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Measuring implementation intentions in the context of the theory of planned behavior

JOSTEIN RISE[1], MARIANNE THOMPSON[1] and BAS VERPLANKEN[2]

[1]*Department of Psychosocial Science, Faculty of Psychology, University of Bergen, Norway*
[2]*Department of Psychology, University of Tromsø, Norway*

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The usefulness of measuring implementation intentions in the context of the theory of planned behavior (TPB) was explored among 112 Norwegian college students. They responded to a questionnaire measuring past behavior, perceived behavioral control, behavioral intentions, implementation intentions, and actual performance of regular exercising and recycling of drinking cartons. Implementation intentions were measured using five items relating to recycling and four items relating to exercise, which showed satisfactory internal consistencies. Consistent with the main prediction, the presence of implementation intentions was related to performing the two behaviors, although behavioral intentions were the strongest determinant for both behaviors. The results suggest that the TPB may benefit from inclusion of the concept of implementation intentions to provide a more complete understanding of the psychological process in which motivation is translated into action.

Key words: Implementation intentions, intention–behavior relation, TPB.

Jostein Rise, Norwegian Institute for Alcohol and Drug Research, PO Box 565, Sentrum, 0105 Oslo, Norway. E-mail: jr@sirus.no

Recent years have witnessed an increased interest in exploring the processes intervening between behavioral intention and behavior. The dominant theory in this research area, the theory of planned behavior (TPB) (Ajzen, 1991), does not pay particular attention to how intentions may lead to action, and which psychological processes may be involved in this relationship. The theory proposes that the intention to perform a particular behavior is the most immediate and important determinant of future behavior, but also recognizes that non-motivational sources, in the form of perceived behavioral control, may predict behavior directly if people have a realistic perception of their actual behavioral control (cf. Ajzen, 1991). Reviews and meta-analyses suggest that perceived behavioral control adds to the predictive value of behavior (e.g. Godin & Kok, 1996; Sheeran & Taylor, 1999; but see Notani, 1998).

In the TPB, behavioral intention is assumed to summarize the motivational forces influencing the enactment of the particular behavior, indicating how much effort people are willing to exert in the planning of behavioral enactment (cf. Ajzen, 1991). Intentions typically account for about 20–40% of the variance in social and health behaviors in prospective studies (Conner & Armitage, 1998; Conner & Sparks, 1996; Godin & Kok, 1996; Randall & Wolff, 1994; Sheeran & Orbell, 1998). Although this percentage is not small, it indicates that a number of people do not enact their positive intentions to perform a particular behavior. This might, for example, be so because of the presence of competing goals/intentions, lack of knowledge of how to fulfill the goal, difficulty of getting started, or simply forgetting an intention. Although a number of methodological reasons may account for the less than perfect predictive power of behavioral intentions (see Sutton, 1998), the finding challenges the idea that motivational processes provide a sufficient explanation of behavior, suggesting that other processes may be operating along with motivation. In other words, merely intending to perform a behavior is not sufficient in many cases (cf. Orbell & Sheeran, 1998).

The concept of *implementation intentions*, which is rooted in self-regulation theory, has been proposed as a mediating process to account for this observed discrepancy (Gollwitzer, 1993; Gollwitzer & Oettingen, 1998; Gollwitzer & Schaal, 1998). Self-regulation theories of goal striving are concerned with how people plan to overcome anticipated problems en route to goal achievement, given that they are committed to a certain goal. Gollwitzer's basic idea derives from the notion that people are likely to form intentions whenever they expect that a particular behavior will be difficult to perform and, further, that this event in itself may instigate a number of self-regulatory processes which enable them to translate the intention into action (see Gollwitzer, 1993, 1996, 1999; Gollwitzer & Brandstätter, 1997; Gollwitzer & Oettingen, 1998). In the theory of action phases (see Gollwitzer, 1990), a distinction is made between a deliberative phase, which is concerned with motivation, and an implementation phase, which is concerned with volition. In the former phase, a goal intention is formed, based upon feasibility and desirability criteria, and is similar to the process of forming a behavioral intention based upon attitude, subjective norm and perceived behavioral control in the TPB. The second phase is concerned with the selection of relevant actions to be taken to get started on the route to behavioral execution through the formation of specific plans in terms of *when*, *where* and *how* to act, that is, the formation

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of implementation intentions. Thus people first decide whether or not to try to achieve a goal or try to perform a behavior, and having formed a positive goal intention implies a sense of commitment or obligation to reach this goal or execute the action. Furthermore, the more important a goal intention is, the more likely it is that people will form implementation intentions in the service of the goal, and the more likely it is that the goal will be reached (Geen, 1995; Gollwitzer, 1996; Gollwitzer & Brandstätter, 1997).

