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Predicting behaviour from perceived behavioural control: Tests of the accuracy assumption of the theory of planned behaviour

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The theory of planned behaviour assumes that the accuracy of perceived behavioural control (PBC) determines the strength of the PBC-behaviour relationship. However, this assumption has never been formally tested. The present research developed and validated a proxy measure of actual control (PMAC) in order to test the assumption. In two studies, participants completed measures of intention and PBC, and subsequently completed measures of behaviour and the PMAC. Validity of the PMAC was established by findings showing: (a) that the PMAC moderated the intention-behaviour relation, and (b) that PMAC scores did not reflect attributions for participants' failure to enact their stated intentions. Accuracy was operationalized as the difference between PBC and PMAC scores. Consistent with theoretical expectations, several analyses indicated that greater accuracy of PBC was associated with improved prediction of behaviour by PBC.

Fishbein's theory of reasoned action (1963, 1980; Fishbein & Ajzen, 1975) has been one of the most influential social-psychological accounts of behaviour for several decades. According to this theory, the proximal determinant of whether or not a person performs a behaviour is her intention to do so (e.g. 'I intend to do X'); people do things that they intend to do and do not do things that they do not intend. Intentions are determined by two constructs; attitude and subjective norm. Attitude is the person's overall evaluation of what it would be like to perform a particular behaviour (e.g. 'It would be good/bad for me to do X') whereas subjective norm is the person's perception of social pressure to perform the behaviour (e.g. 'Most people who are important to me think that I should do X'). Meta-analytic reviews support the predictive validity of the theory of reasoned action. Intentions explain between 19% and 38% of the variance in behaviour in prospective studies (e.g. Armitage & Conner, 2001; Randall & Wolff, 1994; Sheeran, 2002; Sheeran & Orbell, 1998; Sheppard, Hartwick, & Warshaw, 1988; Sutton, 1998; van den Putte, 1993), while attitudes and subjective norms explain between 33% and 50% of the variance in intentions (e.g.

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One limitation of the theory of reasoned action is that it only predicts voluntary behaviours, or behaviours over which the individual has a good deal of control (e.g., Ajzen, 1985). However, a person may strongly intend to perform a behaviour, but not perform it because she does not possess the requisite ability, resources, or opportunity. To address this issue, Ajzen (1985, 1987, 1991, Ajzen & Madden, 1986) added the construct of perceived behavioural control (PBC) to the theory of reasoned action. PBC is the person's perception of the extent to which performing a behaviour is under her control and typically is measured by ratings of the ease versus difficulty of performing the behaviour (e.g., ‘For me to do X would be easy/difficult’). The revised model—the theory of planned behaviour—proposed that PBC was an additional predictor of intention alongside attitude and subjective norm and that, in certain circumstances, PBC could also directly predict behaviour (over and above the effects of intentions).

PBC should be associated with intention because a person is unlikely to intend to perform a behaviour that is outside her control (Sheeran, 2002). Conversely, a person is more likely to intend to perform a behaviour when she believes she has the ability and resources to perform it (at least in the case of positively evaluated behaviours, see Eagly & Chaiken, 1993, p. 189). Meta-analytic reviews have supported the PBC-intention relation. For example, Godin and Kok (1996) found a sample-weighted average correlation $r_w = .46$ between PBC and intention. Across 76 applications of the theory of planned behaviour that they examined, PBC predicted intention in 65 cases (86%) after controlling for the theory of reasoned action, and explained an additional 13% of the variance on average. Similar findings were obtained in meta-analyses by Sheeran and Taylor (1999) and Armitage and Conner (2001).

According to Ajzen and Madden (1986), two conditions determine the extent to which PBC directly affects behaviour: ‘First, the behavior being predicted must not be under complete volitional control. When it is, the concept of perceived behavioral control becomes largely irrelevant for prediction of behavior and the theory of planned behavior reduces to the theory of reasoned action’ (pp. 459–460). Madden, Ellen, and Ajzen (1992) provided an elegant demonstration of this point in a longitudinal study of 10 behaviours that had different mean levels of PBC. For behaviours that were perceived as easy to perform (e.g., ‘listening to an album’), the theory of planned behaviour performed no better than the theory of reasoned action ($R^2$ was .23 for both models). However, when the behaviour was perceived as less controllable (e.g., ‘getting a good night’s sleep’), then PBC contributed substantial additional variance after controlling for intention ($R^2 = .13$ and .41, for the theory of reasoned action and the theory of planned behaviour, respectively).

The second condition that determines the strength of the PBC–behaviour relationship is that ‘. . . perceptions of behavioral control must reflect actual control in the situation with some degree of accuracy. When this is not the case, the measure of perceived behavioral control can add little to the prediction of behavior’ (Ajzen & Madden, 1986, p. 460). The logic of this accuracy assumption can be explained as follows: Ajzen and Madden ‘. . . are not claiming a direct causal effect for perceived behavioral control’ (p. 472), because it is actual control—not PBC—that is the causal determinant of behaviour. However, because it is generally difficult to obtain a measure of actual control, researchers can use PBC as a proxy for actual control. The issue then is how well does PBC act as a proxy for actual control, i.e. how accurately
does PBC reflect actual control over the behaviour. When perceptions of control are accurate, PBC should predict behaviour but when perceptions of control are inaccurate (do not reflect actual control), PBC should not predict behaviour.

