



Moderating role of perceived behavioral control in the theory of planned behavior: A preregistered study

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Abstract

Investigators frequently rely on the theory of planned behavior (TPB) as a conceptual framework to explain and predict human behavior in a variety of behavioral domains. Much of this research has focused on predicting behavioral intentions from attitudes, subjective norms and perceived behavioral control, typically by examining the additive effects of these constructs. However, in the original formulation of the TPB, perceived behavioral control was postulated to moderate the influence of attitude and subjective norm on intention. This tenet of the TPB has been drawing increasing attention in recent years. In a preregistered program of research conducted in two European countries (Germany and UK) concerning two different behaviors (exercising and reducing energy consumption), we found empirical support for the postulated moderating effects. The results suggest that as scores on perceived behavioral control increase, the strength of the association between attitude and intention increases as well, whereas the strength of the association between subjective norm and intention decreases. Implications of these findings for theory and future research are discussed.

1 | INTRODUCTION

The theory of planned behavior (TPB—Ajzen, 1985, 1991, 2012) is a widely applied theoretical and methodological framework for understanding and predicting human behavior. Well over 2000 empirical studies have confirmed the theory's predictive validity in a variety of behavioral domains from physical activity to drug use, from recycling to choice of travel mode, from driving under the influence of alcohol to organ donation, and from safer sex to consumer behavior, to name but a few (see Ajzen, 2020 for a partial list of references; and Armitage & Conner, 2001; Downs & Hausenblas, 2005; Hagger et al., 2016; Hagger et al., 2002; Hausenblas et al., 1997; Hirschey et al., 2020; McDermott et al., 2015; McEachan et al., 2011; McEachan et al., 2016; Notani, 1998; and Riebl et al., 2015 for meta-analyses of this research).

Notwithstanding its popularity and despite the empirical support it has garnered, the TPB has come under its share of criticism (e.g., Hobbis & Sutton, 2005; Morgan & Bachrach, 2011; Ogden, 2003; Sniehotta et al., 2014). It is beyond the scope of this article to review the various issues raised. An extensive analysis can be found in Fishbein and Ajzen (2010, pp. 281–318) and responses to specific concerns in Fishbein

and Ajzen (2005), Ajzen (2011), Ajzen and Fishbein (2004), and Ajzen (2015). In their critique, Sniehotta et al. (2014) bemoaned, among other things, the correlational nature of much TPB research, questioned the utility of the TPB as a basis for behavior change interventions, and called for the theory to be retired. A response to the issues raised by these authors can be found in Ajzen (2015). Suffice it to say that their concern regarding the correlational tests of the theory and regarding its utility as a framework for behavior change interventions is unfounded. In a meta-analysis of 82 behavior change interventions based on the TPB, Steinmetz et al. (2016) found strong evidence for the effectiveness of the interventions, thus, providing support for the causal relations set out in the theory.

2 | BRIEF DESCRIPTION OF THE THEORY OF PLANNED BEHAVIOR

According to the TPB, the proximal antecedent of any given behavior is the intention to perform the behavior in question. However, intentions are expected to lead to behavioral performance only to the

extent that the individual has sufficient control over performance of the behavior (see Yang-Wallentin et al., 2004 for a review). A variety of other factors can also reduce the relation between intention and behavior. Among other things, predictive validity will tend to decline if intention and behavior are not measured at the same level of generality or specificity, that is, if measures of these variables are not compatible; if new information becomes available that changes previously assessed intentions such that they are no longer predictive of behavior; and if people forget to act on their intentions in a timely manner (see Sheeran & Webb, 2016 and Fishbein & Ajzen, 2010, pp. 29–71 for discussions).

The intention in turn is determined by three factors: attitude toward the behavior, which represents the individual's positive or negative evaluation of the behavior; subjective norm, that is, the perceived social pressure to engage in the behavior; and perceived behavioral control. From a theoretical perspective, perceived behavioral control does not exert a direct influence on intention. Instead, it is expected to moderate the effects of attitude and subjective norm (see Ajzen, 1985, 2002; La Barbera & Ajzen, 2020). Thus, for example, people are unlikely to form an intention to conserve energy merely because they believe that they are capable of doing so (cf. Eagly & Chaiken, 1993). Nevertheless, perceptions of control may determine how and to what extent attitudes and subjective norms influence intentions to conserve energy.

In the original formulation of the TPB (Ajzen, 1985), perceived behavioral control was indeed assigned the role of a moderating variable. However, because empirical research tended to find only main effects, later formulations (e.g., Ajzen, 1991, 2012) and most empirical applications of the model have treated perceived behavioral control as a direct determinant of intention with a status equal to that of attitude and subjective norm. The failure to find interaction effects has usually been attributed to methodological issues, primarily related to restriction of range (Ajzen, 2002; Fishbein & Ajzen, 2010; La Barbera & Ajzen, 2020; Yzer & Van De Putte, 2014).

