



Evaluating the effects of implementation intention and self-concordance on behaviour

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The purpose of the present study was to investigate effects of implementation intentions on taking one multivitamin tablet, everyday, for 2 weeks, among individuals who endorsed self-concordant and self-discordant forms of motivation. A 2 (implementation intentions: yes, no) × 3 (motivation: self-concordance, self-discordance, control) experimental design was adopted with university students being exposed to manipulations of implementation intentions, self-concordance, and self-discordance (male = 110, female = 120, *M* age = 23.50 years, *SD* = 7.21). Results of the study indicated that while implementation intentions increased multivitamin intake for individuals who endorsed self-concordant and self-discordant forms of motivation, the combination of self-concordance and implementation intentions produced particularly enhanced levels of compliance on multivitamin intake. The implications of results of the present study to theory development and practice are discussed.

Self-determination theory proposes that often people do not adhere to a behaviour because they perceive that it is not concordant with the self (Deci & Ryan, 1985). Self-concordance has been defined as the extent to which people perceive goal-directed behaviours to be within their system of personal interests and values versus something one feels compelled to do by interpersonal and/or intra-personal forces (Sheldon & Elliot, 1999). One conclusion that emerges from contemporary research on self-determination theory is that individuals reporting self-discordant reasons for performing a behaviour are likely to actively contemplate pros and cons of performing the behaviour and make no commitment to change because self-discordant goals generate intra-personal conflict (Deci & Ryan, 1985, 1987; Sheldon & Kasser, 1998). In contrast, individuals reporting self-concordant reasons for executing a behaviour are likely to make a commitment to behaviour and make the necessary life-style changes to accommodate that behaviour (Deci, Eghrari, Patrick, & Leone, 1994;

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Deci, Koestner, & Ryan, 1999; Sheldon & Elliot, 1999; Sheldon & Houser-Marko, 2001). The reason for this is that experiences of self-concordance (i.e., experiences of self-determination) are associated with enhanced levels of energy and effort exertion which are essential for exercising self-control during the process of behavioural change (Moller, Deci, & Ryan, 2006; Sheldon & Elliot, 1999; Williams, Gagne, Ryan, & Deci, 2002; Williams *et al.*, 2006).

While self-concordance appears to influence behavioural enactment, for many individuals, self-concordance alone is not sufficient to encourage adherence. People often forget to perform behaviours or they may temporarily interrupt the execution of behaviour because other competing goal-directed behaviours gain priority over the original behaviour. In order to address the difficulties in adherence presented by low intention-behaviour relationships, Gollwitzer (1999) proposed implementation intentions as a powerful self-regulatory strategy that promotes initiation of goal-directed behaviour. In general, implementation intentions take the form 'if situation *z* arises then I will perform behaviour *x*'. The general experimental paradigm used to facilitate implementation intentions requires research participants to write down *when*, *where*, and/or *how* they will pursue their behavioural goals.

A clear trend emerging from this programme of research is that forming implementation intentions decreases the probability of people forgetting to initiate their goal-related behaviour at critical moments (Gollwitzer & Sheeran, 2006; Sheeran & Orbell, 1999; Webb & Sheeran, 2008). This is because planning *when* and *where* to initiate prospective action strengthens the mental association in memory between representations of situations and representations of actions (Aarts & Dijksterhuis, 2000; Aarts, Dijksterhuis, & Midden, 1999; Webb & Sheeran, 2007, 2008). Research has also shown that increased accessibility of situational representations in memory increases the probability of action opportunities to get noticed and be initiated, given that mere perception of action opportunities can elicit actions in an immediate and automatic way (Webb & Sheeran, 2007, 2008). Further, research has demonstrated that implementation exercises are particularly helpful with regard to behaviours and goals that are difficult to accomplish or co-occur with other behaviours or distractors (e.g., Hagger & Montasem, 2009), and for people who are plagued by distractive, counter-intentional intrusive thoughts, such as individuals who suffer from drug addiction and schizophrenia (Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997). Moreover, there is evidence to suggest that implementation intention effects are sensitive to (a) the strength of the goal intention, measured through self-report as the extent to which participants intend to pursue a goal behaviour (i.e., 'I Intend to achieve X') and (b) the goal activation, which refers to the extent to which the memory of a goal representation is active or not. In two independent studies, Sheeran, Webb, and Gollwitzer (2005) found an interaction between implementation intentions and goal intentions such that implementation intentions predicted goal attainment when goal intentions were strong (Study 1) or active (Study 2).