Given the importance of the accuracy assumption for understanding the direct path from PBC to behaviour, it is surprising that virtually no studies have tested whether accuracy moderates the predictive validity of PBC. In fact, a literature search revealed just a single study that addressed this issue—Ajzen and Madden (1986, Expt 2). This experiment measured PBC and the other variables from the theory of planned behaviour with respect to getting an ‘A’ on a course at the beginning of the semester and again at the end of the semester (one week before the examination). Between the first and second assessments participants received a great deal of feedback on class projects and examinations which should have meant that their perceptions of control over getting an ‘A’ became more accurate. The findings for PBC were consistent with this idea. Whereas PBC assessed at wave 1 did not predict participants’ final examination performance, the wave 2 measure of PBC was a reliable predictor even after intentions had been taken into account.

In our view, Ajzen and Madden’s (1986) analysis does not represent an optimal test of the accuracy assumption—for three reasons. First, their experiment does not constitute a direct test of the assumption because accuracy was never measured; it is impossible to say for certain that perceptions of control were more accurate at the second assessment on the basis of the data that were presented. Second, the fact that the β for PBC at wave 2 was significant whereas the β for PBC at wave 1 was not significant does not constitute sufficient evidence that the second assessment provided significantly better prediction of behaviour than the first assessment; a formal comparison of the unstandardized regression coefficients for the two PBC assessments is required. Thirdly, Ajzen and Madden’s experimental design did not capture individual differences in the accuracy of PBC—even though participants were likely to differ with respect to how correct were their perceptions of control. Thus, considerable local variation in the accuracy of PBC was probably masked in the analyses of whole-group data.

It is important to say in Ajzen and Madden’s defence that it is easy to understand why the accuracy of PBC (and individual differences in accuracy) were not measured—a measure of a participant’s actual control over a behavioural performance would be needed in order to assess the accuracy of his/her perceptions of control. However, as Ajzen has repeatedly pointed out (e.g. 1987, 1991; Ajzen & Madden, 1986), it is very difficult to measure people’s actual control. Indeed, an ‘objective’ measure of actual control does not seem feasible. For example, two people could have the exact same ability, resources, opportunity, etc. (i.e. ‘actual control’) and yet have different perceptions of how much control they have, and there would be no way of knowing who was correct. Consequently, it seems reasonable that a measure of actual control should leave it up to individual people to make the assessment, under conditions where they are likely to know as much as possible.

In the present study we used this reasoning to try to develop and validate a proxy measure of actual control (PMAC). It seemed to us that the condition where people are likely to know as much as possible about the extent of their actual control over a behaviour is after they have attempted to perform it; until people have tried to perform the behaviour, they cannot be certain about how much control they have over its performance. Thus, the PMAC proposed here involves participants’ post-behavioural attempt assessment of actual control. The PMAC was operationally defined by items of
the form ‘How easy/difficult was it for you to do X in the last two weeks’ and ‘How much control did you have over doing X?’ The key feature of this form is that it becomes possible to compare participants’ PBC scores (taken before performance of the behaviour using, e.g. ‘How easy/difficult is it for you to do X in the next two weeks’) with participants’ PMAC scores in order to derive a measure that captures individual differences in accuracy of PBC.

But how can the PMAC be validated? Two criteria would seem to be essential. First, the PMAC should moderate the intention–behaviour relationship. The reason why Ajzen (1991) introduced the concept of PBC was because ‘a behavioral intention can find expression in behavior only if the behavior in question is under volitional control’ (p. 181). Thus, by definition, actual control moderates the intention–behaviour relation such that intentions better predict behaviour as actual control increases. Similarly, for the PMAC to be a valid indicator of actual control, the PMAC has to affect how well intentions are translated into behaviour.

The second criterion relates to the consideration that the PMAC involves a measure taken after participants have tried to perform the behaviour. This procedure could invite self-presentational bias in situations where people fail to achieve the level of performance of a behaviour that they had set in their behavioural intention—people might be tempted simply to attribute the failure to live up to their intention to ‘lack of control’. Consequently, the PMAC could reflect a self-serving bias instead of reflecting accurate assessment of actual control. A demonstration that PMAC scores do not differ for participants with positive intentions who achieve their intentions versus participants with equivalent intentions who fail to achieve their intentions is required to rule out this possibility.

Thus, the present research has two aims; (a) to develop and validate a proxy measure of actual control, and (b) to test whether the accuracy of PBC moderates the PBC–behaviour relationship.

STUDY I

Method

Participants and procedure
Participants were N=172 undergraduates at a UK university who completed a questionnaire based on the theory of planned behaviour (TPB) concerning their views about eating a low-fat diet. One month later, N = 91 participants reported their eating behaviour and completed the proxy measure of actual control. There were no differences on TPB variables between participants who completed the Time 1 measures only and participants who completed both waves of data collection.