A number of empirical studies attest to the utility of forming implementation intentions in the process of translating a behavioral (or goal) intention into actual behavioral performance (or goal achievement) (see Gollwitzer, 1993; Gollwitzer & Brandstätter, 1997; Orbell, Hodgkins & Sheeran, 1997; Sheeran & Orbell, 1999, 2000; Verplanken & Faes, 1999). For example, Gollwitzer and Brandstätter (1997) asked participants to write a report on how they spent their Christmas holidays and to return it within a specified period. Half the participants were instructed to form implementation intentions by being asked to specify when and where they intended to write the report, while the other half of the subjects did not receive these instructions. The proportion of participants who returned their reports within the critical time period was higher among those who had formed implementation intentions than among those who were not instructed to do so. These results have been replicated in a series of experiments reported by Gillholm, Ettema, Selart and Gärling (1999) and Gillholm, Erdeus, and Gärling (2001).

In a study on breast self-examination (BSE), Orbell *et al.* (1997) asked participants to form implementation intentions, specifying where and when they would perform BSE the next month. They provided strong support for the idea that the formation of implementation intentions increased the probability of successful performance of BSE among persons who are motivated to perform BSE, in that 100% of the implementation group performed BSE compared with 53% of the control group. In a subsequent study, Sheeran and Orbell (1999) extended these findings to a repeated behavior (taking a vitamin C pill each day). Verplanken and Faes (1999) demonstrated, in the area of healthy eating, that the effect of implementation intentions was additive to the predictive value of intention upon later behavioral performance using a manipulation of implementation intentions as a predictor of healthy eating and was on a par with a measure of behavioral intention in a regression equation.

Gollwitzer and Oettingen (1998) have argued that the neglect of self-regulatory strategies in the TPB is particularly unfortunate in the area of research on health behavior, considering its dominating role here (cf. Norman, Abrahams & Conner, 2000). They reasoned that most projects promoting health behavior change, like changing to more healthy diets and starting to exercise regularly, constitute goals, which may be difficult and indeed sometimes unpleasant to implement, and accordingly might benefit from being supplemented by implementation intentions. In particular, this might be so because of low motivation and weakly held beliefs in the deliberation phase, as well as distractions and temptations in the volitional phase. Along similar lines, Sheeran and Orbell (1999) proposed that the intention to exercise is a goal intention (in contrast to a behavioral intention) in terms of being a goal which can be achieved by a number of different acts.

In this study, we are concerned with predicting the performance of two socially important behaviors, regular exercise and recycling of drinking cartons. In order to start exercising on a regular basis, planning efforts have to be enacted in terms of deciding on when, where and what preparatory acts need to be executed in the service of achieving the goal of exercising. Other problems occur for social dilemma behaviors like recycling, for example that there is no tangible personal benefit deriving from recycling, only personal costs (e.g. Thøgersen, 1996). Furthermore, recycling of drinking cartons is a novel behavior for most people, in the sense that the technology has not been available until recently, and thus the implementation of the decision to recycle drinking cartons may be surrounded by a lot of uncertainties. In short, it can be expected that implementation intentions may be helpful in enacting the intention to perform a behavior.

One issue that has not received much attention is the relation between perceived behavioral control and the formation of implementation intentions in the volitional process. The notion favored by Gollwitzer (1993) seems to be that perceived behavioral control plays a role in the deliberation phase, and thus influences the formation of implementation intentions only indirectly, through behavioral intentions. In contrast to this idea, Gärling and Fujii (2001) propose that perceived behavioral control influences the formation of implementation intentions directly. They argue further that there should be a negative relation between perceived behavioral control and planning intentions (similar to implementation intentions), that is, individuals who believe they have a low degree of control over the behavior should be more inclined to form implementation intentions. However, their concern was with the formation of implementation intentions, and thus they did not include a measure of goal achievement. A third idea is, of course, that perceived behavioral control moderates the relation between implementation intentions and goal achievement; that is, if people perceive a high degree of control over a particular behavior then they see less need for forming implementation intentions in the service of goal achievement.

