The motivation-impact gap in pro-environmental clothing consumption

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Abstract

Accurate models of pro-environmental behavior can support environmental sustainability. Previous studies identifying the psychological predictors of pro-environmental behavior rarely accounted for environmental impact. We studied the greenhouse gas emissions of clothing purchasing across four countries and found that psychological factors like attitudes and personal norms strongly predicted a common self-reported behavior scale of clothing purchasing, but only weakly predicted clothing-related greenhouse gas emissions. This result challenges widespread inferences using pro-environmental behavior scales and suggests that psychological factors may be a poor predictor of clothing-related environmental impact.

Far-reaching and rapid behavioral changes are required to meet global and national sustainability targets[1,2]. Understanding how to motivate and achieve such far-reaching behavioral changes is thus of profound scientific and practical importance. Here, we investigate the cognitive, affective, and social (henceforth *psychological*) predictors of pro-environmental behaviors (PEB) by consumers. The psychological factors were selected from models that are influential and widely studied in PEB research such as the Theory of Planned Behavior[3] and the Value-Belief-Norm theory[4]. Studies drawing upon such models commonly report that psychological factors strongly predict both general and domain-specific PEBs[5,6].

For several methodological reasons, those findings may be of little relevance for understanding the predictors of individuals' actual environmental impact. First, many PEB scales exclusively ask for frequency reports of repeated behaviors, which excludes rare but high-impact behaviors such as air travel, vehicle purchase, or home weatherization[7] (but see ref. [8]). Second, PEB items often only ask about the rough frequency of behaviors like reducing shower time ("never, rarely, sometimes, often, always"[9]) at the expense of accuracy and more objective assessment. This measurement imprecision invites subjective interpretations, precludes estimating or inferring the associated environmental impact, and consequently undermines accurately predicting between-person variability in environmental impact. Third, frequency reports are typically given equal weight in scale scoring, although behaviors have environmental impacts that vary by orders of magnitude[10,11]. Fourth, common self-report PEB measures implicitly or explicitly tie behavior to psychological motivations (e.g., “I avoid clothes products because of environmental concerns”[12]), which may artificially inflate their relationships with motivational predictors (e.g., attitudes, intentions, or personal norms). These four factors may produce strong correlations between psychological predictors and common PEB scales, but

weaken the link between these scales and environmental impact. This is also evidenced by studies finding self-report scales of pro-environmentally intended behavior are largely unrelated to individuals' actual environmental impact[13,14].

Critically, if PEB scales are weakly or even unrelated to impact, evidence regarding the psychological predictors of PEB scales cannot inform our understanding of what predicts individuals' actual environmental impact. In addition, given that the typical way of measuring PEB likely inflates its relationship with psychological factors, the relationship between psychological factors and environmental impact might be weaker than commonly suggested by PEB research[13–15]. We tested this idea by combining a typical PEB scale with robust self-report-based measures of environmental impact to compare psychological and demographic predictors of behaviors with moderate environmental impact[16].

The current study focuses on clothing consumption, which is responsible for 2-3% of global greenhouse gas emissions[17] and causes severe local environmental degradation (e.g., pollution of ecosystems)[18]. We used data from a large survey conducted in 2016-2017 across four countries (Germany, Poland, Sweden, and the United States; total $N = 4{,}591$).

To examine the predictiveness of psychological factors for clothing-related environmental impact, we integrate several key concepts identified in the psychological literature. These include goals, self-efficacy, awareness of need to address the environmental consequences of clothing, ascription of responsibility to address the environmental consequences through one's personal clothing consumption, attitudes, intentions, personal norms, social norms, and perceived behavioral constraints. All measures were tailored to the clothing context, except for one measure that assessed the life goal to live environmentally friendly (see Supplementary Table 1 for measurement overview), and they were scored such that higher numbers on those

measures were theoretically expected to result in lower clothing-related greenhouse gas emissions.

We analyzed four outcome measures that assess the environmental impact of self-reported clothing consumption. The first was the Environmental Apparel Scale (EAC)[12], which is a typical multi-item scale of clothing-related PEBs (e.g., how often one "buys clothing made from organically grown natural fibers"). We added three more outcome measures that specifically assessed clothing purchasing quantity and associated greenhouse gas (GHG) emissions: (i) the self-reported number of clothing items purchased within the last three months (*clothing purchase*; rated on a 7-point scale); (ii) the GHG emissions from jeans and t-shirts purchased within the last three months (*jeans and t-shirt purchase*); and (iii) the annual GHG emissions from maintaining a stock of jeans and t-shirts accounting for purchase, use (washing and drying), and disposal (*steady stock*). These three are collectively referred to as the *impact-focused* outcome variables (see Methods and Supplementary Table 2 for descriptive statistics). These impact-focused outcome measures used self-report and contained measurement error; however, they were not subject to the two key limitations of PEB scales such as the EAC: vague frequency terms and confounding with psychological motivations.