Questionnaires
Intention to eat a low-fat diet was assessed by three items measured on 7-point scales: ‘I intend to eat a low-fat diet over the next month’ (definitely do not–definitely do), ‘I want to eat a low-fat diet over the next month’ (definitely do not–definitely do), and ‘I plan to eat a low-fat diet over the next month’ (definitely do not–definitely do). Reliability was satisfactory (α = .86). PBC was assessed by four items measured on 7-point scales: ‘How much personal control do you feel you have over eating a low-fat diet in the next month?’ (very little control–complete control), ‘How much do you feel
Table 1. Hierarchical regression of behaviour on intention, proxy measure of actual control, and interaction term: Study 1

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>$\beta$</th>
<th>$\beta$</th>
<th>$\beta$</th>
</tr>
</thead>
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<td>.42***</td>
<td>.35***</td>
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<td>2.</td>
<td>PMAC</td>
<td>---</td>
<td>.19*</td>
<td>.27**</td>
</tr>
<tr>
<td>3.</td>
<td>Intention $\times$ PMAC</td>
<td>---</td>
<td>---</td>
<td>.23*</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td></td>
<td>.19</td>
<td>.04</td>
<td>.04</td>
</tr>
<tr>
<td>$\Delta F$</td>
<td></td>
<td>20.83***</td>
<td>4.03*</td>
<td>5.15**</td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
<td>.19</td>
<td>23</td>
<td>.27</td>
</tr>
<tr>
<td>Model $F$</td>
<td></td>
<td>20.83***</td>
<td>12.78***</td>
<td>10.64***</td>
</tr>
</tbody>
</table>

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

Key. PMAC = proxy measure of actual control.

that whether you eat a low-fat diet in the next month is beyond your control?" (very much so—not at all), 'I believe I have the ability to eat a low-fat diet in the next month' (definitely do not—definitely do), and 'How confident are you that you will be able to eat a low-fat diet in the next month?' (very unsure—very sure). Again, reliability was satisfactory ($\alpha = .77$).

Behaviour was measured using two items: 'I have eaten a low-fat diet in the last month' (strongly disagree—strongly agree) and 'How often did you eat a low-fat diet in the last month?' (never—frequently; $\alpha = .84$). The proxy measure of actual control (PMAC) comprised a single-item indicator: 'How easy did you find it to eat a low-fat diet in the last month?' (7-point scale; not at all easy—extremely easy).

Results

Validation of the proxy measure of actual control

Two analyses were conducted to validate our proxy measure of actual control (PMAC). The first analysis tested whether the PMAC moderated the relationship between intention and behaviour. We conducted a three-step hierarchical regression; behaviour was regressed on intention at step 1, on intention and the PMAC at step 2, and the intention by PMAC interaction was added to the equation at step 3. Variables were mean-centred to reduce potential multicollinearity (Aiken & West, 1991). Table 1 shows the results of these analyses. Intention on its own explained 19% of the variance in behaviour. The addition of the PMAC contributed a significant increment in the variance accounted for ($\Delta R^2 = .04$, $p < .05$) and intention and the PMAC were both significant predictors of behaviour. The final equation showed that the interaction term was associated with a significant improvement in the fit of the model ($\Delta R^2 = .04$, $p < .05$) and that the interaction term, intention, and the PMAC all had significant regression coefficients.

The intention by PMAC interaction was decomposed in the manner specified by Aiken and West (1991). We computed simple slopes for intention at three levels of the moderator: low control (one standard deviation below the mean for the PMAC), moderate control (the mean for the PMAC) and high control (one standard deviation above the mean). Figure 1 shows that when PMAC scores were low, intention did not predict behaviour ($B = .18$, ns). However, as PMAC scores increased from low to
Figure 1. Interaction between intention and proxy measure of actual control: Simple slopes for intention at three levels of control: Study 1.

moderate ($B = .28$, $p < .001$), and from moderate to high ($B = .41$, $p < .001$), the predictive validity of intention increased. These findings support the validity of PMAC as an index of actual control; higher scores on the PMAC are associated with greater consistency between intentions and behaviour.

The second concern about the PMAC related to the possibility that this index would be subject to self-presentational bias. More particularly, participants who failed to enact their positive intentions to exercise could simply attribute this failure to 'lack of control'. Hence, PMAC scores could reflect the operation of self-serving bias instead of reflecting an accurate retrospective assessment of actual control (as we propose). To test this possibility, we compared the PMAC scores for those participants with positive intentions ($N = 70$) who either did, or did not, eat a low-fat diet. Contrary to the idea that PMAC simply reflects an attribution for failing to enact one's intention successfully, scores did not differ between the groups ($M = 3.46$ and $4.07$, $SD = 0.97$ and 1.33, for participants who failed to enact their intentions and participants who succeeded in enacting their intentions, respectively), $t(68) = 1.56, n.s.$ In sum, the findings support the validity of the PMAC as an index of actual control: the PMAC moderates the intention–behaviour relation in the same manner as the TPB proposes that actual control should moderate the intention–behaviour relation; moreover, PMAC scores are not simply attributions by participants for discrepancies between their intentions and behaviour.

Accuracy of perceived behavioural control and behaviour

The second aim of the present study was to test whether the accuracy of PBC moderates the PBC–behaviour relationship. We first examined how accurate participants
Table 2. Hierarchical regression of behaviour on perceived behavioural control, accuracy of perceived behavioural control, and perceived behavioural control by accuracy interaction: Study 1.