Interest in the moderating role of perceived behavioral control (PBC) has been growing in recent years, but relevant empirical research is still limited in scope. Most attention has been devoted to moderation of the intention-behavior relation by PBC, while relatively few studies have explored the moderating effect of PBC on the attitude-intention and the subjective norm-intention relations. Several investigators (Conner & McMillan, 1999; Hukkelberg et al., 2014; Kothe & Mullan, 2015; La Barbera & Ajzen, 2020; Yzer & Van De Putte, 2014) have found a significant positive interaction between attitude and PBC in the prediction of intention: the higher the perceived control over the behavior, the stronger was the association between attitude and intention. The interaction between subjective norm and PBC has received less attention. The few studies that have addressed this issue have revealed conflicting findings; some reported no significant moderating effects (e.g., Earle et al., 2019; Kothe & Mullan, 2015; Umeh & Patel, 2004), while others reported significant but inconsistent patterns of interaction. Thus, in the prediction of intention to quit smoking, Yzer and

Van Den Putte (2014) found a significant *positive* subjective norm * PBC interaction, whereas predicting intentions to smoke, Guo et al. (2007) found a significant *negative* interaction: the association between subjective norm and intention was stronger when individuals had low rather than high levels of perceived behavioral control. To add to the uncertainty, in a study of traffic violations (Castanier et al., 2013), the capacity and autonomy subdimensions of PBC (see Fishbein & Ajzen, 2010) revealed significant positive as well as significant negative interactions with subjective norms in the prediction of intentions to drive under the influence of alcohol and to disobey road signs.

In a series of three studies conducted in Italy, La Barbera and Ajzen (2020) obtained a consistent pattern of results regarding the moderating effect of perceived behavioral control. High PBC was found to strengthen the relation between attitudes and intentions (positive interaction) while it weakened the relation between subjective norms and intentions (negative interaction). This pattern was observed in three different behavioral domains: intentions to vote in favor of European Union integration, to reduce food waste, and to conserve energy. The authors interpreted the negative subjective norm by perceived behavioral control interaction to mean that when individuals have high confidence in their ability to perform a given behavior, they are less prone to rely on what significant others think they should do when forming their intentions.

The research described in the present article was designed to strengthen the evidential base for a positive moderating effect of PBC on the attitude-intention relation and a negative moderating effect of PBC on the subjective norm-intention relation. As noted, relatively few TPB studies have tested for these moderating effects, and in many cases, only direct effects have been observed. A possible explanation is restriction of range on one or the other of the variables that enter into the interaction. Observing theoretically predicted moderating effects requires that scores on the variables that enter into the interaction cover the full range of the measurement scales (see Ajzen & Fishbein, 2008). When scores are concentrated on one or the other side of the scale, computing the interaction term amounts to little more than multiplying by a constant with no appreciable effect on correlations. It is often the case, for example, that most participants in a study believe that they are capable of performing the behavior of interest (e.g., eat a balanced diet) or else that most participants have a positive attitude or a strongly supportive subjective norm with respect to the behavior. When this is the case, strong interactions are unlikely to be observed. In the present study, we examined the distribution of scores to make sure that the measures of the TPB predictors had the required psychometric properties to permit interactions to emerge.

Recognizing that the results reported by La Barbera and Ajzen (2020) may have limited generalizability because all their studies were carried out with Italian samples, in the present research the moderating effects of perceived behavioral control were tested in two different countries, Germany and the United Kingdom. Moreover, the behavioral domains addressed in the previous

studies, voting for EU integration, reducing food waste, and conserving energy all have important societal implications that go beyond their possible consequences for the individual. It is conceivable that the results are limited to behaviors of this kind, that is, to behaviors with implications for the collective. To rule out this possibility, in the present research, we tested the moderating effects of PBC in relation to the intention to exercise, a largely individualistic behavior. However, we also tried to replicate the results obtained by La Barbera and Ajzen (2020) in relation to the intention to conserve energy.

In line with theoretical considerations and the results of previous research outlined above, we formulated the following hypotheses.

Hypothesis 1 *Intentions can be predicted from attitude, subjective norm, and perceived behavioral control.*

Hypothesis 2 *The interaction between attitude and perceived behavioral control in the prediction of intention is significant and positive in both countries and with respect to both behavioral intentions.*

Hypothesis 3 *The interaction between subjective norm and perceived behavioral control in the prediction of intention is significant and negative in both countries and with respect to both behavioral intentions.*

The study reported in this article was preregistered in PsychArchives on December, 2018, before data collection, and can be found together with complete data sets and materials at <https://www.psycharchives.org/handle/20.500.12034/1976>. The preregistered protocol describes the study's rationale, hypotheses, and procedures.

