was used ($M = 2.94$; $SD = .94$).

Socioeconomic behavior determinants included age, gender, education level, income, household size (i.e., the number of people living in the same household), homeownership status, and residential area. Age, household size, gender, highest education level, and homeownership were assessed with corresponding survey items. Further, participants were

asked to report their net monthly household income, which we divided by the number of

household members to obtain an estimate of net monthly income per capita. Residential

location was categorized in a binary way as follows: "urban" for locations of > 20,000

inhabitants; and "rural" for locations of < 20,000 inhabitants.

Results

Predicting Pro-environmental Behavior vs. Environmental Impacts

We conducted regression analyses predicting (self-reported) pro-environmental

behavior and environmental impacts (energy use and carbon footprint) with our set of

psychological and socioeconomic determinants. The results of these analyses are shown in

Table 3 (for correlations between the predictors and the different dependent variables, see

online Appendix B). As expected, environmental self-identity was the strongest and only

significant predictor of pro-environmental behavior ($\beta = .70$, $p < .001$, $R^2 = .52$); none of the

socioeconomic variables reached significance in this analysis. By contrast and other than

expected, environmental self-identity did not predict overall energy use or carbon footprint;

the corresponding regression weights were negligible with $\beta = -.09$, $p = .003$, and $\beta = -.08$,

$p = .008$. Further, and in contrast to previous studies, the unexpected direction of our

regression weights revealed that higher levels of environmental self-identity were associated

with slightly higher levels of energy use and bigger carbon footprints (note that the answer

scale of environmental self-identity was coded such that low values mean high estimates of

environmental self-identity).

In line with previous studies, our regression analyses revealed a dominant role of

socioeconomic factors in explaining participants' overall environmental impact. The most

important predictor proved to be income ($\beta = .25$, $p < .001$ for energy use, and $\beta = .27$,

$p < .001$ for carbon footprint), followed by homeownership ($\beta = .22$, $p < .001$, and $\beta = .19$,

$p < .001$ respectively). In other words, participants with higher incomes and those owning

homes tended to consume more energy and displayed bigger carbon footprints than participants with lower incomes and those who rent. Significant, albeit weaker, regression weights were found for age, gender, and household size: elderly people, women, and those living with a greater number of people tended to use less energy and emit less greenhouse gases (per capita). Negligible effects were found with respect to education level and residential area. With $R^2 = .19$ for energy use and $R^2 = .20$ for carbon footprint, the explained variances of our models were satisfactorily high.

Predicting Different Behavior Indicators of Energy Use

Of course, overall energy use and carbon footprint are both highly aggregated behavior impact measures. We therefore investigated in a second step the predictor patterns of different behavioral indicators with varying degrees of their contribution to environmental impact, as well as intent-oriented significance. We tested the same set of predictors as before. In the following, we first describe our results for indicators in the housing domain, followed by results for indicators in the domains of food and transportation.

In a slightly less distinct way, indicators in the housing domain confirmed the above reported patterns in the predictor sets among pro-environmental behavior and the environmental-impact measures. As shown in Table 4, high levels of environmental self-identity were, as expected, significantly related with possession of more energy-efficient appliances ($\beta = -.15, p < .001$) – our intent-oriented behavior indicator. However, unexpectedly, high levels of environmental self-identity were also related with slightly bigger living spaces ($\beta = -.04, p = .043$), and higher energy consumption of household appliances ($\beta = -.13, p < .001$) – our impact-oriented indicators. In both examples, however, socioeconomic factors were more important in explaining variance than environmental self-identity. Bigger living spaces were related with smaller numbers of household members, homeownership, higher incomes, and increasing age ($R^2 = .65$). Higher energy consumption

of household appliances was related with smaller numbers of household members, income, age, and education level ($R^2 = .22$).

On the other side, participants were more likely to report possessing more energy-efficient appliances if they lived in households with fewer household members, had higher incomes, were younger, were homeowners, or were female ($R^2 = .19$).

In the food domain, environmental self-identity significantly explained variance in meat eating – our (high) impact-oriented indicator in this domain. As shown in Table 5, participants reporting higher environmental self-identity also reported eating less meat in comparison with average consumers ($\beta = -.09$, $p = .004$). However, even more predictive power was associated with gender ($\beta = .32$, $p < .001$) – with women more frequently reported eating less meat than the population average – followed by household size ($\beta = -.09$, $p = .032$), indicating that meat consumption is greater in bigger households. Our intent-oriented indicator – i.e., purchase of organic food – was best predicted by environmental self-identity ($\beta = .39$, $p < .001$). Interestingly, socioeconomic factors – especially homeownership, gender, and education level – also accounted for some of the variance of purchase behavior.

Finally, the two high-impact indicators in the transportation domain again reinforced the patterns described above. As shown in Table 5, environmental self-identity was not significantly related with distances traveled on vacation ($\beta = .03$, $p = .507$); further, environmental self-identity was (unexpectedly) negatively related with distances traveled in passenger cars ($\beta = -.11$, $p < .001$). In this way, participants claiming high environmental self-identity showed no tendency to refrain from long-distance vacations, and even recorded more kilometers in passenger cars than participants with low environmental self-identity. Again, however, socioeconomic factors displayed the greatest explanatory power: distances traveled on vacation mainly depended on participants' income, household size, and residential area. With respect to distances traveled in passenger cars, all our socioeconomic

predictors (with the exception of education level) showed significant predictive power,

especially number of household members and income level.

Relationships between Self-identity, Income, and Behaviors

Last of all, we were interested in exploring in greater detail the relationships between

environmental self-identity, income, and the different behavior variables. Environmental self-

identity was correlated with income ($r = -.14$, $p < .001$, cp. online Appendix B), indicating

that people with higher incomes hold more positive levels of environmental self-identity. Our

regression analyses reinforced the assumption that the effect of self-identity might be

outweighed by the income effect when it comes to energy-related high-impact behaviors.