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable(s) entered</th>
<th>β</th>
<th>β</th>
<th>β</th>
</tr>
</thead>
<tbody>
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<td>.36***</td>
<td>.34***</td>
<td>.34***</td>
</tr>
<tr>
<td></td>
<td>PBC</td>
<td>.20</td>
<td>.19</td>
<td>.18</td>
</tr>
<tr>
<td>2.</td>
<td>Accuracy</td>
<td>—</td>
<td>.07</td>
<td>.03</td>
</tr>
<tr>
<td>3.</td>
<td>PBC × Accuracy</td>
<td>—</td>
<td>—</td>
<td>.22**</td>
</tr>
<tr>
<td>ΔR²</td>
<td></td>
<td>.21</td>
<td>.00</td>
<td>.05</td>
</tr>
<tr>
<td>ΔF</td>
<td></td>
<td>11.98***</td>
<td>0.47</td>
<td>5.34*</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>.21</td>
<td>.21</td>
<td>.26</td>
</tr>
<tr>
<td>Model F</td>
<td></td>
<td>11.98***</td>
<td>8.09***</td>
<td>7.71***</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001.
Key. PBC = perceived behavioural control.

were at judging their control over the behaviour by comparing participants' PBC scores with their PMAC scores (scores were standardized prior to the analysis). The correlation between PBC and the PMAC was \( r = .49, p < .001 \), indicating a relatively strong relationship between the two measures. However, a \( t \) test showed that participants generally overestimated their control over the behaviour (\( M_s = .15 \) and \( -.04 \), \( SD_s = .90 \) and .96, for PBC and the PMAC, respectively), \( t(90) = 2.14, p < .04 \). We next computed an accuracy measure as the absolute difference between PBC scores and PMAC scores (higher scores indicate greater accuracy). A one-sample \( t \) test indicated that the mean accuracy (\( M = .74 \)) was significantly different from zero, i.e. perfect accuracy, \( t(90) = 11.02, p < .001 \).

The moderator hypothesis was tested by means of a three-step hierarchical regression; intention and PBC entered the equation at the first step, accuracy of PBC entered at the second step, followed by the PBC by accuracy interaction at the final step. Again, variables were mean-centred to reduce potential multicollinearity. Table 2 shows the results of these analyses. Intention and PBC explained 21% of the variance in behaviour in the first equation. The \( \beta \) for intention was significant, whereas the \( \beta \) for PBC was not. The addition of accuracy of perceptions of control at the second step did not improve the fit of the model (\( ΔR^2 = .00, ns \)). Consistent with predictions, however, the entry of the interaction between PBC and accuracy on the final step contributed a significant increment in the variance (\( ΔR^2 = .05, p < .05 \)). Intention and the interaction term were the only significant predictors of behaviour in the final equation.

To decompose the interaction, we computed simple slopes for PBC at three levels of accuracy: low accuracy (one standard deviation below the mean), moderate accuracy (the mean) and high accuracy (one standard deviation above the mean). Figure 2 shows that when accuracy of PBC was low, PBC did not predict behaviour (\( B = .10, p > .47 \)). In contrast, when accuracy was moderate, PBC was a significant predictor of behaviour (\( B = .34, p < .001 \)), and the predictive validity of PBC increased as accuracy improved from moderate to high (\( B = .56, p < .001 \)). These findings support the accuracy hypothesis; greater accuracy of PBC is associated with stronger relationships between PBC and behaviour.
**Discussion**

Findings supported the validity of the PMAC and the importance of accurate perceptions of control in determining the strength of the PBC–behaviour relation. However, two issues still need to be addressed. First, we employed a single-item PMAC that did not overlap with the items used to measure PBC. Although this procedure reduced the potential for consistent responding to PBC and PMAC items by participants, it would be desirable to employ a multi-item PMAC which contains similar items to the PBC measure to ensure that this consideration did not influence our findings. Secondly, it would be desirable to test the PMAC and the accuracy assumption in a different behavioural domain in order to enhance the generality of our analyses. For both of these reasons, we conducted a second study.

**STUDY 2**

Our second study examined exercise behaviour. The aims were the same as Study 1; (a) to validate the PMAC, and (b) to test whether the accuracy of PBC moderates the PBC–behaviour relationship.

**Method**

**Participants and procedure**

Participants were $N = 333$ undergraduates at a UK university who completed a questionnaire based on the theory of planned behaviour concerning their views about exercise. Two weeks later, $N = 226$ participants reported their exercise behaviour and completed the proxy measure of actual control. There were no differences on TPB
variables between participants who completed the Time 1 measures only and participants who completed both waves of data collection. Because the present study forms part of a larger research programme, only items that are relevant to this study are presented below.

We employed two data collection procedures that were designed to increase the accuracy of responses and reduce concerns about self-presentation. First, participants were instructed to be honest on the questionnaires used at both time points ('Please answer the questions honestly. Remember, there are no right or wrong answers—it is what you think that is important'). Secondly, participants knew that their answers were anonymous and would be used for research purposes only (participants generated their own code so that questionnaire answers at the two time points could be matched). Evidence suggests that these procedures can be effective in increasing the validity of responses (cf. Sheeran & Abraham, 1994).