Another issue that might receive more attention is the relationship between past behavior and implementation intentions. The role of past behavior in the theory of reasoned action/planned behavior has been discussed by others (e.g. Ajzen, 1991; Ouellette & Wood, 1998; Sheeran, Orbell & Trafimow, 1999; Sutton, 1994). With regard to implementation intentions, it can, on the one hand, be expected

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that past behavioral experience will give the person knowledge about when, where, and how one might enact intentions. Thus, one might expect positive correlations between past behavioral frequency and the degree to which a person forms implementation intentions. On the other hand, one might reason that new behaviors in particular will benefit from implementation intentions. Orbell *et al*. (1997) demonstrated that, among participants who had formed implementation intentions, past behavior exerted no significant effect upon their subsequent performance of BSE, whereas among those who had not formed implementation intentions subsequent BSE was highly predictable from past behavioral frequency. Another situation arises when implementation intentions are in conflict with past behavior. For instance, Verplanken and Faes (1999) included unhealthy habits as a predictor of healthy eating in addition to intentions to eat healthily, which were either supported or not by implementation intentions. These authors found main effects of all three variables, suggesting that although implementation intentions were effective in eliciting healthy eating, they were not able to break the effect of counterintentional habits. Yet another perspective on the relationship between habits and implementation intentions was suggested by Orbell and Verplanken (2001). These authors demonstrated that forming habitual responses mediated the effect of implementation intentions on the performance of the intended behavior.

Measurement of implementation intentions

Most of the cited studies have induced implementation intentions experimentally. Given that empirical studies elucidating the processes underlying the relation between behavioral intentions and behavioral performance are frequently conducted in a survey context, it might be worth exploring the workings of implementation intentions as a measured construct in such a context, along with other measured variables. Most studies of implementation intentions have focused upon where and when to perform the particular behavior (Gollwitzer & Brandstätter, 1997; Orbell *et al.*, 1997; Sheeran & Orbell, 1999; however, see footnote in Sheeran & Orbell, 1999). Verplanken and Faes (1999) argued that while the *where* and *when* aspects of implementation intentions may be important in the initiation of a target behavior, the *how* aspect may also be necessary, for example in situations where behavioral enactment is dependent upon a subset of different actions or if the road to goal achievement is paved with difficulties. In the present context, it may be important to specify all three aspects of implementation intentions – when, where and how. Further, it would be of interest to explore the relative contribution of these three aspects in the striving toward goal achievement, an issue which seems not to have been addressed previously. In particular, this may have practical relevance if one wants to focus upon the volitional phase in promoting healthy and environmental behaviors. We thus included measurements of implementation intentions. These measures were intended to indicate the degree to which implementation intentions had been formed.

Another issue is whether one should adopt a global or specific measurement approach. Gollwitzer and Brandstätter (1997) adopted a global approach by giving the study subjects the following description (p. 188):

> In order to achieve their goals people execute behaviors that can be described along three dimensions: One refers to the point in time, the second to the place, and the third to the type of action that is linked to the situational context specified by time and place. Please indicate whether you have by now committed yourself to a certain situational context for initiating specific goal-directed actions in the sense of "When I encounter the situational context y, I will perform behavior z".

Subjects then indicated "yes" or "no" to whether they had actually formed implementation intentions. The main idea behind this approach is presumably that, with such a global measure, a person is expected to consider all possible factors which may facilitate or hinder behavioral enactment, and thus arrive at an overall assessment of implementation intentions. On the other hand, the completion of a questionnaire is a low-involvement activity for most people, making it unreasonable to expect the respondents to invest a high level of cognitive effort in such an endeavor (Tourangeau & Rasinski, 1988). From this vantage point, it might be advantageous to provide the respondents with specific items covering the when, where and how of implementation intentions to ensure that these particular aspects will be explicitly considered. Such a measure is also expected to be more reliable because it is based upon more information.

Overview

In the present study, the workings of implementation intentions were explored concerning two socially important behaviors: regular exercise and recycling of drinking cartons. The study served two main purposes. First, it aimed to investigate the role of implementation intentions in the context of the TPB, in particular in the relationships between intentions, perceived behavioral control and later behavior concerning regular exercise and recycling. In order to specify in more detail the psychological processes contributing to goal achievement, that is, performance of regular exercise and recycling of drinking cartons, a full mediational analysis was applied, starting with the relation between past behavior and actual behavioral performance, and then including the other theoretical predictors, namely perceived behavioral control, behavioral intention and implementation intentions, as well as all interactions. Second, implementation intentions were measured, rather than manipulated. Thus, this study explored the usefulness of a measurement of the degree to

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which participants had formed implementation intentions in the prediction of subsequent intended behavior.