Fig. 1 shows the profound differences in the bivariate correlations between the psychological factors and the four outcome variables. EAC was positively correlated with all psychological factors (Rs range from .14 to .70, $Ps < .001$) and most strongly correlated with predictors widely theorized as being most proximal to behavior, including goal importance, goal efficacy, intention, and personal norms (Rs > .54, Ps < .001). By contrast, the psychological factors were unrelated or only weakly correlated with the number of clothing items purchased within the last three months, the GHG emissions from jeans and t-shirt purchases, and the annual

GHG emissions from maintaining a steady stock of jeans and t-shirts (*R*s < .17). In addition to being weak correlations, the direction of the relationships was surprising, as most psychological variables were positively correlated with the impact-focused outcome variables. See Supplementary Fig. 1 for correlation matrix with all psychological, demographic, and outcome variables.

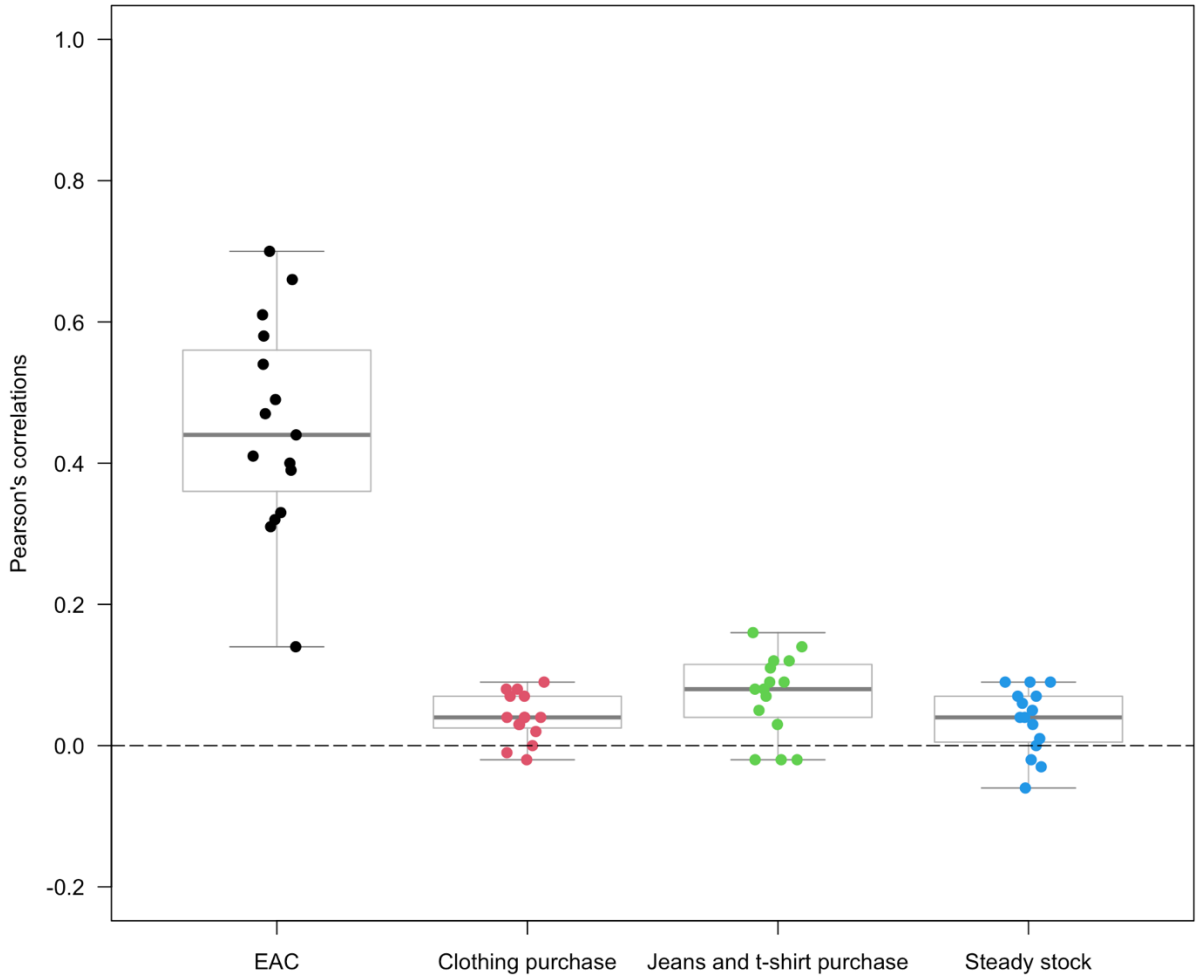

Fig. 1. Correlations between psychological factors and clothing behaviors. The boxplot shows the bivariate correlations between the psychological variables and the four outcome variables. All values are shown in Supplementary Fig. 1. The dots represent individual bivariate correlations, the bars indicate minimum to maximum values, and the horizontal line indicates the median. Correlations higher than .04 are $P < .01$ due to the large sample. The jeans and t-shirt purchase and steady stock variables indicate GHG emissions.

EAC was weakly but positively correlated with the impact-focused outcome variables (*Rs* = .08-.10, *P*s < .001; Supplementary Fig. 1). These relationships were in the opposite direction than expected and suggest that people scoring high on the EAC purchased *more* clothing items within the last three months and had *greater* GHG emissions from jeans and t-shirts purchases and from maintaining a steady stock of this clothing. As shown in Fig. 2, the positive correlations were predominantly driven by participants in the United States, but the direction of the relationships was consistent across countries and outcome variables. The direction remained consistent when participants with disproportionately high GHG emissions were removed (>= 3 *SD* above the mean), except for the correlation between EAC and steady stock where negative correlations were then observed in Sweden and Poland (see Supplementary Fig. 2).

To investigate the predictiveness of psychological (and demographic) factors, two regression models were created for each outcome variable—one model with only socio-demographic factors and another with both socio-demographic and psychological factors (see Supplementary Tables 3 and 4). The objective was to test the combined predictiveness of psychological factors rather than the predictiveness of specific psychological factors. Interpreting individual coefficients is complicated by multicollinearity from the strong correlations between the psychological factors[19], but overall model fit is not, so we focused on differences in R^2. Consistent with previous research, the regression model for EAC showed strong predictability when including the psychological factors with $R^2 = .62$ (socio-demographics only: $R^2 = .03$). The predictability of psychological factors for the three impact-focused outcome variables was considerably more modest: number of clothing items purchased ($R^2 = .12$; socio-demographics only: $R^2 = .10$), GHG emissions from jeans and t-shirt purchases ($R^2 = .15$; socio-demographics only: $R^2 = .11$), and annual GHG emissions from maintaining a steady stock of jeans and t-shirts

(R^2 = .07; socio-demographics only: R^2 = .04) (see Supplementary Tables 5-8 for country-specific results).