Thus, following the procedure of Hayes and Matthes (2009), we tested whether

environmental self-identity moderates the effect of income on different behaviors by

recalculating the regression analyses reported above. Income, environmental self-identity,

and the interaction of income and self-identity were included as predictors (note that income

and environmental self-identity were centered for this procedure; for details on the statistics

as well as graphical representations, see online Appendix C.) The results showed the same

main effects of income and environmental self-identity found in the previous regressions

(with two exceptions: the effect of environmental self-identity did not reach a significant

level in predicting living space, and income now significantly predicted the purchase of

organic food). Visual inspection of high-impact behaviors (see Figures in online Appendix C)

revealed, as expected, smoother increases between low and high incomes for people high in

environmental self-identity. However, compared with those low in self-identity, none of the

interaction terms reached a significant level in the statistical tests. Thus, our assumption of a

moderating effect of environmental self-identity could not be confirmed with our data.

Discussion

In this study, we investigated how individuals' environmental stance relates to their intent-driven pro-environmental behavior, on the one hand, and their actual environmental impact, on the other. Based on Stern's (2000) distinction between intent-oriented and impact-oriented research perspectives on environmentally significant behavior, we sought to shed more light on the psychological and socioeconomic determinants of different behaviors varying in their degree in terms of environmental impact, as well as underlying psychological intention.

Diverging Determinants of Intent-oriented versus Impact-oriented Behaviors

Consistent with previous research (Bruderer Enzler & Diekmann, 2015; Gatersleben et al., 2002; Kennedy et al., 2015; Whitmarsh, 2009), we found that participants' pro-environmental stance (i.e., "environmental self-identity" in this case) was the main predictor of their intent-oriented pro-environmental behavior. Unexpectedly, however, and in contrast to previous studies showing motivational variables to play a supportive – albeit marginal – role (Bruderer Enzler & Diekmann, 2015; Gatersleben et al., 2002; Kennedy et al., 2014, 2015; Keuschnigg & Schubert, 2013; Whitmarsh, 2009), in our study environmental self-identity was linked to environmental impact in an ambiguous, even controversial, manner: rather than using less energy, people high in environmental self-identity in our sample used slightly more energy and had a slightly bigger carbon footprint than those indicating less environmental awareness.

There are several possible explanations for these unexpected findings, which contrast with earlier studies. First, direct comparison with previous studies must be done with caution due to national and regional differences between sample populations. Differences with other studies exist in terms of infrastructural context, climatological specificities, and the CO_2 intensity of the national energy mix. Two previous studies from Germany that might enable direct comparison were both focused on urban populations (Hunecke et al., 2007;

Keuschnigg & Schubert, 2013), whereas our German sample population was broad-based and more representative, including urban and rural areas. Our results point to a substantial mismatch between environmental self-identity and environmental impact with respect to daily transportation, or annual distances travelled. Notably, travel distances and travel modes strongly depend on geographical location: there tend to be more environmentally friendly travel options (e.g., public transport) in urban areas than in suburban or rural areas (Scheiner, 2010). Thus, future studies might look more closely at differences between geographical locations (e.g., rural vs. urban).

Second, direct comparison of our results with those of other studies is further complicated by differing operationalization of impact-oriented measures. For example, some studies report impact measures at the household level (e.g., Gatersleben et al., 2002; Kennedy et al., 2015), whereas we focused on per capita impacts. However, as shown in a study by Holden (2004), collinearity exists between household size and ecological awareness. Further, differences may arise based on the consumption domains chosen to measure overall environmental impact (e.g., whether air travel is included) or based on whether, and to what extent, indirect energy use is also accounted for. Finally, differences may result based on use of different assessment units, whether ecological footprint (e.g., in Csutora, 2012), energy use (e.g., in Abrahamse & Steg, 2009; Gatersleben et al., 2002; Poortinga et al., 2004), or carbon footprint (e.g., in Bruderer Enzler & Diekmann, 2015; Kennedy et al., 2014, 2015; Keuschnigg & Schubert, 2013; Notter et al., 2013; Tabi, 2013). Indeed, use of more standardized assessment procedures would enhance the comparability of future studies. Moreover, future research might address the potential bias that could result from our procedure of mixing calculations of direct energy use (housing and transportation) and indirect energy use (food); this could be done by testing different combinations of calculation approaches, so as to enable estimation of the impact of different methodological choices.

The third, and perhaps most interesting, possible explanation for our unexpected result could relate to the incoherent relationship structure between income (the dominant determinant of overall impact), environmental self-identity, and environmental impact. Our correlation analyses (see online Appendix B) revealed that both environmental impact and environmental self-identity increase steadily with rising income. The seemingly counterintuitive relationship between environmental self-identity and environmental impact found in the present study may result because individuals' genuinely felt pro-environmental stance is overridden by the overall effect of various consumption options that open up with higher socioeconomic status. In this way, any influence of pro-environmental motivation is counterbalanced by the "income effect". Evidence for this is suggested by the results of our moderator tests that revealed insignificant interaction effects. This suggests that the observed positive relationships between income and high-impact energy consumption behaviors holds for participants indicating high as well as low levels of environmental self-identity. Future studies should look more closely at these interdependences.

Diverging Determinants of Different Behavior Indicators of Energy Use

High-impact behaviors in the housing and transportation domains displayed an ambiguous relationship with environmental self-identity; in these domains, the behavior of participants reporting high levels of environmental self-identity tended to be more harmful, or at least no better, than the behavior of those reporting low levels of environmental self-identify, an insight that was also supported by tests for potential moderating effects. Indeed, income and number of household members appeared to be the dominant determinants of high-impact behaviors in these domains. Notably, however, positive relationships were found between environmental self-identity and certain *low-impact* behaviors in the housing domain, in particular ownership of energy-efficient household appliances and purchasing of organic foods. Previous studies on environmental self-identity confirm its explanatory power vis-à-vis low-impact behaviors, such as recycling, waste reduction, purchasing choice, showering