METHOD

Participants and design

The study consisted of two waves, separated by two weeks. In the first wave, 142 college students in Bergen, Norway, filled out a questionnaire. Of these, 112 responded in the second wave, and thus formed the sample for the present analyses. No significant differences in demographics or any other variables were found when comparing those who did and those who did not respond to the second measurement (see Thompson & Rise, 2001, for more detailed information). The components of the TPB (behavioral intentions and perceived behavioral control) along with implementation intentions and past behavior were measured in the first wave, along with the other components of the TPB as well as a number of other concepts, in order to predict regular exercise and recycling of drinking cartons within a timeframe of two weeks. In the second wave, participants indicated whether or not they had executed the respective behaviors.

Measurement of concepts

Behavioral intention was measured by summing the response scores for the following four items: "I expect to deliver drinking cartons from my household for recycling/to do regular exercise during the next fortnight"; "How likely is it that you are going to deliver drinking cartons from your household for recycling/do regular exercise during the next fortnight?"; "I intend to deliver drinking cartons from my household for recycling/do regular exercise the next fortnight"; "I plan to deliver drinking cartons from my household for recycling/do regular exercise over the next fortnight". Seven-point response scales anchored at "very unlikely" (1) and "very likely" (7) were used for all items. No distinctions were made between behavioral expectations and intentions, since they formed one bipolar scale with a high internal consistency (alpha = 0.98 for both behaviors).

Perceived behavioral control was measured by eight items, such as: "If I wanted to, I would have no problem with exercising regularly/recycling drinking cartons over the next two weeks"; "I would like to exercise regularly/recycle drinking cartons over the next two weeks, but I don't know if I can"; "I have complete control over exercising regularly/recycling drinking cartons over the next two weeks"; "Exercising regularly/recycling drinking cartons over the next two weeks is difficult for me". Items were scored on a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Cronbach's alphas were 0.85 for recycling and 0.89 for exercise.

Implementation intentions were conceptualized in terms of *when*, *where* and *what to do* or *how to implement* the particular behavior. In order to reach the goal of actually performing the recycling of drinking cartons, a number of specific activities have to be planned (when and where) and executed (what or how). In relation to this behavior, the respondents were asked about whether they had made detailed plans about: "*when* you are going to deliver drinking cartons to the recycling site during the next 14 days" (i.e. on a specific day); "*where* you are going to deliver the cartons" (e.g. in a special container at the supermarket or own container for this particular purpose), "*how* the drinking cartons are going to be sorted (e.g. rinsed, wrapped, and placed in a box); "*how* the cartons are going to be stored" (e.g. in the cellar); "*how* the cartons are going to be delivered" (e.g. carried to a container). The respondents were requested to respond with "yes" (2) or "no" (1) to each of these questions, and the responses were subsequently summed.

Concerning regular exercise, the respondents were similarly asked whether they had made detailed plans about the following: "*when* you are going to exercise during the next fortnight?" (e.g. on a particular day); "*where* you are going to do the exercise" (e.g. in a fitness center); "*what* kind of exercise actions to be involved in" (e.g. jogging or swimming); "*how* to be transported to the specified place" (e.g. take the bus). The respondents were similarly requested to answer "yes" (2) or "no" (1) to each question, and scores were summed.

Past behavior was measured in terms of frequency measures during the last year: "In a typical two-week period in the last year, how many times have you delivered drinking cartons from your household for recycling/exercised?" The respondents were requested to register the actual number of times.

Actual recycling/exercise was measured by a second questionnaire two weeks later. Respondents were asked whether they had exercised regularly or recycled drinking cartons over the last two weeks. A score of "2" was given if the participants reported performing the respective behaviors within the specified period of time and "1" if they did not. Prior to the questions on exercise, the respondents were told the following: "Regular exercise implies physical activities such as aerobics, jogging, swimming, fast walk lasting at least 20–30 minutes on each occasion at least once or twice a week".

RESULTS

Implementation intentions

The correlations among the various indicators of implementation intentions were generally lower for recycling of drinking cartons than for regular exercise. For recycling, the strongest correlation was between "sort" and "store" ($r = 0.754$, $p < 0.0001$), while the lowest was between "sort" and "when" ($r = 0.244$, $p < 0.01$). For exercise, the strongest correlation was between "what" and "where" ($r = 0.799$, $p < 0.0001$), and the lowest between "how" and "when" ($r = 0.561$, $p < 0.0001$).