3 | OVERVIEW

In the first part of our study, we tested the direct and interactive effects of attitude, subjective norm and perceived behavioral control on intention to exercise. In line with recent WHO's recommendations, we defined the behavior as "doing at least 150 min of moderate exercise per week." In the second part, we tested the direct and interactive effects of attitude, subjective norm and perceived behavioral control on intentions to conserve energy. This behavioral intention was defined as "energy-saving behaviors such as turning off lights, limiting the duration of hot showers, using public instead of private transportation, and so on."

Drawing on previous studies (La Barbera & Ajzen, 2020), we expected to find an increase of about 3% explained variance due to the ATT*PBC and SN*PBC interactions. An a-priori power analysis performed by means of the software G*Power (Faul et al., 2009) showed a required sample of 315 participants for detecting such an effect with 80% power and a 5% significance level. Therefore, two convenience samples of 400 participants each were recruited by an agency (Respondi.com) in Germany and the United Kingdom, and a total of 395 valid response were collected in each country (Germany:

196 females, $M_{age} = 42.68$, $SD_{age} = 14.14$; United Kingdom: 195 females, $M_{age} = 44.30$, $SD_{age} = 14.13$).

Each participant completed an online TPB questionnaire regarding each of the two behavioral intentions (exercising and reducing individual energy consumption). The order of items was randomized and the order of behaviors was counterbalanced (one half of the participants completed a questionnaire with an exercise-energy order, the other half behaviors in reverse order). The presentation order was entered as a control variable in all the regression models tested in this article, and because it was never found to have a significant effect, it was excluded from the final models. Items were formulated in English, translated into German by a native German speaker with a Ph.D. in social psychology, back translated into English, and finally double-checked by native speakers of English and German with the same level of education.

In the following sections, methods and results are presented by the behavior involved, first dealing with the intention to exercise in the German and British samples followed by intention to reduce energy consumption in the two samples. All TPB measures described in this article followed the guidelines provided by Fishbein and Ajzen (2010, Appendix). Since all responses were collected on 7-point scales, and due to the presence of interaction terms in the regression models, unstandardized regression coefficients are reported.¹

4 | EXERCISE

4.1 | Measures

4.1.1 | Intention

Three items were used to measure the intention to do at least 150 min of moderate exercise per week (e.g., "I intend to do at least 150 min of moderate exercise per week"; strongly disagree - strongly agree). Responses were averaged across items to produce a single composite score with higher values indicating a stronger intention (Cronbach's α GER = .95; Cronbach's α United Kingdom = .95).

4.1.2 | Attitude

Attitude was measured by asking participants to rate the statement "For me, to do at least 150 min of moderate exercise per week is:" on two 7-point bipolar adjective scales ("worthless-valuable," "bad-good"). A composite measure was computed by averaging the scores (Spearman-Brown GER $\rho = .91$; Spearman-Brown United Kingdom $\rho = .92$). Higher values indicate more positive attitudes toward exercising.

¹The scripts and outputs of the analysis performed are available upon request to the corresponding author.

4.1.3 | Subjective norm

Three items were used to measure subjective norm (e.g., “Most people I care about think I should do at least 150 min of moderate exercise per week”; extremely unlikely—extremely likely). The answers were aggregated into a single average score (Cronbach's α GER = .75; Cronbach's α United Kingdom = .80). Higher values indicate subjective norms supportive of exercising.

4.1.4 | Perceived behavioral control

Two items were used to measure perceived behavioral control: “I am capable of doing at least 150 min of moderate exercise per week” (strongly disagree—strongly agree) and “For me, doing at least 150 min of moderate exercise per week is” (impossible—possible). Item were averaged to create a single score (Spearman-Brown GER ρ = .91; Spearman-Brown United Kingdom ρ = .94). Higher values indicate higher perceived behavioral control.

4.2 | Results

Descriptive statistics are provided in Table 1. The frequency distribution of the study variables—which is a major issue for testing interactions (Fishbein & Ajzen, 2010; La Barbera & Ajzen, 2020)—was inspected first. All the variables' scores covered the full range of the 7-point scales, standard deviations exceeded 1.0, and no excess skewness and kurtosis was observed (Field, 2009; Gravetter & Wallnau, 2014). Taken together, these findings suggest that there was no special problem that could impede the moderation test.

As can be seen in Table 2, the correlations among the TPB variables were significant and of moderate to large magnitude in both national samples; no significant differences were found between mean scores of the study variables across national groups.

A hierarchical regression analysis was performed to test the direct effects of the three TPB factors on intention and the

hypothesized interactions. The analysis was conducted on 1,000 bootstrap samples by means of the software SPSS 26 (IBM). On the first step, intention was regressed on attitude, subjective norm and perceived behavioral control. On the second step, the two-way interactions (ATT*PBC and SN*PBC) were entered as predictors of intention. The variables were mean-centered before calculating the interaction terms. Results are summarized in Table 3.