duration, or the practice of fuel-efficient driving (Gatersleben et al., 2014; Nigbur et al., 2010; van der Werff et al., 2013a, 2013b; Whitmarsh & O'Neill, 2010). Also consistent with our results, in earlier studies, no or only marginal associations were found between environmental self-identity and high-impact behaviors such as investing in energy-conserving home improvements, reducing car use, or flying less (Gatersleben et al., 2014; Nigbur et al., 2010; Whitmarsh & O'Neill, 2010). Based on identity theory, several explanations are possible for this phenomenon. It may be that high-impact behavior decisions (travel mode choices, decisions about place of residence) are typically made in "environmental identity"-incongruent contexts, i.e., contexts in which "being green" is not salient for people. Identity-based motivations may only translate into action in context conditions that activate a certain identity concept (Oyserman, 2009). Indeed, following the assumption of a multidimensional identity concept (Brekhus, 2008), it may be that typical decision contexts of high-impact behavior not only fail to activate people's "green" identity, but also trigger other personal or social identities that are incongruent with environmental protection, such as that of demonstrating belonging to a high-status in-group. We might conclude that certain decisions and behaviors appear more congruent with an environmental self-identity, while others (unfortunately the high-impact ones) fail to exert a strong enough ("green") identity-building function. Further research should more closely examine the symbolic functions of high-impact behaviors in relation to "being green" versus "being wealthy" (status). Further, we might also conclude that "being green" is not always easy. For example, it requires knowing the actual effectiveness of different behaviors (e.g., de Boer, Witt, & Aiking, 2016), accepting financial and time-related costs, inconveniences, and giving up habits one holds dear. Self-identities include not only identity-congruent actions, but also identity-congruent mindsets used to make sense of the world; having an environmental self-identity may help individuals interpret the difficulties they face in a motivating way, but it may also have demotivating effects (Oyserman, 2009, 2014).

Our results revealed one key, high-impact behavior that was an exception to this pattern: meat consumption. Indeed, lower meat consumption was predicted by higher levels of environmental self-identity, independent of income. This result is consistent with other recent studies (de Boer, Schösler, & Boersema, 2013; van der Werff et al., 2013b; Whitmarsh & O'Neill, 2010). Generally speaking, it appears that reducing meat consumption for environmental reasons is slowly gaining ground (Siegrist, Visschers, & Hartmann, 2015).

Overall, our results support the conclusion that having a pro-environmental stance does not automatically lead to an environmentally friendly lifestyle. The findings suggest that environmentally aware people intend to behave in a pro-environmental manner, but they mainly focus on behaviors that have relatively small benefits. In other words, they have good intentions but only achieve minimal results in terms of overall environmental impact.

Our results may be explained with the assumption that environmental awareness may only result in environmentally significant behavior if the latter is congruent with the type of lifestyle afforded by one's income level. In this way, higher-income environmentally concerned people tend to buy energy-efficient appliances and environmentally sound products. However, for many of the same people, when environmentally significant behavior means curtailing consumption – e.g., refraining from car use or air travel, or living in smaller homes – their pro-environmental motivation fails to be decisive. Similar results were found in a recent French study (Cayla, Maizi, & Marchand, 2011). These authors found a positive correlation between income and the intensity of energy use (e.g., weekly number of washing machine uses), whereas no correlation was found between income and energy-management practices (e.g., using a washing temperature of 30 ºC or 40 ºC, turning off lights, setting to standby mode, or reducing temperature of the home). In this way, the higher-income groups in this study tended to display practices similar to our intent-oriented behaviors, but used energy services much more intensively than lower-income groups (thus not exhibiting any curtailment in high-impact behaviors).

Other studies point to competition between environmental concerns and consumption-oriented lifestyles within populations: Gatersleben et al. (2010) found that significant numbers of people exhibit both high environmental concerns and high materialistic values. Pro-environmental beliefs and materialistic beliefs may not contradict each other on a psychological level. However, in practice – on the level of impacts – they frequently do.

Implications and Conclusions

The present study was based on data derived from a larger survey representing one of the most extensive efforts to quantify per capita consumption of resources in Germany to date, in particular with respect to energy use and related greenhouse gas emissions. The assessment was based on a detailed item battery covering different consumption domains (e.g., even including pet ownership) in combination with interviewer observations. Nevertheless, our study has several limitations that should be considered when interpreting its results.

The first such limitation has to do with the comparability of impact measures (already discussed above) due to differences in assessment and calculation procedures used in different studies. Future research could benefit strongly from establishment and use of a standardized, validated assessment instrument. Notably, initial attempts in this direction have been made, for example, by Armel, Yan, Todd, and Robinson (2011).

A second study limitation involves our choice of psychological variables and operationalization. Behavior-specific motivational variables might display stronger links with high-impact behaviors (e.g., as found in Hunecke et al., 2007 for daily transportation) than we found for environmental self-identity. However, in the present study, we primarily sought to test how and whether people's general pro-environmental stance shapes their lifestyle and its environmental impacts, and we refrained from assessing psychological variables on a behavior-specific level. It was, however, a challenge to measure a motivational variable and a

self-reported behavior variable at the same aggregation level as overall energy use and carbon footprint without being redundant in terms of questions asked for the assessment of environmental impacts. The item operationalization we used is only suitable to a limited extent. The high correlation between environmental self-identity and pro-environmental behavior found (cp. online Appendix B) likely reveals a lack of distinction between the items used. Future research might opt for a more intermediate level between specific behaviors (as commonly used in studies on pro-environmental behavior) and the overall aggregation level used in this study. This might enable the formulation of more distinct items.

Despite these limitations, we believe the findings of the present study give rise to several crucial insights and relevant questions for future research and policy. They call into question whether current studies, but also policy interventions, target the most relevant behaviors. Regarding studies, we strongly agree with other researchers who recommend focusing on high-impact behaviors (e.g., Bilharz & Schmitt 2011; Gatersleben et al., 2002; Steg & Vlek, 2009; Stern, 2000, 2011). Moreover, we believe that a broader approach – focusing on behavior patterns or lifestyles, rather than specific behaviors – would add significant value to current methods of environmental psychological research.