Recently, research has examined the combined effects that self-concordance and implementation intentions exert on goal progress (see also Koestner, Lekes, Powers, & Chicoine, 2002; Koestner *et al.*, 2006; Koestner, Otis, Powers, Pelletier, & Gagnon, 2008). The rationale behind testing these effects was that the increased levels of energy and effort often displayed by individuals reporting self-concordant reasons for acting may not be sufficient in facilitating effective goal pursuit (Moller *et al.*, 2006). This is because successful goal pursuit requires continuous adjustments of original plans and such adjustments may deplete energy resources and corresponding capacity to exert

sustained effort among self-concordant individuals. Because implementation intentions relieve the burden of making continuous adjustments and commitments to a plan (Brandstätter *et al.*, 2001; Webb & Sheeran, 2003), implementation intentions may reduce depletion of energy resources (Hagger, Wood, Stiff, & Chatzisarantis, 2010; Moller *et al.*, 2006), and thus enable the energy-advantage associated with self-concordance to become especially evident. To date, a number of studies have indeed found a statistically significant interaction between self-concordance and implementation intention such that individuals who furnished self-concordant goals with implementation intentions displayed the greatest goal progress (see also Koestner *et al.*, 2006, 2008). However, there are a number of reasons why previous research cannot unequivocally support the hypothesis that implementation intentions are beneficial for individuals pursuing self-discordant goals relative to individuals who pursue self-discordant goals but do not furnish these goals with implementation intentions.

Previous studies that found a statistically significant interaction between self-concordance and implementation intentions did not conduct simple slopes analysis to compare individuals furnishing self-discordant goals with implementation intentions with individuals who did not furnish self-discordant goals with implementation intentions (see Koestner *et al.*, 2002, 2006, 2008). For example, in a series of studies conducted recently by Koestner *et al.* (2008; Studies 2 and 3), it was shown that individuals who furnished self-concordant forms of motivation with implementation intentions progressed more at their goals than individuals who furnished non-self-concordant motivation with implementation intentions. However, simple slopes analysis was not used to compare self-discordant individuals who formed implementation intentions with self-discordant individuals who did not form implementation intentions (see also Koestner *et al.*, 2002). Although a statistically significant interaction for the effect of implementation intention and self-concordance on goal progress supports the notion that interventions employing these two strategies in tandem produces greater goal progress than any other combination between self-concordance, self-discordance, and implementation intentions, analysis of the statistically significant interaction might have also shown that furnishing self-discordant goals with implementation intentions produced greater goal progress than the goal progress produced by self-discordance without implementation intentions (Aiken & West, 1991). We also think that there are theoretical grounds and experimental evidence to suggest that implementation intentions will be beneficial for individuals whose motivation is self-discordant. For example, one implication of Brandstätter *et al.*'s (2001) studies is that implementation intentions are beneficial for individuals who are characterized by less optimal forms of motivation because implementation exercises help individuals stay focused on the goal at hand and avoid deliberation of unfavourable feelings and perceptions associated with less optimal forms of motivation (Gollwitzer & Schaal, 1997; Webb & Sheeran, 2008). As the motivation of self-discordant individuals is less optimal in a sense that it does not express personal interests and values (Sheldon & Elliot, 1999), it is predicted that implementation intentions will be beneficial for participants who endorse self-discordant forms of motivation (relative to individuals who do not furnish self-discordant goals with implementation intentions).