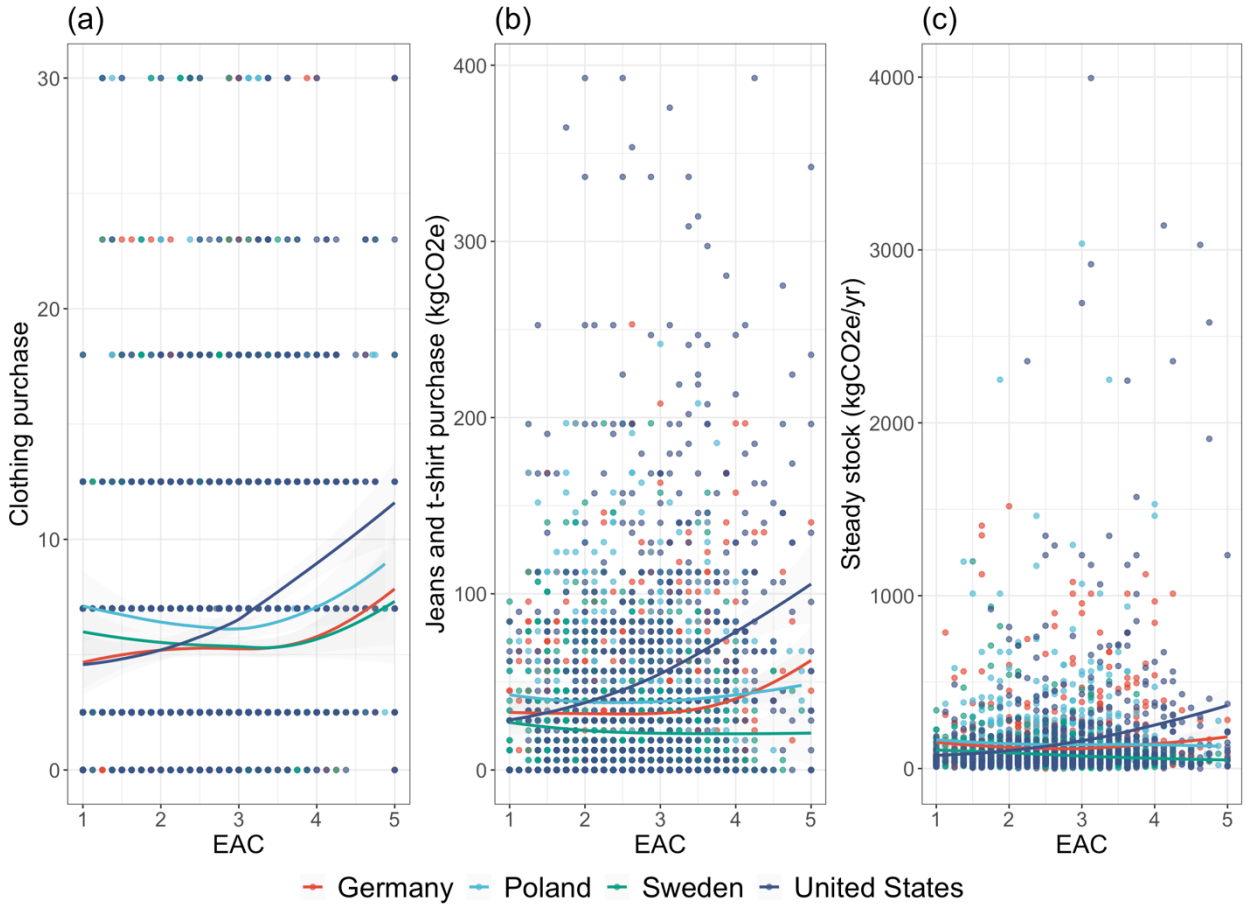

Fig. 2. GHG emissions increase with higher self-reported pro-environmental clothing behavior (EAC). (a) correlation between EAC and self-reported clothing items purchased within last three months (7-point scale with category midpoints reported); (b) correlation between EAC and GHG emissions associated with self-reported purchases of jeans and t-shirts within last three months; (c) correlation between EAC and annual GHG emissions from maintaining a steady stock of jeans and t-shirts.

Several sensitivity analyses examined whether specific analytical decisions affected the results. These include regression models without outliers for the jeans and t-shirt purchase and steady stock outcome variables (>= 3 *SD* above the mean, Supplementary Table 9); using log transformation due to positively skewed distributions (Supplementary Table 10); an ordinal regression model for the 7-point scaled clothing purchase outcome variable (Supplementary

Table 11); regression models excluding participants who indicated unrealistically high years of education (Supplementary Table 12); and regression models with the raw jeans and t-shirt purchase and steady stock variables (Supplementary Tables 13-14). All sensitivity analyses showed consistent main findings and therefore demonstrate the stability of the main findings across analytical decisions.

Taken together, these findings indicate a strong intention-impact gap and expose the limitations of using PEB scales to infer environmental impact in the clothing domain. This has important implications for intervention research. Perhaps relationships between psychological predictors and PEB scales should not be taken as a solid basis for selecting targets for invervention, because these psychological factors may not be as important for the prediction of actual impact as previously thought. This conclusion cannot be strongly generalized beyond the psychological factors studied here. While we included many popular factors from the psychological literature, other predictors or alternative measures may yield different results.

Since the present study is specific to the clothing domain, future research could investigate whether similarly low predictiveness of psychological factors of environmental impact are observed in other domains. Future studies could also systematically manipulate the dimensions on which EAC and our impact-focused outcome measures differ (e.g., generality, response scale, number of items, impact weighting) to unpack why such contrasting results are observed across outcome variables.

We caution that the psychological measures addressing environmental impacts and the impact-focused outcome variables' strict focus on GHG emissions were not perfectly matched, and so the different foci may have resulted in weaker or opposite correlations. For example, participants could have shifted from purchasing conventional clothing to acquiring clothing

through alternative low-impact means (e.g., secondhand or swapping markets), which were not measured here. However, as reported in Ref[20], only 13% of all captured purchases in this same dataset were acquired secondhand and therefore this is unlikely to be a major confound. The three impact-focused outcome variables were also derived from self-reported behavior, which comes with well-known limitations despite being common practice in life cycle assessments and environmental input-output modeling (see Methods and Ref[21] for additional limitations related to the life cycle assessment). Future research could use other behavior measures focused on impact, particularly objective observations.