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Note

1. Exchange rate of EUR (€) to USD ($) 1.38 on April 1, 2014.

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Table 1

Socioeconomic sample characteristics

Characteristics	*M*	*SD*	%
Age in years	49.8	17.6	
Net monthly per capita income in € (income)	1,186.7	624.3	
Number of household members	2.5	1.2	
Gender			
male			49.1
female			50.9
Highest education level completed (education)			
secondary school			39.5
intermediate school			32.7
higher education entrance qualification			20.7
higher education			5.6
missing			1.5
Home ownership			
rental			72.2
owns home			27.8
Residential area			
urban			59.2
rural			40.8

Table 2

Descriptive statistics of pro-environmental behavior, overall energy use, carbon footprint, and different indicators of energy use

	Research perspective	*N*	*M*	*SD*	*Median*	*Min*	*Max*	Skew-ness	Kurtosis
Overall measures									
Pro-environmental behavior[1]	intent	1,007	2.94	.90	3	1	5	.08	-.55
Overall energy use (kWh/a)	impact	1,012	13,677.22	7,130.92	12,057.20	2,673.58	7,4284.06	1.90	7.57
Carbon footprint (kgCO$_2$e/a)	impact	1,012	4,547.20	2'189.53	4,046.54	1,068.24	1,8097.01	1.56	3.77
Housing									
Living space (m^2) per person	impact	1,002	40.19	19.99	35	5	305	3.72	34.09
Household appliances (kWh/a)	impact	1,012	525.60	289.81	444.55	109.35	2954.40	2.11	7.99
Energy-efficient appliances[2]	intent	960	.72	.84	.50	0	5	1.46	2.39
Food									
Meat consumption[3]	impact	1,011	3.10	.93	3	1	6	.74	1.38
Organic foods[4]	intent	1,009	2.98	.79	3	1	4	-.59	-.09
Transportation									
Car trips (km/a)[5]	impact	962	2.93	1.98	3	0	8	-.11	-.80
Vacation trips (km)[6]	impact	512	4.99	1.31	5	1	8	.24	.10

Notes. [1]Answer categories from 1 = "I totally agree" to 5 = "I totally disagree". [2]Number of energy-efficient household appliances A$^+$ to A^{+++}.

[3]Answer categories from 1 = "I eat much more meat than the average consumer" to 6 = "I do not eat meat at all". [4]Answer categories from 1 = "very important" to 4 = "not at all important". [5]Answer categories from 1 = "less than 1,000 km" to 8 = 'more than 30,000 per year"; people who never use personal cars were coded as 0. [6]Answer categories from 1 = '1 to 50 km" to 8 = "more than 5,000 km"; people who did not go for vacation in the last year were coded as missing.

Table 3

Regression analyses for pro-environmental behavior, overall energy use, and carbon footprint

	Pro-environmental behavior			Overall energy use (kWh/a)			Carbon footprint (kgCO$_2$e/a)		
	B	*S.E.*	*β*	*B*	*S.E.*	*β*	*B*	*S.E.*	*β*
Constant	1.10	.16		4.17	.05		3.68	.05	
Age	.00	.00	.00	.00	.00	-.12**	.00	.00	-.13***
Gender (male = 0)	-.05	.04	-.03	-.06	.01	-.13***	-.06	.01	-.16***
Education	-.04	.03	-.04	.00	.01	-.02	.00	.01	.00
Income	.00	.00	-.01	.00	.00	.25***	.00	.00	.27***
N. of household members	-.01	.03	-.01	-.02	.01	-.10*	-.02	.01	-.09*
Owns home (rental = 0)	-.07	.05	-.03	.10	.02	.22***	.08	.01	.19***
Urban vs. rural region	.07	.04	.04	.00	.01	.01	.00	.01	-.01
Environmental self-identity	.66	.02	.70***	-.02	.01	-.09**	-.02	.01	-.08**
R^2 / R^2adj	.52 / .51			.19 / .19			.20 / .19		
F	123.03***			27.46***			28.97***		
N	934			935			935		

Notes. All variables were entered simultaneously into the equation. *$p < .05$, **$p < .01$, ***$p < .001$. Due to their skewed distribution, overall

energy use and carbon footprint were log-transformed.

Table 4

Regression analyses for different indicators of energy use in the housing domain

	Living space (m^2)			Household appliances (kWh/a)			Energy-efficient appliances		
	B	*S.E.*	*β*	*B*	*S.E.*	*β*	*B*	*S.E.*	*β*
Constant	1.63	.03		3.00	.05		1.50	.20	
Age	.00	.00	.10***	-.00	.00	-.09*	-.01	.00	-.18***
Gender (male = 0)	.01	.01	.03	.00	.01	.00	.14	.05	.08**
Education	.01	.00	.03	-.02	.01	-.09**	-.02	.03	-.02
Income	.00	.00	.21***	.00	.00	.09*	.00	.00	.21***
N. of household members	-.09	.00	-.58***	-.08	.01	-.42***	-.16	.03	-.22***
Owns home (rental = 0)	.15	.01	.37***	.01	.02	.02	.30	.06	.16***
Urban vs. rural region	.01	.01	.02	-.00	.01	-.01	-.06	.05	-.03
Environmental self-identity	-.01	.00	-.04*	-.03	.01	-.13***	-.13	.03	-.15***
$R^2 / R^2 adj$	.65 / .64			.22 / .21			.19 / .18		
F	209.10***			32.79***			25.06***		
N	927			935			892		

Note. All variables were entered simultaneously into the equation. *$p < .05$, **$p < .01$, ***$p<.001$. Due to their skewed distribution, home size, and household appliances were log-transformed.