Most critical, we propose that it is important to re-examine the interactive effects of self-concordance and implementation intentions on goal progress and behaviour because previous studies did not sufficiently observe the well-established effects of self-concordance (relative to self-discordance) or implementation intentions (relative to no-implementation intention conditions) on goal progress when observing the

interaction (i.e., Koestner *et al.*, 2002, 2006). For example, Koestner *et al.* (2002, Study 1) did not report a significant effect of self-concordance in the control group in which participants did not form implementation intentions (see also Koestner *et al.*, 2008; Studies 2 and 3). Neither did they replicate the well-established negative effects of self-discordance on motivation (Deci *et al.*, 1999). These null findings are inconsistent with a number of studies supporting positive relationships between self-concordance, implementation intentions, and goal progress and indicate that manipulations were not powerful enough to produce the well-established self-concordance, self-discordance, and/or implementation intention effects (Gollwitzer & Sheeran, 2006; Koestner *et al.*, 2002). They also render interpretations of previous data sets problematic. For example, if a re-analysis of previous data sets does not support, for example, an implementation intention effect in the domain of self-discordance then one explanation could be that the manipulation of implementation intentions was not sufficiently powerful to produce such an effect. In addition, if implementation intentions have been found to be beneficial in the domain of self-discordance then it can be argued that this may be due to the manipulations of self-discordance not being powerful enough to produce self-discordance effects.

Overall, the current study contributes to the extant literature by evaluating implementation intention effects in the domains of self-concordance and self-discordance. Our target goal behaviour is consuming one multivitamin tablet everyday for a fortnight. In accordance with previous research (Koestner *et al.*, 2002, 2006, 2008), we hypothesized that individuals who were prompted to adopt self-concordant motivation and formed implementation intentions would consume more multivitamin tablets than participants who adopted any other combination of the self-concordance, self-discordance, and implementation intention manipulations (H_1). In addition, we hypothesized that participants who furnished self-discordant motivation with implementation intentions would consume more multivitamin tablets than participants that did not furnish self-discordant motivation with implementation intentions (H_2). Finally, in accordance with previous research supporting moderating effects of goal intentions on implementation intention effects (Sheeran *et al.*, 2005), the present study measured and statistically controlled for the effects of intentions when evaluating research hypotheses.

Method

Research participants and procedure

The sample comprised 230 students recruited from 10 compulsory classes at university campuses (male = 110, female = 120, M age = 23.50 years, SD = 7.21). To be included in the study, participants should not have consumed multivitamin pills the last 5 weeks. We adopted a 3 (motivation: self-concordance, self-discordance, none) \times 2 (implementation intentions: yes, no) experimental design. Manipulation and measurement of variables took place in quiet classroom settings of less than 20 participants. Upon arrival, participants completed consent forms and were provided with a pack of 14 multivitamin tablets. Immediately after, all participants were informed that the study required from them to take one tablet everyday for the next 2 weeks. We manipulated variables via instructions included in a questionnaire. Participants were randomly allocated to one of six experimental conditions. Two weeks after the manipulation of variables, participants were approached again in classrooms and were

asked to report how many multivitamin tablets had taken the last 2 weeks. Out of the 230 participants, 199 were present and reported multivitamin intake in the classrooms (male = 94, female = 105, M age = 23.55 years, SD = 7.34, response rate = 86.5%). This high response rate was due to the fact that participants were attending compulsory classes. Those participants who were absent were contacted via e-mail and reported their multivitamin intake via e-mail. Out of the 31 participants who were recontacted via e-mail, only one male participant did not report his multivitamin intake. It is also important to note here that among those participants who were present in the classes, 22 participants did not bring the packets of multivitamin tablets with them. Those 22 participants were asked to verify their reports of multivitamin intake through an e-mail. None of the participants who did not bring the multivitamin packets with them made a report that was different from the report made during data collection. The study was approved by University's ethics committee.

Manipulations

Implementation intentions

We used a global format rather than an 'if-then' format in manipulating implementation intentions (see Chapman, Armitage, & Norman, 2009; Sniehotta, 2009). That is, we prompted participants to specify in an open-ended question 'where' and 'when' they were willing to take one multivitamin tablet, everyday, for the following 14 days (Sheeran & Orbell, 1999). Specifically, participants read the following instructions: 'Please decide now where (a place) and when (at what time) you will take a multivitamin tablet everyday the following 2 weeks and write it down in the space below'. A space was also provided for participants to report their responses. The space prompted participants to report a place (e.g., 'please report a place here') and a time (e.g., 'please report a time here'). In the control group (no implementation intention group), participants were not prompted to form implementation intentions but were prompted to take one tablet everyday for the next 2 weeks.