**Questionnaires**

To reduce ambiguity about the meaning of 'exercise', the following definition was printed at the top of the questionnaires used at both time points: 'Exercise here means at least 20 minutes of moderate/vigorous activity. Exercise includes activities such as aerobics, badminton, jogging, rugby, etc. It does not include activities such as walking to the bus stop, dancing at clubs, etc.' Unless otherwise stated, all items were measured on 7-point bipolar scales.

Intentions were assessed by two items: 'I intend to exercise at least six times over the next two weeks' (strongly agree—strongly disagree) and 'I intend to exercise at least six times over the next two weeks' (definitely do—definitely don't) which were reliable ($\alpha = .88$). PBC was measured by four items: 'For me to exercise at least six times in the next two weeks would be . . . ' (very easy—very difficult), 'How much control do you have over exercising at least six times in the next two weeks?' (no control—complete control), 'If I wanted to, I could easily exercise at least six times in the next two weeks' (strongly agree—strongly disagree), and 'I feel in complete control of whether or not I exercise at least six times over the next two weeks' (strongly agree—strongly disagree). Reliability was moderate ($\alpha = .68$).

Behaviour was assessed by two items: 'How many times did you exercise in the last two weeks?' and 'How often did you exercise in the last two weeks?' (not at all—every day). These items were standardized and proved reliable ($\alpha = .88$). The PMAC was assessed by three items: 'For me, exercising at least six times in the last two weeks was . . . ' (very easy—very difficult), 'How much control did you have over exercising at least six times in the last two weeks?' (no control—complete control), and 'If I had wanted to, I could easily have exercised at least six times in the last two weeks' (strongly agree—strongly disagree). Reliability was satisfactory ($\alpha = .78$).

**Results**

**Validation of the proxy measure of actual control**

Two analyses were again conducted to validate the PMAC. We first tested whether the PMAC moderated the relationship between intentions and behaviour using a three-step

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1A fourth PMAC item (equivalent to the fourth item used to measure PBC) was omitted from the Time 2 questionnaire because of a clerical error. Supplementary analyses designed to address this issue are described in the Results section.
Table 3. Hierarchical regression of behaviour on intention, proxy measure of actual control, and interaction term: Study 2

<table>
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<th>Step</th>
<th>Variable entered</th>
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<th>$\beta$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
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<td>Intention</td>
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<td>.49***</td>
<td>.44***</td>
</tr>
<tr>
<td>2.</td>
<td>PMAC</td>
<td></td>
<td>.25***</td>
<td>.31***</td>
</tr>
<tr>
<td>3.</td>
<td>Intention × PMAC</td>
<td></td>
<td></td>
<td>.29***</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td></td>
<td>.36</td>
<td>.07</td>
<td>.08</td>
</tr>
<tr>
<td>$\Delta F$</td>
<td></td>
<td>125.02***</td>
<td>29.27***</td>
<td>37.47***</td>
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<tr>
<td>$R^2$</td>
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<td>.36</td>
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<tr>
<td>Model $F$</td>
<td></td>
<td>125.02***</td>
<td>85.03***</td>
<td>78.45***</td>
</tr>
</tbody>
</table>

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

Key. PMAC = proxy measure of actual control.

Hierarchical regression with mean-centred variables. Table 3 shows that intention on its own explained 36% of the variance in behaviour. The addition of the PMAC contributed a significant increment in the variance accounted for ($\Delta R^2 = .07; \Delta F = 29.27, p < .001$); intention and the PMAC were both predictors of behaviour. The final equation showed that the interaction term was associated with a significant improvement in the fit of the model ($\Delta R^2 = .08; \Delta F = 37.47, p < .001$) and that the interaction term, intention, and the PMAC all had significant regression coefficients.

Simple slopes analyses showed that even when scores on the PMAC were low, intention predicted behaviour ($B = .08, p < .05$). However, as PMAC scores increased from low to moderate ($B = .25, p < .001$), and from moderate to high ($B = .38, p < .001$), the predictive validity of intention increased (see Fig. 3). The consideration that higher scores on the PMAC are associated with greater consistency between intentions and behaviour again supports the validity of PMAC as an index of actual control.

Our second analysis addressed the possibility that PMAC scores might reflect participants' attributions for failing to enact their intentions. We dichotomized the intention measure at the scale mid-point (4) and dichotomized the behaviour measure at the target level of exercise specified in the intention measure (i.e. 'six times in the next two weeks'). We then compared the PMAC scores for the participants with positive intentions ($N = 107$) who either performed, or did not perform, the behaviour. Again, PMAC scores did not differ between the groups ($Ms = 5.10$ and $5.28; SDs = 1.40$ and $1.22$, for participants who failed to enact their intentions and participants who succeeding in enacting their intentions, respectively), $t(105) = 0.49$, ns. In sum, the findings support the validity of the PMAC as an index of actual control in a different behavioural domain compared with Study 1.

Accuracy of perceived behavioural control and behaviour

Our second aim was to test whether the accuracy of PBC moderates the PBC-behaviour relationship. Again, we began by examining how accurate participants were at judging their control over the behaviour by comparing PBC and PMAC scores. The correlation between the two measures was relatively strong ($r = .53, p < .001$). A $t$ test
showed that participants generally overestimated their control over the behavioural performance ($M$s = 5.04 and 4.65, $SD$s = 1.17 and 1.44, for PBC and PMAC, respectively), $t(225) = 4.73, p < .001$. When we computed an accuracy measure as the absolute difference between PBC scores and PMAC scores (higher scores indicate greater accuracy), a one-sample t test indicated that the mean accuracy ($M = 1.04$) was significantly different from zero, i.e. perfect accuracy, $t(225) = 18.16, p < .001$. These findings are consistent with those obtained in Study 1.