Table 5:

Regression analyses for different indicators of energy use in the food and transportation domain

	Meat consumption			Organic foods			Car trips (km/a)			Vacation trips (km)		
	B	*S.E.*	*β*	*B*	*S.E.*	*β*	*B*	*S.E.*	*β*	*B*	*S.E.*	*β*
Constant	3.26	0.22		2.73	0.17		0.83	0.42		3.56	0.44	
Age	0.00	0.00	0.02	0.00	0.00	-0.04	-0.01	0.00	-0.10**	0.00	0.00	-0.05
Gender (male = 0)	0.59	0.06	0.32***	-0.21	0.04	-0.14***	-0.58	0.11	-0.15***	0.04	0.11	0.02
Education	-0.02	0.04	-0.02	-0.11	0.03	-0.13***	-0.13	0.07	-0.06	0.02	0.07	0.02
Income	0.00	0.00	-0.04	0.00	0.00	-0.05	0.00	0.00	0.43***	0.00	0.00	0.41***
N. of household members	-0.07	0.03	-0.09*	-0.04	0.03	-0.05	0.84	0.07	0.48***	0.20	0.07	0.17**
Owns home (rental = 0)	-0.01	0.07	-0.01	-0.24	0.05	-0.14***	0.42	0.14	0.10**	0.19	0.13	0.07
Urban vs. rural region	0.08	0.06	0.04	-0.08	0.04	-0.05	0.32	0.11	0.08**	-0.24	0.11	-0.09*
Environmental self-identity	-0.09	0.03	-0.09**	0.32	0.02	0.39***	-0.22	0.06	-0.11***	0.04	0.06	0.03
$R^2 / R^2 adj$		.13 / .12			.27 / .26			.34 / .33			.15 / .14	
F		16.97***			42.90***			55.56***			10.23***	
N		934		475	934			891			475	

Note. All variables were entered simultaneously into the equation. *$p < .05$, **$p < .01$, ***$p < .001$.

Appendix A

Illustration of different elements included in our assessment of overall per capita energy use
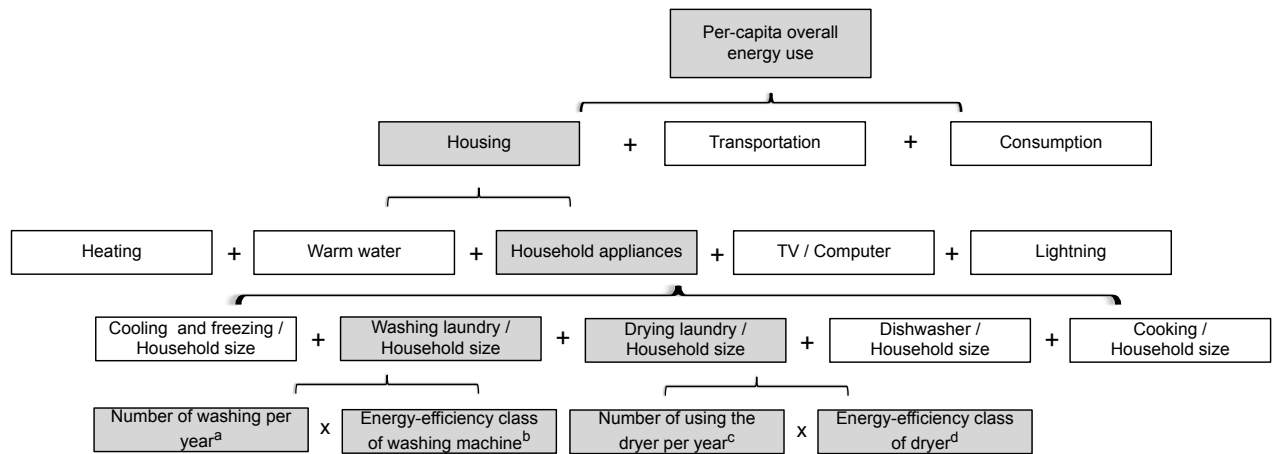

Figure A1. Detailing the example of laundry (as part of the energy use of household appliances).
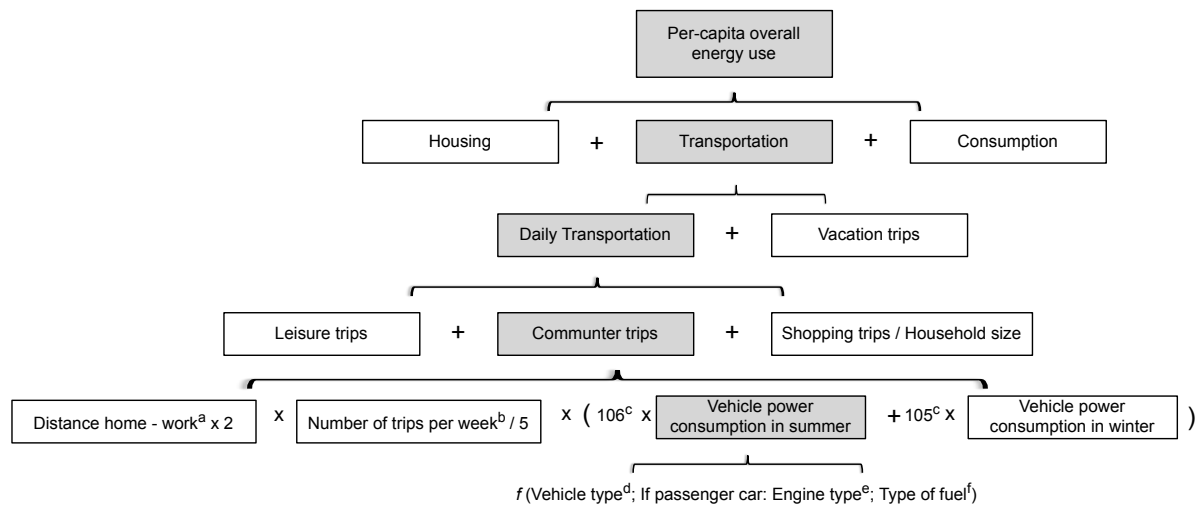
Notes. Elements shown in grey-highlighted rectangles are described in greater detail at each descending level, for details see Kleinhückelkotten and Neitzke (2016).