Motivation

Motivation was operationally defined as the extent to which participants perceived consumption of multivitamin tablets to be personally important to them or that it was important to the experimenter. We used self-reflection exercises to facilitate perceptions of self-concordant and self-discordant motivation (Koestner *et al.*, 2002). Specifically, self-concordance was manipulated by asking participants think why taking one multivitamin tablet, everyday, for the following 2 weeks was important to them personally. Participants were also asked to write the reasons explaining importance of multivitamin consumption in a questionnaire and reflect on these reasons for approximately 5 min. In the self-discordance group, participants were asked to think why taking multivitamin tablets everyday, the next 5 weeks was important to the experimenter. In this group, participants were also asked to write the experimenter's reasons for introducing consumption of multivitamin and reflect on these reasons for approximately 5 min. Our design also included a control group where participants were not asked to reflect on any reason. As before, participants in this group were prompted to take one multivitamin tablet, everyday, for the next 2 weeks.

Measures

Self-concordance

Immediately after manipulation of motivation, participants completed measures of self-concordance for taking multivitamin tablets (Williams *et al.*, 2006). The questionnaire asked why the participants decided to take multivitamin tablets and then provided several possible reasons that had been pre-selected to represent four different motivational styles. The forms of self-discordant motivation that the questionnaire measured were external regulation (e.g., 'I decided to take multivitamin tablets because others say I should') and introjection (e.g., 'I decided to take multivitamin tablets because I will feel guilty if I disagree to take multivitamin tablets'). Identification (e.g., 'It is important to me to take multivitamin tablets') and intrinsic motivation (e.g., 'I take multivitamin tablets because it is enjoyable') reflected more self-concordant forms of motivation. Reasons for taking multivitamin pills were measured on seven-point scales ranging from (1) *not at all true* to (7) *very true*.

In accordance with previous research (Ryan & Connell, 1989), we calculated a relative autonomy index (RAI) to identify whether participants endorsed self-discordant or self-concordant forms of motivation. The RAI was calculated by the sum of weighted responses to the self-concordance and self-discordance measures using the following weighting procedure: external regulation $\times (-2)$ + introjection $\times (-1)$ + identification + intrinsic motivation $\times (2)$. In the present study, we used the RAI to evaluate whether our manipulations of motivation were successful in inducing self-concordance and self-discordance.

Intentions

Intentions to take multivitamin tablets were measured after the manipulation of self-concordance and implementation intentions. Measures of intentions serve the role of a general measure of motivation that indicate the extent to which individuals intend to take multivitamin tablets over the next 2 weeks. We measured intentions through three items and on seven-point Likert scales ranging from *strongly disagree* (1) to *strongly agree* (7). An example item was: 'I intend to take one multivitamin tablet every day over the next two weeks' (Ajzen & Fishbein, 1980).

Multivitamin intake

Consumption of multivitamin tablets was measured 2 weeks after the manipulation of implementation intentions and self-concordance. Specifically, participants were asked to bring the multivitamin tablets with them in the classrooms 2 weeks after the manipulation self-concordance and implementation intentions. While in the classrooms, participants were asked to count and report how many tablets they did not consume the last 2 weeks. Those who forgot to bring the packets of tablets with them were allowed to report consumption of multivitamin tablets but they were also asked to verify their multivitamin intake via an e-mail.

Results

Manipulation check

In the preliminary analysis, we tested whether our self-reflection exercises were successful in facilitating self-concordant and self-discordant motivations.