A principal component analysis (PCA) was run for the indicators of recycling and exercise implementation intentions, and only one factor emerged according to the eigenvalue > 1 criterion for both behaviors. For recycling the five items measuring implementation intentions accounted for 55.0% of the variance. These five items were subsequently combined into a sum score with an alpha coefficient of 0.794. For exercise, the four implementation intentions also formed one factor, accounting for 76.7% of the variance. These items were combined into a sum score with an alpha coefficient of 0.894.

Descriptive statistics and zero-order correlations for the main constructs are given in Tables 1 and 2, for recycling and exercise, respectively. It can be seen that the major difference between recycling and exercise concerns how often the behaviors had been performed in the past. The correlations among the predictors turned out in general to be relatively strong. For example, for recycling the correlation between implementation intentions and behavioral intentions was quite strong ($r = 0.638$, $p < 0.0001$); the same was the case for the correlation between implementation intentions and actual behavior ($r = 0.575$, $p < 0.0001$), and for the

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Table 1. *Descriptive statistics and correlations among the constructs for recycling (n = 112)*

	INT	PBC	IPI	PB	B	Mean	*SD*
INT	1.00	0.403	0.638	0.530	0.778	19.80	8.90
PBC		1.00	0.460	0.245	0.616	46.03	9.94
IPI			1.00	0.324	0.575	7.60	1.68
PB				1.00	0.521	1.29	1.68
B					1.00	1.60	0.49

Notes: All correlation coefficients are statistically significant at the $p < 0.001$ level.
INT = behavioral intention; PBC = perceived behavioral control; IPI = implementation intentions; PB = past behavior; B = actual behavior.

Table 2. *Descriptive statistics and correlations among the constructs for exercise (n = 112)*

	INT	PBC	IPI	PB	B	Mean	*SD*
INT	1.00	0.787	0.786	0.589	0.716	19.71	8.86
PBC		1.00	0.692	0.481	0.580	42.03	10.52
IPI			1.00	0.471	0.669	6.46	1.69
PB				1.00	0.505	3.83	3.54
B					1.00	1.61	0.49

Notes: All correlation coefficients are statistically significant at the $p < 0.001$ level.
INT = behavioral intention; PBC = perceived behavioral control; IPI = implementation intentions; PB = past behavior; B = actual behavior.

correlation between implementation intentions and perceived behavioral control ($r = 0.460$, $p < 0.001$), and past recycling ($r = 0.324$, $p < 0.001$). For regular exercise, there was a tendency toward stronger correlations among the constructs. Thus the correlation between implementation intentions and behavioral intentions was strong ($r = 0.786$, $p < 0.0001$). The lowest correlation was between implementation intentions and past exercise ($r = 0.471$, $p < 0.001$).

Prediction of recycling

Table 3 shows the hierarchical regression analysis in which actual recycling behavior was regressed on the following predictors, in this sequential manner: past behavior, perceived behavioral control, behavioral intention, and implementation intentions. In the second step, the direct effect of past behavior was reduced from a beta weight of 0.583 to 0.408 when perceived behavioral control entered the equation. When behavioral intention was included, the beta weight of past behavior was reduced to 0.236 ($p < 0.001$), while the direct effect of perceived behavioral control on actual recycling behavior was reduced from a beta weight of 0.459 to a non-significant beta weight of 0.124 ($p = 0.141$). Thus perceived behavioral control exerted an effect on recycling behavior only indirectly, through behavioral intention. In the final and most relevant step, implementation intentions entered the analysis. It can be seen that perceived behavioral control did not have an indirect effect on behavior as mediated by implementation intentions. Thus the effect of perceived behavioral control on actual behavior remained of similar size when implementation intentions were accounted for. Furthermore, there was only a minor change in beta weights for behavioral intentions when implementation intentions were accounted for (from 0.557 to 0.473). Thus implementation intentions did not mediate much of the effect of perceived behavioral control and behavioral intention on recycling. Furthermore, the beta weight of implementation intentions on recycling was of only borderline significance (0.137, $p = 0.077$). Only past behavior (0.234, $p < 0.001$) and behavioral intention (0.473, $p < 0.0001$) had a significant impact on behavioral performance. Altogether, the full model accounted for 65.5% of the variance in actual recycling.