A clear pattern of results, consistent across the two national samples, emerged from the regression analysis. Variables in Step 1 explained a substantial proportion of variance; nevertheless, adding the interactions in Step 2 significantly improved prediction of intentions. The regression coefficients of all three TPB constructs were statistically significant, but as hypothesized, the regression coefficients of the ATT*PBC and SN*PBC interactions were also significant and showed the predicted opposite signs. In Table 4, we show the effects of attitude and subjective norm at three levels of perceived behavioral control: one SD below the mean, at the mean, and one SD above the mean. It can be seen that the strength of the association between attitude and intention increased as the PBC values increased, whereas the strength of the association between subjective norm and intention decreased as the PBC values increased. Figure 1a and b illustrate the slopes.

5 | REDUCING ENERGY CONSUMPTION

5.1 | Measures

The items used in relation to exercise were adapted to measure intentions, attitudes, subjective norms and perceived behavioral control with respect to reducing energy, described in the questionnaire as the regular performance of energy-saving behaviors such as turning off lights, limiting the duration of hot showers, using public instead of private transportation, and so forth. All measures proved reliable: Intention, Cronbach's α GER = .95, United Kingdom = .94; attitude, Spearman-Brown GER ρ = .91, United Kingdom ρ = .89; subjective norm, Cronbach's α GER = .72; United Kingdom = .78,

	Germany				United Kingdom			
	INT	ATT	SN	PBC	INT	ATT	SN	PBC
Mean	4.67	5.22	3.44	5.22	4.44	5.14	3.56	5.07
Median	5.00	5.50	3.33	5.50	4.67	5.50	3.67	5.50
SD	1.99	1.72	1.58	1.77	2.13	1.73	1.63	1.94
Skewness	-.485	-.879	.219	-.821	-.284	-.759	.067	-.757
SE Skewness	.123	.123	.123	.123	.123	.123	.123	.123
Kurtosis	-.995	-.043	-.655	-.248	-1.29	-.210	-.838	-.599
SE Kurtosis	.245	.245	.245	.245	.245	.245	.245	.245
Min	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

TABLE 1 Summary of descriptive statistics: Exercising

Note: ATT, attitude; PBC, perceived behavioral control; SN, subjective norm.

perceived behavioral control, Spearman-Brown GER $\rho = .89$, United Kingdom $\rho = .89$. Hence, for all measures, items were averaged to produce a single score, with higher values indicating stronger intentions, more favorable attitudes, more supportive subjective norms and higher perceived behavioral control.

TABLE 2 Correlations among study variables and mean differences between the two national samples: Exercising

Measure	INT	ATT	SN	PBC
Intention	.22	.800***	.424***	.753***
Attitude	.778***	.08	.402***	.801***
Subjective norm	.472***	.452***	-.12	.311***
Perceived behavioral control	.785***	.768***	.399***	.15

Note: Diagonal cells (in bold) show the mean differences between national subsamples (GER-UK). Lower diagonals show Pearson's r correlation coefficients for the U.K. sample, upper diagonals for the GER sample. ATT, attitude; PBC, perceived behavioral control; SN, subjective norm.

* $p < .05$; ** $p < .01$; *** $p < .001$.

5.2 | Results

Descriptive statistics are shown in Table 5. It can be seen that, as was true for exercise, no special problems emerged with respect to the frequency distributions of the study variables.

In Table 6 it can be seen that all correlations among study variables were significant and moderate to large in both national samples. Significant mean differences between countries emerged with respect to attitudes and subjective norms (see diagonal cells). Participants in the United Kingdom held more favorable attitudes toward reducing energy consumption and also reported stronger subjective norms in support of this behavior.

A hierarchical regression analysis based on 1,000 bootstrapped samples was performed to test for the direct effects of the TPB predictors on intention and for the hypothesized interactions. On the first step, intention was regressed on attitude, subjective norm and perceived behavioral control; on the second step, the two-way interactions (ATT*PBC and SN*PBC) were added as predictors of intention. The variables were mean-centered before calculating the interaction terms. Results are summarized in Table 7.