[a] Item in the questionnaire read as follows: "How many loads of laundry do you wash in your washing machine on average?"; answer categories ranged from 1 = "fewer than 1 per week" to 5 = "more than 10 per week". For answer category 1, we assumed 26 loads of laundry per year; for answer category 5, we assumed 650 loads of laundry per year.

[b] Item in the questionnaire read as follows: "What kind of washer do you use?". Answer categories ranged from 1 = "a washer of the energy-efficiency class A+ to A+++" to 4 = "an old washer without an energy class rating". Our assumptions on the energy consumption per laundry load for different washing-machine energy-efficiency classes were based on Blepp, Gross, & Quark, 2012; German Environment Agency (UBA) (2012); VZRP, 2012a.

[c] Items in the questionnaire read as follows: "How many loads of laundry do you dry in your dryer on average?"; answer categories ranged from 1 = "fewer than 1 per week" to 5 = "more than 10 per week".

[d] Item in the questionnaire read as follows: "What kind of dryer do you use?". Answer categories ranged from 1 = "a dyer of the energy-efficiency class A+ to A+++" to 4 = "an old dryer without an energy class rating". Our assumptions on the energy consumption per laundry load for different dryer energy-efficiency classes were based on VZRP, 2012b. For clothesline (hang) drying of laundry, an energy consumption value of 0 was entered.

Figure A2. Detailing the example of commuter trips (as part of the energy use of daily transportation).

Notes. Elements shown in grey-highlighted rectangles are described in greater detail at each descending level, for details see Kleinhückelkotten and Neitzke (2016).

[a] Item in the questionnaire read as follows: "How far is it from your home to your workplace or school (only one way)?"; answer categories ranged from 1 = "less than 5 km" to 6 = "more than 100 km". We controlled for trips from secondary residences; none of the participants commuted to work from a secondary residence.

[b] Item read as follows: "How often per week do you commute from your home to your work place or school?"

[c] Average number of working days for the year 2013, in summer, and in winter (based on Federal Statistical Office 2014b)

[d] Item read as follows: "Which of the following transportation modes do you usually use for the trip from your home to your working place or school? Please indicate the transportation mode you use for the summer season, and for the winter season." Participants could choose among the following transport modes: passenger car, city bus, tramway or suburban train, bicycle, e-bike, walking, long-distance train, remote bus, motorcycle, moped, airplane, taxi, or detailing another option. The consumption data used for different transportation modes stems from DEKRA 2014; German Environment Agengy (UBA) 2014; 2012b, Verkehrsklub Deutschland (VCD) 2012; Walnum 2011.

[e] Item read as follows: "Is your passenger car powered by a gas engine, an electric engine, or a hybrid engine?"

[f] Item read as follows: "What kind of fuel powers the passenger car you use?" Participants could choose among petrol, diesel, petroleum gas, liquefied gas, or biofuel.

<div align="center">References</div>

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Appendix B:

Correlation Analysis

As shown in Table B1 we found unexpected, albeit weak, negative correlations between pro-environmental behavior and our two environmental-impact measures. Note that the answer scale for pro-environmental behavior was coded such that low values mean high estimates of pro-environmental behavior. In other words, participants who viewed themselves as making an effort to behave in an environmentally friendly manner actually tended to consume more energy on average ($r = -.12, p < .001$) and to emit more greenhouse gases ($r = -.12, p < .001$) than those who did not.

Going further, our analysis of correlations among pro-environmental behavior and specific behavior indicators revealed associations in the expected direction for the following: ownership of energy-efficient household appliances, consumption of meat, and importance of organic foods. Conversely, no or unexpected correlations were found between pro-environmental behavior, on the one hand, and living space, energy consumption of household appliances and our two transportation indicators, on the other. Participants with higher levels of self-reported pro-environmental behavior lived in larger homes ($r = -.11, p = .001$), used more energy in the kitchen and for laundry ($r = -.07, p = .022$), drove longer distances in passenger vehicles ($r = -.11, p = .001$), and did not refrain from long-distance vacations ($r = -.05, p = .315$). Notably, these four indicators – living space, household appliances, passenger car use, and vacation travel – were also the biggest contributors to overall energy use, so this observed mismatch with self-perceived pro-environmental behavior is highly relevant.

Table B1:

Correlations among outcome variables and predictors

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Pro-environmental behavior[1]																	
2	Overall energy use (kWh/a)	-.12**																
3	Carbon footprint (kgCO$_2$e/a)	-.12**	.97**															
4	Living space (m^2) per person	-.11**	.40**	.38**														
5	Household appliances (KWh/a)	-.07*	.29**	.31**	.37**													
6	Energy-efficient appliances[2]	-.22**	.26**	.24**	.33**	.06												
7	Meat consumption[3]	-.12**	-.21**	-.23**	.04	-.05	.06											
8	Organic foods[4]	.44**	-.04	-.03	-.10**	.09**	-.22**	-.23**										
9	Car trips (km/a)[5]	-.11**	.48**	.48**	-.03	-.01	.18**	-.21**	-.12**									
10	Vacation trips (km)[6]	-.05	.33**	.37**	.11*	.03	.13**	-.06	-.10*	.25**								
11	Age	.02	-.03	-.05	.36**	.11**	-.05	.05	.02	-.22**	-.04							
12	Gender (male = 0)	-.10**	-.16**	-.20**	.00	.01	.07*	.35**	-.17**	-.18**	.00	.015						
13	Education	-.15**	.14**	.16**	.07*	-.07*	.12**	-.03	-.22**	.20**	.20**	-.322**	.00					
14	Income	-.12**	.34**	.36**	.58**	.27**	.33**	-.01	-.13**	.20**	.32**	.093**	-.06*	.31**				
15	N. of household members	-.02	-.12**	-.12**	-.63**	-.42**	-.22**	-.07*	-.06	.32**	-.03	-.409**	-.01	.14**	-.48**			
16	Owns home (rental = 0)	-.16**	.26**	.23**	.32**	-.05	.15**	-.02	-.24**	.25**	.19**	.088**	-.04	.19**	.18**	.19**		
17	Urban vs. rural region	.07*	.01	.00	-.03	-.04	-.04	.02	-.03	.09**	-.07	-.064*	.01	.04	.00	.07*	.02	
18	Environmental self-identity[4]	.71**	-.15**	-.13**	-.11**	-.13**	-.20**	-.11**	.44**	-.16**	-.02	.041	-.11**	-.13**	-.14**	-.02	-.15**	.05