Table 3. *Regressing (hierarchically) recycling behavior upon past behavior (PB), perceived behavioral control (PBC), behavioral intention (INT), and implementation intentions (IMP) (n = 112).*

Step	R^2	R^2_{change}	F_{change}	p level, F_{change}	Beta
Step 1					
PB	0.339	0.339	54.998	$p < 0.0001$	0.583 ($p < 0.0001$)
Step 2					
PB					0.408 ($p < 0.0001$)
PBC	0.510	0.180	39.696	$p < 0.0001$	0.459 ($p < 0.0001$)
Step 3					
PB					0.236 ($p < 0.001$)
PBC					0.124 ($p = 0.141$)
INT	0.644	0.125	36.925	$p < .0001$	0.557 ($p < 0.0001$)
Step 4					
PB					0.234 ($p < 0.001$)
PBC					0.117 ($p = 0.161$)
INT					0.473 ($p < 0.0001$)
IMP	0.655	0.011	3.190	$p < 0.077$	0.137 ($p = 0.077$)

Finally, three interaction terms were included in the regression model in a stepwise manner. First, the interaction term comprising past recycling and implementation intentions was included, then the term consisting of the product of perceived behavioral control and implementation intentions, and in the third step the interaction term comprising behavioral intention × implementation intentions was included. None of these steps contributed to a significant increase in R^2 of recycling of drinking cartons beyond that accounted for by the main effects of the other predictors.

To explore more fully the relation between perceived behavioral control, behavioral intentions and implementation intentions, the last was regressed on past behavior, perceived behavioral control and behavioral intentions. Here only behavioral intention had a significant beta weight (0.638, $p < 0.0001$). However, the predictive power of perceived behavioral control on implementation intentions was reduced

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Table 4. *Regressing (hierarchically) exercise behavior upon past behavior (PB), perceived behavioral control (PBC), behavioral intention (INT), and implementation intentions (IMP) (n = 112).*

Step	R^2	R^2_{change}	F_{change}	p level, F_{change}	Beta
Step 1					
PB	0.275	0.275	41.696	$p < 0.0001$	0.524 ($p < 0.0001$)
Step 2					
PB					0.322 ($p < 0.0001$)
PBC	0.418	0.143	26.695	$p < 0.0001$	0.428 ($p < 0.0001$)
Step 3					
PB					0.157 ($p < 0.058$)
PBC					0.042 ($p = 0.695$)
INT	0.529	0.111	25.551	$p < 0.0001$	0.590 ($p < 0.0001$)
Step 4					
PB					0.155 ($p = 0.055$)
PBC					–0.011 ($p = 0.915$)
INT					0.415 ($p < 0.002$)
IMP	0.557	0.028	6.848	$p < 0.010$	0.278 ($p < 0.010$)

from a beta weight of 0.438 ($p < 0.0001$) to an insignificant beta weight of 0.053 ($p = 0.616$) when behavioral intentions and past behavior were accounted for. Thus perceived behavioral control exerted a significant indirect effect on implementation intention mediated by behavioral intentions.

To provide a more detailed analysis of the relation between implementation intentions and recycling behavior, the latter was regressed on the five indicators of recycling implementation intentions in terms of when (sorting), where (storing) and how (delivery). The five indicators accounted for 40% of the variance in recycling, and the *where* aspect (i.e. a specific place of delivery) was by far the strongest determinant (beta = 0.534, $p < 0.0001$), followed by sorting (beta = 0.217, $p < 0.05$). The beta weights of the other predictors did not reach statistical significance.

Prediction of exercise

In Table 4, the hierarchical regression analysis is shown for the prediction of regular exercise. The predictive power of past behavior for subsequent exercise was substantially reduced when perceived behavioral control was included, from a beta weight of 0.524 ($p < 0.001$) in the first step to 0.322 ($p < 0.001$) in this step. Similarly, the beta weight of perceived behavioral control on behavior was substantially reduced from 0.428 ($p < 0.001$) to 0.042 ($p = 0.695$) when behavioral intentions were included, in step 3. Thus, as for recycling, perceived behavioral control influenced behavior only indirectly, through behavioral intentions. In the final step, it can be seen that the inclusion of implementation intentions did not change the predictive power of perceived behavioral control, which remained insignificant. For behavioral intention, the beta weight changed from 0.590 ($p < 0.0001$) to 0.415 ($p < 0.001$). Thus, in addition to having a strong direct effect on subsequent behavior (beta = 0.415, $p < 0.001$), behavioral intentions also affected regular exercise through implementation intentions, which in turn had significant direct effect on exercise behavior (beta = 0.278, $p < 0.01$). The beta weight of past behavior on exercise behavior was of only borderline significance ($p = 0.055$). Altogether, the three predictors accounted for 55.7% of the variance in regular exercise.

In the same way as for recycling, three interaction terms comprising exercise implementation intentions were included after the four predictors had been accounted for in a stepwise manner: past exercise × implementation intentions; perceived behavioral control × implementation intentions; and behavioral intentions × implementation intentions. None of these steps raised the explained variance of regular exercise above that accounted for by the four predictors.