TABLE 3 Hierarchical regression analysis of the intention to exercise

Predictor	Germany			United Kingdom		
	<i>b</i>	95% CI	R^2 (ΔR^2)	<i>b</i>	95% CI	R^2 (ΔR^2)
Step 1			.689***			.702***
ATT	.569***	[0.418; 0.719]		.471***	[-1.310, -0.681]	
SN	.161***	[0.081, 0.239]		.159***	[0.339, 0.610]	
PBC	.358***	[0.216, 0.501]		.482***	[0.079, 0.236]	
Step 2			0.718*** (0.029***)		[0.355, 0.602]	.726*** (.024*)
ATT	.618***	[0.492, 0.731]		.509***	[-2.249, -1.276]	
SN	.234***	[0.151, 0.317]		.204***	[0.374, 0.645]	
PBC	.365***	[0.243, 0.487]		.519***	[0.128, 0.285]	
ATT*PBC	.120***	[0.085, 0.157]		.109***	[0.410, 0.628]	
SN*PBC	-.093***	[-0.135, -0.054]		-.044*	[0.069, 0.149]	

Note: Unstandardized regression coefficients are reported. Results are based on 1,000 bootstrap samples.

ATT, attitude; PBC, perceived behavioral control; SN, subjective norm.

* $p < .05$; ** $p < .01$; *** $p < .001$.

TABLE 4 Effects of attitude and subjective norm on intention at three values of the moderator (PBC)

Independent variable	PBC moderator	Germany		United Kingdom	
		<i>b</i>	SE	<i>b</i>	SE
Attitude	-1 SD	.408***	.060	.298***	.061
	M	.622***	.055	.510***	.053
	+1 SD	.835***	.068	.723***	.068
Subjective norm	-1 SD	.399***	.069	.294***	.069
	M	.233***	.040	.205***	.041
	+1 SD	.068	.048	.117	.050

Note.: Values for moderators are the mean and plus/minus one SD from mean.

* $p < .05$; ** $p < .01$; *** $p < .001$.