Notes. r = Pearson correlation coefficient, * $p < .05$, ** $p < .01$. [1]Answer categories from 1 = "I totally agree" to 5 = "I totally disagree". [2]Number of energy-efficient household appliances in classes A$^+$ to A^{+++}. [3]Answer categories from 1 = "I eat much more meat than the average consumer" to 6 = "I do not eat meat at all". [4]Answer categories from 1 = "very important" to 4 = "not at all important". [5]Answer categories from 1 = "less than 1,000 km" to 8 = "more than 30,000 km per year", whereas people who never use personal cars were coded as 0. [6]Answer categories from 1 = "1 to 50 km" to 8 = "more than 5,000 km", whereas people who did not go for vacation in the last year were coded as missing.

Appendix C:

Statistics and Figures of the Moderation Analyses

Table C1: *Linear models predicting pro-environmental behavior, overall energy use, and carbon footprint (moderation analysis)*

	Pro-environmental behavior				Overall energy use (kWh/a)				Carbon footprint (kgCO$_2$e/a)			
	B	*S.E.*	*t*	*p*	*B*	*S.E.*	*t*	*p*	*B*	*S.E.*	*t*	*p*
Constant	2.92	.02	140.21	.000	4.09	.01	629.63	.000	3.61	.01	608.57	.000
Env. Self-identity (centered)	.68	.02	29.65	.000	-.02	.01	-3.49	.001	-.02	.01	-3.08	.002
Income (centered)	.00	.00	-1.03	.306	.00	.00	9.06	.000	.00	.00	9.76	.000
Income x Env. Self-identity	-.00	.00	-1.49	.138	.00	.00	.90	.364	.00	.00	1.27	.205
R^2	.51				.13				.14			
N	945				946				946			

Notes. Due to their skewed distribution, overall energy use and carbon footprint were log-transformed.

Table C2: *Linear models predicting energy indicators in the housing domain (moderation analysis)*

	Living space (m^2)				Household appliances				Energy-efficient appliances			
	B	*S.E.*	*t*	*p*	*B*	*S.E.*	*t*	*p*	*B*	*S.E.*	*t*	*p*
Constant	1.57	.00	328.08	.000	2.67	.01	400.77	.000	.71	.03	27.08	.000
Env. Self-identity (centered)	-.01	.01	-1.12	.261	-.02	.01	-2.90	.004	-.14	.03	-5.70	.000
Income (centered)	.00	.00	19.90	.000	.00	.00	7.08	.000	.00	.00	7.75	.000
Income x Env. Self-identity	.00	.00	1.33	.184	.00	.00	1.77	.077	.00	.00	-.68	.500
R^2	.33				.09				.14			
N	938				946				902			

Notes. Due to their skewed distribution, home size and household appliances were log-transformed.

Table C3: *Linear models predicting energy indicators in the food domain (moderation analysis)*

	Meat consumption				Organic foods			
	B	*S.E.*	*t*	*p*	*B*	*S.E.*	*t*	*p*
Constant	3.11	.03	103.03	.000	3.00	.02	130.77	.000
Env. Self-identity (centered)	-.11	.03	-2.93	.003	.35	.02	14.14	.000
Income (centered)	.00	.00	-.43	.670	-.00	.00	-2.21	.027
Income x Env. Self-identity	.00	.00	.56	.579	.00	.00	.79	.427
R^2			.01				.21	
N			945				945	

Table C4: *Linear models predicting energy indicators in the transportation domain (moderation analysis)*

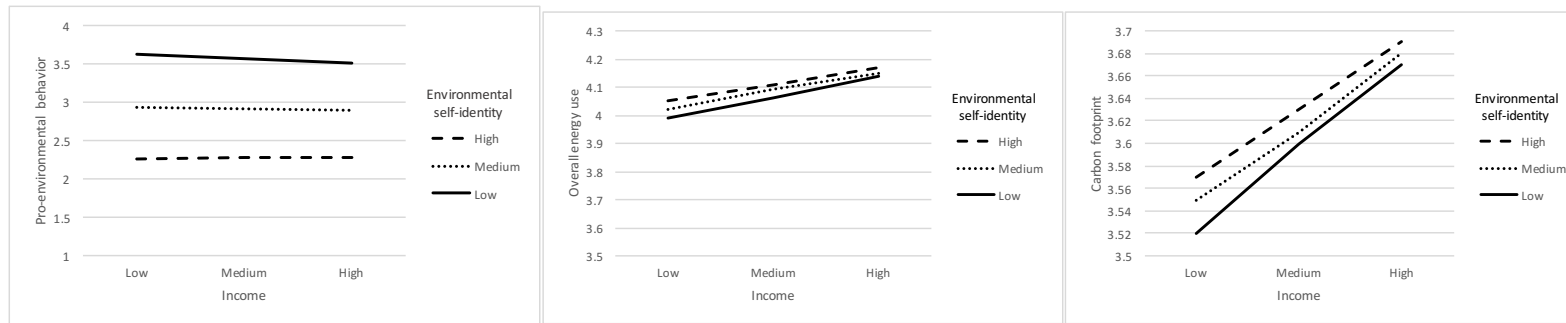|	Car trips (km/a)				Vacation trips (km)			
	B	*S.E.*	*t*	*p*	*B*	*S.E.*	*t*	*p*
Constant	2.94	.06	45.76	.000	5.03	.06	89.42	.000
Env. Self-identity (centered)	-.31	.07	-4346	.000	-.01	.06	-.15	.881
Income (centered)	.00	.00	6.12	.000	.00	.00	6.79	.000
Income x Env. Self-identity	.00	.00	.44	.662	.00	.00	.59	.556
R^2			.06				.10	
N			901				480	

Figure C1. Visual depictions of the interactions between environmental self-identity and income for pro-environmental behavior (left), overall energy use (medium), and carbon footprint (right). *Notes.* For income: Medium = Mean income (€1,186.7), Low / High = ± 1 *SD* (624.3). For Environmental self-identity: Medium = Mean (2.94 on a scale from 1 to 5), Low / High = ± 1 *SD* (.94).