The moderator hypothesis was tested by means of a three-step hierarchical regression using mean-centred measures of intention, PBC, and accuracy. Table 4 shows that intention and PBC together explained 37% of the variance in behaviour in the first equation. The $\beta$ for intention was significant, whereas the $\beta$ for PBC was marginally significant ($p = .074$). The addition of accuracy of perceptions of control at the second step was associated with a marginally significant improvement in the fit of the model ($\Delta R^2 = .01, \Delta F = 3.17, p = .077$). Intention remained a significant predictor and the betas for PBC and accuracy were both marginally significant. The entry of the interaction between PBC and accuracy on the final step contributed a significant increment in the variance ($\Delta R^2 = .02, \Delta F = 6.30, p < .02$). Intention and the interaction term were the only significant predictors of behaviour in the final equation.

Simple slopes analyses showed that when accuracy of PBC was low, PBC did not predict behaviour ($B = .10, p > .18$). In contrast, when accuracy was moderate, PBC was a significant predictor of behaviour ($B = .24, p < .001$) and the predictive validity of PBC increased as accuracy improved from moderate to high ($B = .39, p < .001$).
Table 4. Hierarchical regression of behaviour on perceived behavioural control, accuracy of perceived behavioural control, and perceived behavioural control by accuracy interaction: Study 2

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable(s) entered</th>
<th>(\beta)</th>
<th>(\beta)</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Intention</td>
<td>.56***</td>
<td>.55***</td>
<td>.53***</td>
</tr>
<tr>
<td></td>
<td>PBC</td>
<td>.10†</td>
<td>.10†</td>
<td>.09</td>
</tr>
<tr>
<td>2.</td>
<td>Accuracy</td>
<td>—</td>
<td>—</td>
<td>.13*</td>
</tr>
<tr>
<td>3.</td>
<td>PBC \times Accuracy</td>
<td>—</td>
<td>—</td>
<td>.13*</td>
</tr>
<tr>
<td>(\Delta R^2)</td>
<td></td>
<td>.37</td>
<td>.01</td>
<td>.02</td>
</tr>
<tr>
<td>(\Delta F)</td>
<td></td>
<td>64.71***</td>
<td>3.17†</td>
<td>6.30*</td>
</tr>
<tr>
<td>(R^2)</td>
<td></td>
<td>.37</td>
<td>.38</td>
<td>.39</td>
</tr>
<tr>
<td>Model (F)</td>
<td></td>
<td>64.71***</td>
<td>44.69***</td>
<td>38.47***</td>
</tr>
</tbody>
</table>

\(†p < .05; \dagger p < .01; \ddagger p < .001.\)

Key. PBC = perceived behavioural control.

see Fig. 4). These findings again support the accuracy hypothesis; greater accuracy of PBC is associated with stronger relationships between PBC and behaviour.²

**Analyses using single-item indicators of PBC and the PMAC**

Although findings from Study 2 are consistent with the accuracy hypothesis, we were concerned that the lack of correspondence between the items used to measure PBC and the items used in the PMAC measure could have influenced the results; four items were used to measure PBC but there were only three equivalent items in the PMAC. This meant that we could not clearly discriminate among participants with accurate PBC, participants who underestimated their PBC and participants who overestimated their PBC because the measure of PBC and the PMAC were not strictly comparable.

We therefore reran the analyses using the item 'For me to exercise at least six times in the next two weeks would be . . . (very easy—very difficult)' as the measure of PBC in order to validate our findings. We chose this item to index PBC because (a) this item most closely matches Ajzen’s (1987) definition of PBC: ‘. . . the perceived ease or difficulty of performing the behavior’ (p. 44), and (b) because meta-analysis indicates that measures of perceived ease have greater predictive validity than measures of perceived control (Trafimow et al., 2002). To ensure correspondence between PBC and the PMAC, the item 'For me, exercising at least six times in the last two weeks was . . . (very easy—very difficult)' was employed as the PMAC measure.

We first reran the validation analyses for the new PMAC. Findings showed that the interaction between intention and the single-item PMAC measure was associated with a significant increment in the variance explained in behaviour after intention and the PMAC had been taken into account (\(\Delta R^2 = .01, \beta = .11, \text{both } p < .04\)). Simple slopes analyses indicated that the predictive validity of intentions improved as PMAC scores

²It is worth mentioning that we also tested whether accuracy moderated the relationship between PBC and intention (accuracy should not moderate this relation). A three-step hierarchical regression of intention on PBC, accuracy, and the PBC by accuracy interaction showed a significant beta for PBC (\(\beta = .39, p < .001\)) but not for accuracy or the interaction term (\(\beta = .05\) and .11, respectively). (Equivalent analyses for Study 1 showed similar results.) These findings support the idea that accuracy is important for understanding the PBC-behaviour relation but that other factors affect the consistency between PBC and intention (cf. Sheeran, Traftimow, Finlay, & Norman, 2002; Traftimow, Sheeran, Conner, & Finlay, 2002).
increased. Intentions did not predict behaviour when PMAC was low ($B = .12$, $ns$) but intention was a significant predictor at higher levels of the PMAC ($Bs = .37$ and .63 for moderate and high levels of the PMAC, respectively, $ps < .001$). It was also the case that scores on the PMAC did not vary as a function of whether or not participants failed to enact their stated intentions, $t(105) = 0.20$, $ns$. In sum, findings for the validation of the single-item PMAC measure are identical to those obtained previously.