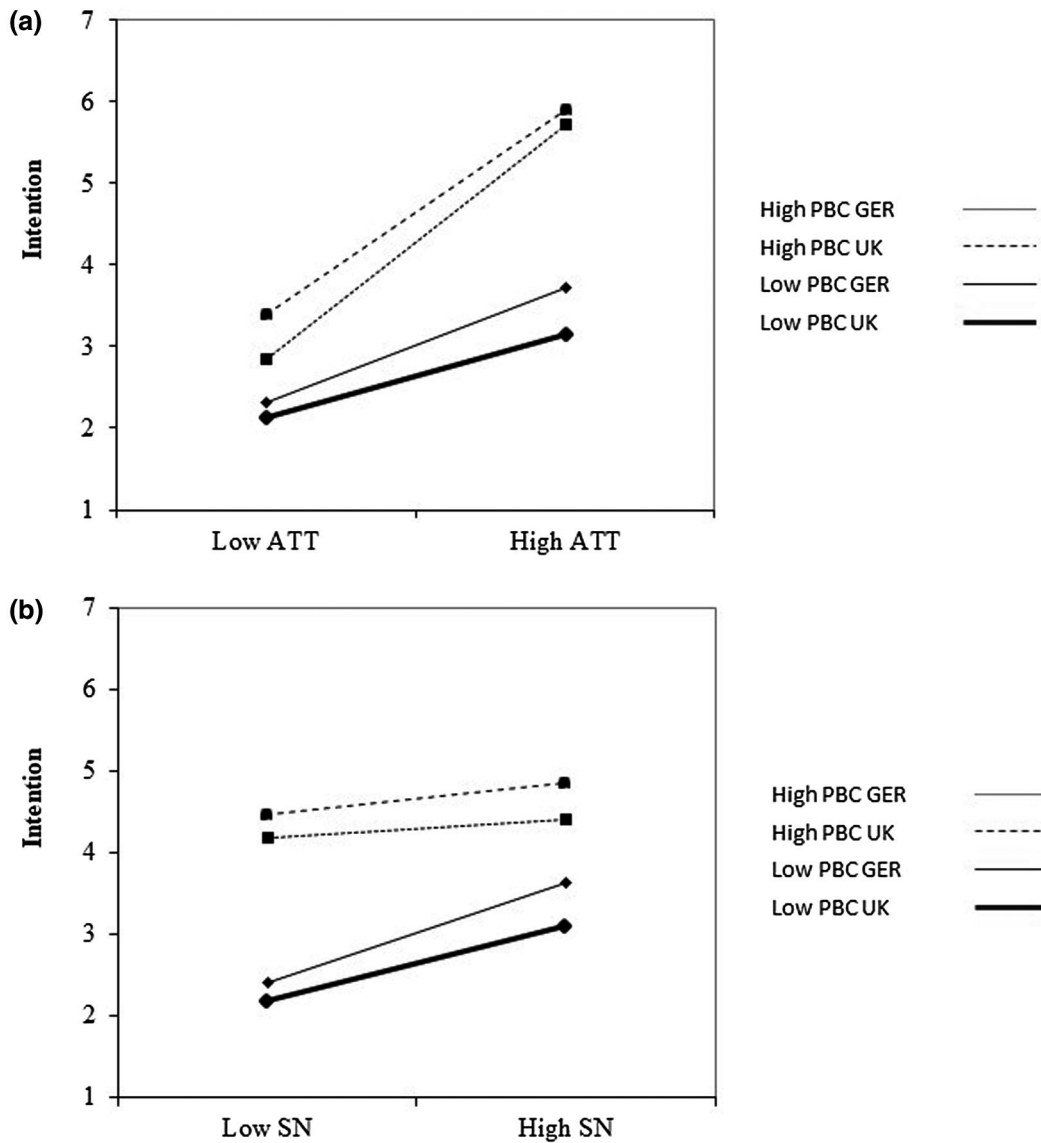


FIGURE 1 (a) ATT-PBC interaction on intention to exercise across the two samples. (b) SN-PBC interaction on intention to exercise across the two samples. ATT, Attitude; SN, Subjective norm; PBC, Perceived behavioral control; GER, German sample; United Kingdom, British sample

	Germany				United Kingdom			
	INT	ATT	SN	PBC	INT	ATT	SN	PBC
Mean	4.94	5.35	3.25	5.35	5.07	5.56	3.75	5.21
Median	5.33	5.50	3.00	5.50	5.00	6.00	3.67	5.00
SD	1.83	1.58	1.50	1.57	1.52	1.37	1.50	1.39
Skewness	-.676	-.952	.355	-.927	-.592	-.917	.003	-.579
SE Skewness	.123	.123	.123	.123	.123	.123	.123	.123
Kurtosis	-.535	.402	-.506	.367	-.104	.697	-.453	.075
SE Kurtosis	.245	.245	.245	.245	.245	.245	.245	.245
Min	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

TABLE 5 Summary of descriptive statistics: Reducing energy consumption

Note: ATT, attitude; PBC, perceived behavioral control; SN, subjective norm.

In both national samples, the regression coefficients of all three TPB predictors were statistically significant and together accounted for over 70% of the variance in intentions. Adding the interaction terms on the second step of the regression analysis showed the hypothesized pattern in the German sample: the regression coefficient for the ATT*PBC interaction was significant and positive (.086; $p < .001$) and the regression coefficient for the SN*PBC interaction was also significant but negative (−.059; $p < .001$). The addition of the two interaction terms in Step 2 raised the amount of explained variance by 1.7% ($p < .001$). The same pattern of results was observed in the U.K. sample. The regression coefficient for the ATT*PBC interaction had a positive sign (.037; $p < .10$) whereas the regression coefficient for the SN*PBC interaction had a negative sign (−.016; n.s.); however, in this case, entering the interaction terms in the regression analysis did not significantly increase the explained variance in intentions.

The analysis of conditional effects showed that, as with respect to exercise, the association between attitude and intention strengthened as perceived behavioral control increased, whereas the association between subjective norm and intention declined as PBC values increased (see Table 8). Figure 2a and b illustrate the slopes.

TABLE 6 Correlations among study variables and mean differences between national samples: Reducing energy consumption

Measure	INT	ATT	SN	PBC
Intention	−.13	.822***	.401***	.774***
Attitude	.794***	−.21*	.346***	.783***
Subjective norm	.502***	.403***	−.49***	.310***
Perceived behavioral control	.777***	.722***	.440***	.14

Note: Diagonal cells (in bold) report differences between means across national subsamples (GER-UK). Lower diagonals show Pearson's r correlation coefficients for UK sample, upper diagonals for GER sample. * $p < .05$; ** $p < .01$; *** $p < .001$.

The results of the present research provide strong support for our hypotheses. Consistent with our first hypothesis, attitude, subjective norm, and perceived behavioral control permitted accurate prediction,

6 | DISCUSSION

TABLE 7 Hierarchical regression analysis of the intention to conserving energy

Predictor	Germany			United Kingdom		
	<i>b</i>	95% CI	R^2 (ΔR^2)	<i>b</i>	95% CI	R^2 (ΔR^2)
Step 1			.731***			.735***
ATT	.607***	[0.454; 0.751]		.509***	[0.383; 0.635]	
SN	.140***	[0.069, 0.210]		.149***	[0.092, 0.212]	
PBC	.379***	[0.222, 0.548]		.418***	[0.303, 0.549]	
Step 2			.748*** (.017***)			.737*** (.002)
ATT	.663***	[0.530, 0.785]		.536***	[0.413, 0.667]	
SN	.171***	[0.096, 0.245]		.159***	[0.087, 0.234]	
PBC	.389***	[0.251, 0.525]		.409***	[0.296, 0.525]	
ATT*PBC	.086***	[0.051, 0.121]		.037	[−0.015, 0.100]	
SN*PBC	−.059***	[−0.108, −0.008]		−.016	[−0.089, 0.047]	

Note: Unstandardized regression coefficients are reported. Results are based on 1,000 bootstrap samples. ATT, attitude; PBC, perceived behavioral control; SN, subjective norm.