As for recycling, exercise implementation intentions were regressed on past exercise behavior, perceived behavioral control, and exercise intention. The beta weight of perceived behavioral control was reduced from 0.605 ($p < 0.0001$) to 0.192 ($p < 0.05$) when implementation intentions were included. Thus, in addition to the direct effect on the formation of implementation intentions, perceived behavioral control had a relatively strong impact on implementation intentions mediated through behavioral intentions. Finally, exercise intentions were strongly related to exercise implementation intentions, having a beta weight of 0.630 ($p < 0.0001$), when past exercise and perceived behavioral control had been taken into account.

The next step was to explore the relation between the indicators of implementation intentions and exercise behavior. The latter was regressed on the *what*, *when*, *where*, and *how* aspects of implementation intentions. The four indicators of implementation intentions explained 46% of the variance in regular exercise, and the *when* aspect was the only statistically significant predictor (beta = 0.345, $p < 0.0001$).

DISCUSSION

The results of the present study suggest that it is possible to obtain a measure of implementation intentions, which appear to be useful in a survey context, and hence elucidate the workings of the concept in a TPB context. This conclusion may be derived from several pieces of information. First, the presence of implementation intentions was found to be related to performing two planned behaviors, regular exercise and recycling of drinking cartons, by exhibiting an additive effect beyond that of motivation to perform the two behaviors. The effectiveness of forming implementation intentions in the service of a goal intention confirms and replicates the findings of a number of other studies applying experimentally manipulated implementation intentions in a TPB context. In particular, the additive effect of implementation intentions was substantial as far as regular exercise is

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concerned, while the effect of implementation intentions for recycling was only borderline. This finding is in line with the argument of Gollwitzer and Oettingen (1998) that the enactment of health behaviors, like regular exercise, constitutes difficult and unpleasant projects (health goals), and should thus in particular benefit from being supplemented by implementation intentions. The results are consistent with the main prediction derived from the theory, which has been confirmed in a number of studies (Gollwitzer & Brandstätter, 1997; Gillholm *et al.*, 1999, 2001; Orbell *et al.*, 1997; Sheeran & Orbell, 1999, 2000; Verplanken & Faes, 1999).

On the other hand, none of the predicted interaction effects was confirmed. For example, the predicted interaction between the two forms of intentions, goal intention and implementation intentions, on actual behavior constitute a key tenet in the theory of implementation intentions. Gollwitzer and Brandstätter (1997) posit that people form implementation intentions when they anticipate difficulties in implementing the goal intention; that is, when they see no difficulties ahead on the road to the goal, motivation may be sufficient. This finding suggests that individuals who do not intend to perform regular exercise also engage in cognitive work about how to implement the alternative, namely to exercise on a regular basis. Alternatively, it might be due to the fact that most participants had positive intentions (mean intentions close to 20, with a maximum of 28). Thus the relative absence of negative intentions might explain why there was no interaction between behavioral intentions and implementation intentions on behavior. Neither was there an interaction between past behavior and implementation intentions on goal achievement (cf. Orbell *et al.*, 1997). This finding suggests that those who have been busy doing exercise in the past also benefit from forming implementation intentions. This is remarkable, considering that many of them presumably are already performing regular exercise successfully and consistently in the same context, and should have no need to form implementation intentions. On the other hand, it might be that implementation intentions are needed to *keep* doing the two behaviors we are concerned with.

The correlation between past behavior and implementation intentions was positive and of considerable magnitude ($r = 0.471$): the more frequently they have been exercising the last year, the higher the level of implementation intentions. There is also some indication that past behavior predicted future behavior beyond the effect of behavioral intention and implementation intentions. This suggests that, although the underlying mechanism is of a similar kind in terms of handing control to the environment, they do not entirely mimic each other. This finding may be understood in terms of their different history of formation, in that implementation intentions are formed by deliberate planning while habits are formed by repeated pairing of behavior and performance context (cf. Verplanken & Aarts, 1999). Neither was there an interaction between perceived behavioral control and implementation intentions on subsequent behavior.