We computed the accuracy measure as the absolute difference between PBC scores and PMAC scores in the same manner as before. Findings again showed that the interaction between accuracy of PBC and PBC contributed a significant increment in the variance explained in behaviour after intention and PBC had been taken into account ($\Delta R^2 = .04, F = 16.07, p < .001$). Simple slopes analyses indicated that the
predictive validity of PBC improved as perceptions of control became more accurate ($βs = .16, .41$ and .62 for low, moderate, and high levels of accuracy, respectively, $ps < .05$). These findings are consistent with the original analyses that showed that the predictive validity of PBC increases as perceptions of control become more accurate.

**Piece-wise regression analyses**

Although the analyses of the single-item indicators of PBC and the PMAC supported the importance of accuracy of PBC in determining how well PBC predicts behaviour, another problem still needs to be addressed. This is because accuracy was measured using a difference score ( | PMAC − PBC | ) in both studies. Griffin, Murray, and Gonzalez (1999) criticized the use of difference scores on the grounds that two participants could arrive at the same difference score despite considerable differences in their scores on the original measures (i.e. the meaning of the two difference scores could be quite different). Griffin et al. recommended that researchers use ‘piece-wise’ regression analyses in order to confirm the validity of difference score analyses (see also Edwards, 1994). This technique involves decomposing the sample into subgroups of interest and conducting separate regression analyses for each group.

Because PBC and the PMAC were measured on the same metric, it was possible to calculate the proportion of the sample (a) that had accurate perceptions of control, (b) that overestimated their control, and (c) that underestimated their control. Participants with accurate PBC were those whose PBC and PMAC scores were identical. Participants who overestimated their PBC were those whose PBC scores were at least 1 point higher than their PMAC scores, whereas participants who underestimated their PBC had PBC scores that were at least 1 point lower than their PMAC scores. Using these criteria, only 27% of the sample had accurate PBC ($N = 59$); 30% underestimated their control ($N = 66$) whereas 43% overestimated their control ($N = 97$).

We then assessed the accuracy hypothesis using piece-wise regression analyses. This involved separate hierarchical regressions of behaviour on intentions and PBC for the accurate, underestimated, and overestimated groups. In all three analyses, intentions entered the regression equation first followed by PBC at the second step. Table 5 shows that for all three groups, intention was a reliable predictor and explained between 27% and 42% of the variance in behaviour. However, the inclusion of PBC at the second step revealed interesting group differences. Although PBC contributed a significant increment in the variance explained in behaviour for all three groups (minimum $ΔR^2 = 4.31, p < .05$), the greatest increment was obtained for participants with accurate PBC (12% of the variance compared with 4% for participants who underestimated their control and 5% for participants who overestimated their control). These findings are consistent with our previous moderator analyses; PBC better predicts behaviour when perceptions of control are more accurate compared to when perceptions of control are less accurate.

**GENERAL DISCUSSION**

The present studies constitute the first direct tests of a key assumption of the theory of planned behaviour concerning the PBC–behaviour relation, namely, that greater accuracy of PBC is associated with stronger relations between PBC and behaviour. Whereas Ajzen and Madden (1986) assumed that a measure of PBC taken closer to the
performance of the behaviour would be more accurate than a measure taken at further remove (for all participants), the present research employed a measure that was able to capture individual differences in the accuracy of PBC. This was made possible by the development and validation of a proxy measure of actual control. We argued that people are in the best position to judge how much control they have over the performance of a behaviour after they have attempted to perform it. Thus, the PMAC was operationalized by participants’ post-behavioural attempt assessments of control. The validity of the PMAC was established by findings showing (a) that the PMAC moderated the intention–behaviour relation such that consistency between intentions and behaviour was greater as participants’ PMAC scores increased, and (b) that PMAC scores were not simply attributions for failing to perform the behaviour at the level stated in participants’ behavioural intentions. The accuracy of participants’ PBC was computed as the difference between their PBC scores and their PMAC scores.

Several analyses indicated that greater accuracy of PBC was associated with improved prediction of behaviour by PBC. First, when we used different items to measure PBC and the PMAC (Study 1), formal moderator analyses prescribed by Aiken and West (1991) indicated that the predictive validity of PBC improved as accuracy improved. Secondly, when multi-item scales were used to measure both the PMAC and PBC (Study 2), we obtained equivalent findings. Thirdly, because we were concerned that the multi-item scales used to measure PBC and the PMAC did not contain identical items, we reran the analyses using the single-item measure of PBC that most closely matched Ajzen’s (1987) definition of PBC and the corresponding PMAC measure). Findings again showed that prediction of behaviour by PBC was better at higher levels of accuracy. Finally, the single-item measures of PBC and the PMAC allowed us to determine precisely whether participants’ PBC was accurate, whether PBC was overestimated, or whether PBC was underestimated. When we conducted piece-wise regressions, findings were consistent with those obtained previously: PBC explained twice as much variance in behaviour when PBC was accurate compared with when PBC was either an overestimate or an underestimate of the extent of control. In sum, the present findings provide convincing support for the assumption that greater accuracy of PBC is associated with a stronger relationship between PBC and behaviour.