* $p < .05$; ** $p < .01$; *** $p < .001$.

TABLE 8 Effects of attitude and subjective norm on intention at three values of the moderator (PBC)

Independent variable	PBC moderator	Germany		United Kingdom	
		<i>b</i>	SE	<i>B</i>	SE
Attitude	−1 SD	.526***	.050	.491***	.044
	M	.664***	.050	.538***	.045
	+1 SD	.802***	.061	.585***	.061
Subjective norm	−1 SD	.270***	.058	.177***	.049
	M	.174***	.034	.159***	.031
	+1 SD	.077	.044	.142***	.037

Note: Values for PBC are at the mean and plus/minus one SD from the mean.

* $p < .05$; ** $p < .01$; *** $p < .001$.

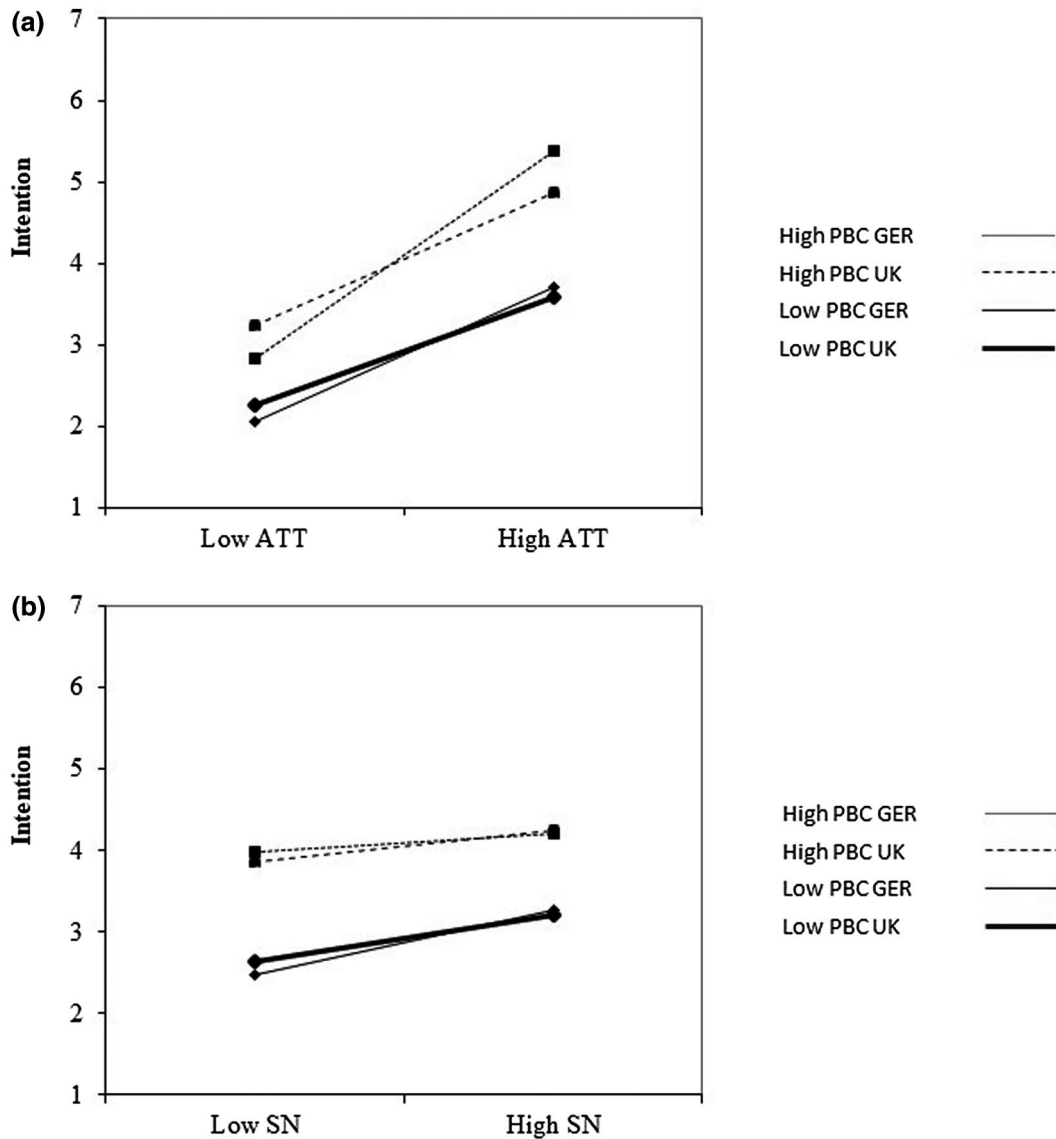


FIGURE 2 (a) ATT-PBC interaction on intention to conserving energy across the two samples. (b) SN-PBC interaction on intention to conserving energy across the two samples. ATT, Attitude; SN, Subjective norm; PBC, Perceived behavioral control; GER, German sample; United Kingdom, British sample