The present study also provided a possibility for exploring in more detail the relation between perceived behavioral control and implementation intentions in a TPB context. The notion favored by Gollwitzer (1993) would appear to be that perceived control influences implementation intentions only indirectly, through goal intention. Only a few studies seem to have addressed this issue. Gärling and Fujii (2001) hypothesized that the direct effect of perceived behavioral control on implementation intentions should be negative, and they found empirical support for this idea. They argued that persons who believe that they have control over a particular behavior should have less need to increase control through planning intentions (i.e. forming implementation intentions). The results from the present study did not support this notion, in that, for exercise, the higher the perceived behavioral control the stronger was the formation of implementation intentions, while for recycling there was no relation. The present results provide partial support for the proposed links in the theory of implementation intentions; thus perceived behavioral control exerted its main effect on the formation of implementation intentions indirectly, through behavioral intentions, that is, through the motivational path. However, it should be noted that there are a number of differences between the study of Gärling and Fujii (2001) and the present one. For example, in the Swedish study the target behaviors were related to fictitious situations, while in the present study real-life behaviors were employed. Furthermore, they conceptualized implementation intentions more broadly, in terms of uncertainty reduction along with decisions about time and place, while the present study included the traditional aspects of implementation intentions (when, where, how).

As noted above, the formation of implementation intentions was particularly important for the translation of the intention to exercise regularly into actual behavioral performance. However, most important for goal achievement was to have a high degree of motivation: behavioral intentions were the strongest direct predictor of subsequent behavior. Furthermore, the effect of the prior predictors, past behavior and perceived behavioral control, on behavioral performance were mainly mediated through behavioral intention, which, according to the TPB, summarizes a person's motivation to act in a particular manner along with how hard the person is willing to try and how much time and effort that person is willing to devote in order to perform a behavior. On the other hand, the results indicate that such a direct effect model underestimates the motivational impact on the two behaviors, because there are also indications of a motivational path on behavior mediated through the formation of implementation intentions. These findings thus support the motivational underpinnings of the TPB. Nevertheless, the importance of having formed implementation intentions in the service of goal achievement suggests

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that motivation is not sufficient for behavioral performance. In particular, this seems to be the case concerning regular exercise, in which the adoption of a self-regulatory strategy appeared important for performing regular exercise.

The importance of implementation intentions in addition to the components of the TPB in the process of goal achievement also supports the claim made by Gollwitzer and Brandstätter (1997) that implementation intentions, in terms of specifying *when* and *where* to perform the behavior, should not be confused with the principle of compatibility, that is identifying a specific behavior in terms of the elements of action, target, context and time. In order to ensure high correlations between measures, they should correspond in specificity (Azjen & Fishbein, 1980). In particular, the *when* and *where* elements of implementation intentions may appear similar to the elements of *time* and *context*, respectively. Gollwitzer and Brandstätter (1997) argue that the principle of compatibility constitutes a psychometric gain in terms of improved prediction, whereas implementation intentions, as a self-regulatory strategy, provide increased psychological insight into the processes underlying the intention–behavior gap.

Implementation intentions also appeared to have been measured satisfactorily in terms of relatively high internal consistencies (0.794 and 0.894, respectively). Moreover, a factor analysis indicated that the implementation intentions items formed a single factor. These results are consistent with an effect indicator model (Bollen & Lennox, 1991). However, the results are also consistent with an alternative measurement model, notably a causal indicator model (Bollen & Lennox, 1991). Thus it makes reasonable sense to argue that the various planning acts (when, where and how) determine implementation intentions rather than vice versa. With the latter approach, behavioral performance may be promoted by inducing changes in the determinants of implementation intentions (cf. Bollen & Lennox, 1991). In this case, it makes sense to estimate the relative importance of the various planning aspects of implementations. The results from this analysis suggest that, if one wants to promote recycling of drinking cartons, one should urge people to identify and decide upon the place of delivery as well as on how to handle the cartons when emptied. On the other hand, with regular exercise one should ask people to decide on the time of their regular exercise.

The results of the present study suggest that, in order to promote regular exercise and to a lesser extent recycling of drinking cartons among young adults, it is not sufficient to strengthen their motivation. In addition, those who are motivated should be made aware of the benefit of implementation intentions, and be provided with instructions on how to make detailed plans (e.g. about the timing of exercise activities). In this way, contingencies between situational cues and goal-directed responses are installed ("I intend to jog on Saturday afternoon"), and the actions contributing to goal fulfillment should thus gain a degree of automaticity by being under the control of relevant situational cues. In this manner, rather simple manipulations may help install implementation intentions and make a substantial difference in terms of behavioral change. Correspondingly, for the promotion of recycling of drinking cartons, one should emphasize the place of delivery. The present results thus indicate that the TPB may benefit from the inclusion of the concept of implementation intentions to provide a more complete understanding of the psychological process by which motivation is translated into action.

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