As well as providing support for a key assumption concerning the PBC–behaviour relation, the present findings have several other implications for the theory of planned behaviour. First, a key rationale for the development of the theory was that the theory of reasoned action could only predict volitional behaviours, i.e. intentions would only predict behaviours over which people have a good deal of control. However, we have been unable to locate any convincing empirical demonstrations that intentions better predict behaviour when control is greater compared with when control is less. The present research, on the other hand, provided such a demonstration. As part of the validation of the PMAC, we were able to show that the predictive validity of intentions improved as PMAC scores increased, in both studies. Thus, the present studies can be viewed as providing support for a key rationale for adding the PBC construct to the theory of reasoned action to form the theory of planned behaviour.

A second important implication for the theory of planned behaviour is that the findings provide insight into why PBC generally provides only a modest increment in the variance explained in behaviour after intention has been taken into account (e.g. Armitage & Conner’s, 2001, meta-analysis found that PBC accounted for an average increment of only 2% of the variance across 66 tests of the theory of planned behaviour). PBC may only weakly predict behaviour because people are generally not
very accurate at judging how much control they actually have over performing a behaviour (cf. Langer, 1975). Several findings were consistent with this idea: there was a significant difference between participants' PBC scores and their PMAC scores in both studies; the sample mean for accuracy was significantly different from zero (perfect accuracy) in both studies; and 73% of the sample showed a difference of at least 1 point between their PBC scores and their PMAC scores (Study 2).

There is a substantial literature on factors responsible for people's illusions of control; including task familiarity and involvement, accuracy and self-enhancement motives, and mood (see Taylor & Brown, 1988; Thompson, Armstrong, & Thomas, 1998, for reviews). Importantly, several studies have examined how the accuracy of judgments of control might be enhanced and, therefore, could prove useful in efforts to strengthen the PBC–behaviour relation. For example, Alloy, Abramson, and Viscusi (1981) showed that inducing negative mood caused participants to give more accurate control judgments compared to participants who received either a neutral mood induction or no mood induction. Similarly, studies have indicated that when the costs of misperceiving one's control are high, people provide assessments that are closer to the true probabilities of success (e.g., Dunn & Wilson, 1990; Sheppard, Ouellette, & Fernandez, 1996). Possibly, therefore, negative mood inductions or manipulations that make salient the costs of optimistic control judgments could be used to enhance the accuracy of PBC which, in turn, could strengthen associations between PBC and behaviour. Further research is required to test these possibilities (see also Trafimow, 1994).

Perhaps the most serious implication of the present findings for the theory of planned behaviour concerns the status of the direct path from PBC to behaviour. Ajzen and Madden (1986) acknowledged that the PBC–behaviour relation is not causal—the real causal determinant of behaviour is actual control (and behavioural intention), not PBC. In schematic representations of the theory, this consideration is reflected in a dashed line from PBC to behaviour, whereas all of the other paths specified by the theory involve causal relations and are represented by solid lines (see e.g., Ajzen & Madden, 1986, Fig. 2, p. 458). The present findings suggest two further possibilities that could be reflected in representations of the theory. First, it might be helpful to represent the role of accurate perceptions of control in determining the strength of the PBC–behaviour association by explicitly including the interaction between accuracy and PBC in the model. Secondly, it might be helpful to represent the causal path from actual control to behaviour. Explicitly including actual control in the model could stimulate greater research on the role of resources, opportunity, and cooperation (as components of actual control) as predictors of behaviour. This inclusion would also acknowledge the benefits of improving actual control over behavioural performance in interventions to promote prosocial or health behaviours.

There is also one final issue that the present research was not designed to address that, nonetheless, merits discussion, namely, the relationships among intention, PBC, and Bandura's (1977) concept of self-efficacy. Ajzen (e.g., 1991, 1998) acknowledged that PBC was derived from self-efficacy. However, PBC is not conceived as a causal determinant of behaviour because the mechanism responsible for the effects of PBC is actual control. Self-efficacy, on the other hand, is conceived as a causal variable, and there is substantial evidence that supports the causal role of self-efficacy (see Bandura, 1997, for a review). Self-efficacy seems to affect behaviour through a variety of mechanisms that do not involve actual control—including greater effort and persistence, increased preparation for action, greater success visualization, lower stress arousal, and
fewer intrusive negative thoughts (e.g. Bandura, 1991, 1997; Cervone, 1989; O’Leary, 1992). Interestingly, however, mechanisms such as effort and persistence are also thought to be responsible for the impact of intention on behaviour (see Ajzen, 1991, p. 181) Thus, one important avenue for future research will be to determine the convergent, discriminant, and predictive validity of self-efficacy in relation to PBC and intention—to see whether self-efficacy qualifies as an additional predictor in the theory of planned behaviour. Future studies should employ measures of intention, PBC, self-efficacy, effort and persistence, as well as the PMAC, to test this possibility.

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References


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