accounting for over 70% of the variance in intentions to exercise and intentions to conserve energy in both Germany and the United Kingdom. Hierarchical regression analyses revealed that PBC had significant direct as well as significant moderating effects. The pattern of moderating effects confirmed our second and third hypotheses and are consistent with the results reported by La Barbera and Ajzen (2020): the predictive power of attitude tends to increase with perceived behavioral control, whereas subjective norm tends to predict intention better when perceived behavioral control is low rather than high. The findings reported by La Barbera and Ajzen, however, were limited in that the behaviors studied had implications for society as a whole (voting for increased European integration, reducing food waste, and conserving energy) and that all three studies were conducted in the same country (Italy). The current preregistered research helps to overcome these limitations by providing strong additional support for the same

pattern of interaction in two different countries and in relation not only to energy conservation, but also in relation to exercising, a behavior of a more individualistic nature.

Alongside these strong features of the present research, certain limitations must be acknowledged. Perhaps most critical is the cross-sectional nature of our study, relying on correlations to test the hypothesized moderating effects of perceived behavioral control. Although this has also been the approach taken by other investigators (e.g., Castanier et al., 2013; Guo et al., 2007), it would be valuable to confirm the current findings with an experimental design in which PBC is manipulated to be either high or low and the effect of the manipulation on the attitude-intention and subjective norm-intention relations is observed. In addition, it is also worth noting that our study did not include a follow-up measure of behavior because our focus was on the prediction of intentions from attitudes and subjective norms, moderated by perceived behavioral

control. Future research can aim for a more complete picture of moderation in the theory of planned behavior by going beyond the prediction of intentions to examine the effect of PBC on the intention-behavior relation.

The increase in explained variance due to the interaction terms was statistically significant in three out of four models but it was of modest size, not exceeding 3%. It should be noted, however, that the independent variables in the present study were strongly associated with behavioral intentions and that the TPB models with only direct effects of attitudes, subjective norm, and perceived behavioral control explained a substantial proportion of variance in intentions, ranging from 69% to 75%. Despite the fact that our measures were found to be highly reliable, the residual error variance imposed an upper limit on predictability. Given the large proportion of variance in intentions accounted for by the main effects of attitude, subjective norm, and perceived behavioral control, little systematic variance was left to be explained by the interaction terms.

Another possible limitation has to do with the national contexts in which our hypotheses were tested. Although the present research generalized our findings beyond the Italian context of the La Barbera and Ajzen (2020) studies, Germany and the United Kingdom are also Western countries with relatively individualistic cultures. It is conceivable that the moderating effects of perceived behavioral control documented in the present study may not generalize to a more collectivistic culture. Of potential relevance, it has been found that subjective norms are better predictors of intentions in collectivistic than in individualistic cultures (e.g., Cho & Lee, 2015), and among collectivistically than among individualistically oriented individuals (Ybarra & Trafimow, 1998). In light of these differences, it would be important to show that even in collectivistic cultures, the predictive validity of subjective norms declines as perceived behavioral control increases. At least one study (Guo et al., 2007), conducted on a large Chinese sample, provides tentative support for the pattern of control interactions found in our research. Although this study suffers from use of measures with poor psychometric properties, it too found that as the level of perceived behavioral control increases, the relation between attitude and intention goes up whereas the strength of the association between subjective norm and intention goes down. These findings offer some reassurance that our pattern of results is not limited to Western cultures, but more research is clearly needed to study the moderating effects of perceived behavioral control in non-Western countries.

7 | CONCLUSIONS

The present findings have important implications for the role of perceived behavioral control in the theory of planned behavior and in other "reasoned action approaches" (Fishbein & Ajzen, 2010) in which perceptions of control are assumed to influence intentions and behavior. As we observed in the introduction, positing a main

effect of perceived behavioral control on intention or on behavior is problematic from a theoretical point of view: while behavior can be directly influenced by such motivational factors as attitude, and perceived social pressure (Ajzen & Kruglanski, 2019), it stands to reason that individuals do not intend to or actually perform a behavior just because they think they can (Eagly & Chaiken, 1993). Yet, many investigators applying reasoned action models continue to focus on the direct, main effect of perceived behavioral control. Our findings point to the importance of considering the ways in which perceived behavioral control moderates the effects of attitudes and subjective norms on behavioral intentions.

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PEER REVIEW

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DATA AVAILABILITY STATEMENT

The preregistered research protocol, together with data sets and materials, can be found at <https://www.psycharchives.org/handle/20.500.12034/1976>.

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