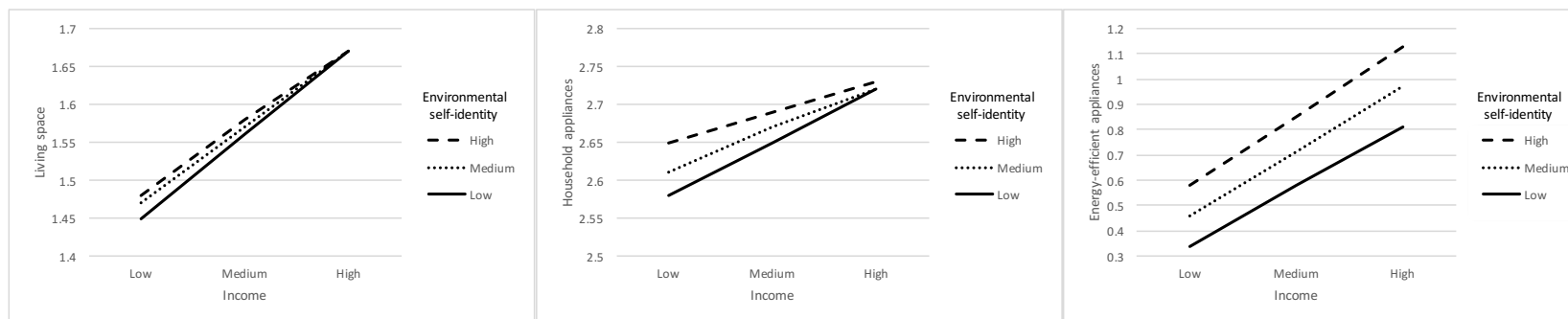Figure C2. Visual depictions of the interactions between environmental self-identity and income for energy indicators in the housing domain. *Notes.* For income: Medium = Mean income (1,186.7€), Low / High = ± 1 *SD* (624.3). For Environmental self-identity: Medium = Mean (2.94 on a scale from 1 to 5), Low / High = ± 1 *SD* (.94).

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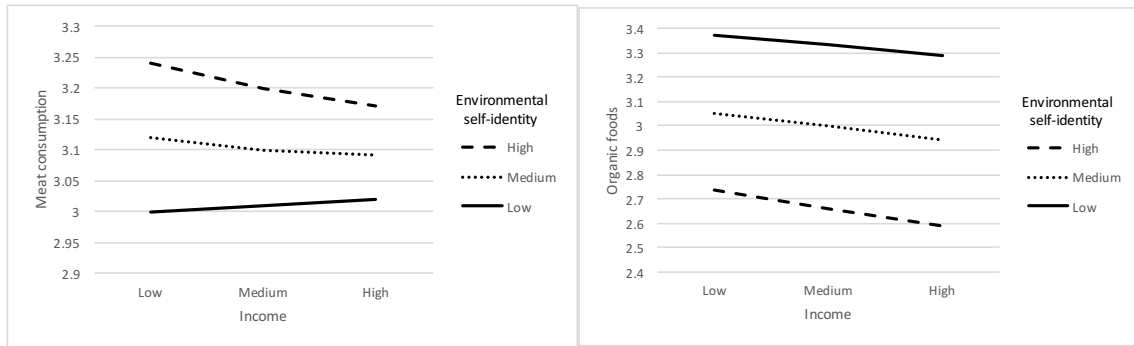
Figure C3. Visual depictions of the interactions between environmental self-identity and income for energy indicators in the food domain. *Notes.* For income: Medium = Mean income (€1,186.7), Low / High = ± 1 *SD* (624.3). For Environmental self-identity: Medium = Mean (2.94 on a scale from 1 to 5), Low / High = ± 1 *SD* (.94).
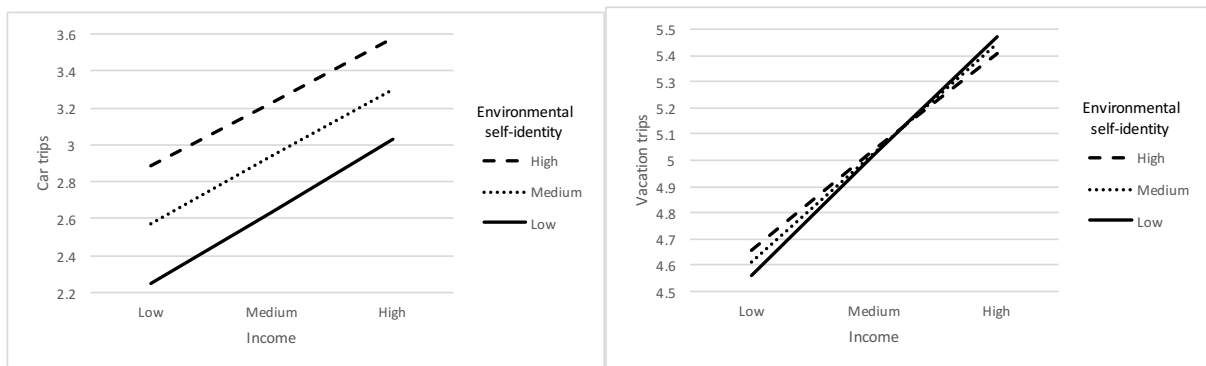

Figure C4. Visual depictions of the interactions between environmental self-identity and income for energy indicators in the transportation domain. *Notes.* For income: Medium = Mean income (€1,186.7), Low / High = ± 1 *SD* (624.3). For Environmental self-identity: Medium = Mean (2.94 on a scale from 1 to 5), Low / High = ± 1 *SD* (.94).

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