Finally, we stress that the present study and much of the literature uses cross-sectional surveys and therefore offers poor causal evidence that psychological factors cause PEBs[22]. Complementary evidence from intervention-focused or longitudinal research is thus critically needed to inform public or private interventions to promote environmentally impactful PEBs and to determine when targeting psychological factors is a promising strategy.

Methods

We assessed self-reported clothing purchasing and psychological factors using an online survey conducted in Germany, Poland, Sweden, and the United States. The survey was administered by the marketing research company Qualtrics, which recruited adult participants (aged 18-65) from each of the four countries based on age, sex, education, and region with the aim of achieving national representativeness. The survey consisted of two parts presented at two to four-week intervals between October 2016 and January 2017, and participants received an incentive for participation (e.g., gift cards). We only included participants taking both survey parts, resulting in a sample of $N = 4{,}591$. This sample was not fully representative due to a self-selection in the participants who completed both survey parts. For the present analysis, 186 participants were removed because they reported never purchasing clothing for themselves. The final sample thus consisted of 4,405 participants ($M_{age} = 42.23$, $SD_{age} = 13.53$; 56.7% female) with the following country breakdown: Germany ($n = 1{,}140$), Poland ($n = 1{,}090$), Sweden ($n = 1{,}125$), and the United States ($n = 1{,}050$).

The psychological factors were selected from the psychological literature on pro-environmental behavior, and the measurement items and scales were either ad-hoc due to a scarcity of clothing-specific scales or inspired by existing scales but tailored to the clothing domain (see Supplementary Tables 1-2 for measurement overview and descriptive statistics). The ad-hoc items and scales were developed based on focus group interviews and pre-tested.

To estimate the greenhouse gas (GHG) emissions associated with jeans and t-shirt purchases, we relied on a recent life cycle assessment[21] based on the survey data to calculate the country-specific per-item GHG emissions (GWP-100 in CO_2-eq.) of conventionally produced jeans and t-shirts. The per-item GHG emissions were then multiplied by the self-reported

purchase quantity to form the *jeans and t-shirt purchase* outcome variable (see Supplementary Information for details). We focused on jeans and t-shirts because they are widely purchased and worn within the four survey countries (e.g., in Sweden t-shirts and jeans comprise 24% and 19% of clothing purchases, respectively[23]). Focusing on specific clothing types also enables more accurate participant recall and reporting, as well as facilitating more precise life cycle assessments. We focused on purchase quantity rather than specific product characteristics (e.g., t-shirts or jeans produced from organic cotton) because the impact of purchase quantity is much greater than substituting conventional t-shirts or jeans for eco-options[18,24].

The *steady stock* outcome variable used a simple residence time calculation of dividing the number of jeans and t-shirt items possessed by the time these items was kept, thereby assuming a steady stock state in which each person maintains the self-reported number of jeans and t-shirts owned by purchasing and discarding, on average, an equal number of items. This calculation yielded an average restock rate of 1.6 jeans and 5.4 t-shirts per person per year across all countries. Participants' annual GHG emissions were then calculated based on their restock rate and self-reported washing and drying behavior (see Supplementary Information and ref. [21] for additional calculation details and Supplementary Table 1 for item details).

The bivariate correlations shown in Fig. 1 and Supplementary Fig. 1 are Pearson's correlation coefficients calculated using the R package *stats*[25]. To analyze the predictiveness of psychological factors, we ran linear regressions with country dummy variables as controls using the *stats* and *lm.beta* packages to calculate the standardized coefficients[26].

This dataset has been published on before. The current research questions, reported analyses, and conclusions do not overlap with the other research, which instead focused on personal norms[27], reducing clothing consumption[28], and self-control[29–31].

Data availability

The dataset analyzed in the present study is not publically available due to data protection policies specified by the funding projects. The dataset is available from the corresponding author upon request.

Code availability

The analysis code is available via the Open Science Framework: https://osf.io/ucwjs/.

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Author contributions

All authors contributed to the conceptualization of the research. K.S.N., T.J., and W.G. collected the data. K.S.N. analyzed the data and wrote the manuscript. C.B., F.L., W.H., T.J., and W.G. provided critical comments and revisions. All authors approved the final manuscript.

Ethics declarations

No ethics approval was obtained for the present study as this was not common practice nor institutionally available at Copenhagen Business School at the time of data collection. However, the study posed no risks to the participants nor include deceit, and an informed consent was obtained from all participants.

Competing interests

The authors declare no competing interests.