Specifically, we conducted a 3 (motivation: self-concordance, self-discordance, control) \times 2 (implementation intentions: yes, no) analysis of variance using measures of RAI as a dependent variable. Results from this analysis revealed a main effect of motivation on measures of RAI ($F(2) = 7.86, p < .05, \eta^2 = .07$). Implementation intentions ($F(1) = 0.91, p > .05, \eta^2 = .01$) did not exhibit main effects on RAI. *Post hoc* analysis of the statistically significant effect revealed that participants who were prompted to reflect on self-concordant reasons reported a higher score on RAI ($M = 1.99, SE = .28$) than participants who were prompted to reflect on self-discordant reasons ($M = 0.63, SE = .30$) ($t(1) = 3.46, p < .05$) and participants who were not prompted to reflect on any reason ($M = 0.78, SE = .18$) ($t(1) = 3.39, p < .05$). In addition, the RAI of participants who reflected on self-concordant reasons was greater than zero ($t(1) = 6.60, p < .05$). However, participants who reflected on self-discordant reasons did not report lower scores on the RAI than participants who did not reflect on any reason for taking multivitamin tablets ($t(1) = 0.30, p > .05$). These results therefore support the view that while self-reflection exercises were successful in facilitating self-concordance, our manipulations were less successful in facilitating self-discordance. For this reason, the group of participants who reflected on self-discordant reasons should be treated as a group of participants displaying a 'less self-concordant form of motivation' and not as a group of participants displaying a self-discordant form of motivation.

We also conducted a 3 (motivation: self-concordance, self-discordance, control) \times 2 (implementation intentions: yes, no) analysis of variance using intentions as a dependent variable. We conducted this analysis in order to investigate whether our manipulation of implementation intentions had an effect on intentions. According to Webb and Sheeran's (2008) recent meta-analysis, implementation intentions should influence behaviour without affecting intentions and as such we did not expect to find an effect of implementation intentions manipulations on intentions. Results from this analysis did not reveal a statistically significant effect of implementation intention on intentions ($F(1) = 0.63, p > .05, \eta^2 = .01$). However, our manipulation of motivation did influence intentions ($F(2) = 7.54, p < .05, \eta^2 = .06$). Further, *post hoc* analysis revealed that participants who reflected on self-concordant reasons reported stronger intentions ($M = 4.91, SE = .17$) than participants who reflected on self-discordant reasons ($M = 4.15, SE = .10$) ($t(1) = 4.04, p < .05$) and of participants who were not exposed to self-reflection exercises ($M = 4.42, SE = .18$) ($t(1) = 2.45, p < .05$). Participants who reflected on self-discordant reasons did not report stronger intentions than participants who did not reflect on any reason ($t(1) = 1.37, p > .05$). Because intentions varied across conditions, we statistically controlled for intentions when evaluating research hypotheses. Most important, the analysis of variance did not support two-way interactions between implementation intentions and motivation on RAI or intentions (all F s < 1.0).

Moreover, we conducted a chi-squared test to examine whether our manipulations of motivation influenced the proportion of participants who forgot to bring the packets of multivitamin tablets with them at follow-up. Results from this analysis revealed that among the participants who forgot to bring the packets of multivitamin tablets with them, 12 participants (54.5%) had been allocated to the control condition, 6 participants (27.3%) were allocated to the self-discordance condition, and 4 participants to the self-concordance condition (18.2%). However, this observed difference in proportions was not statistically significant across conditions ($\chi^2(2) = 1.09, p > .05$).

Table 1 presents descriptive statistics for multivitamin intake, RAI, and intentions. In addition, Cronbach's alpha reliability for RAI and intentions are reported. All measures displayed satisfactory levels of internal consistency reliability. Correlations revealed positive relationships between multivitamin intake and intentions. RAI was positively associated with intentions but not with multivitamin intake.

Table 1. Descriptive statistics

	<i>M</i>	<i>SD</i>	α	1	2	3
1. Number of multivitamin pills taken	9.87	4.97	–	1.0		
2. Intentions	4.36	1.34	.93	.40*	1.0	
3. RAI	1.02	2.08	.81	.07	.30*	1.0

* $p < .01$.

The effects of self-reflection exercises and implementation exercises on multivitamin intake

To examine our hypothesis, a 3 (motivation: self-concordance, less self-discordance, control) \times 2 (implementation intentions: yes, no) analysis of covariance was conducted using actual number of multivitamin tablets as a dependent variable and intentions as a covariate. Results revealed statistically significant main effects for motivation ($F(2) = 7.52$, $p < .05$, $\eta^2 = .06$) and implementation intentions ($F(1) = 29.29$, $p < .05$, $\eta^2 = .12$). *Post hoc* univariate analyses revealed that participants who were prompted to adopt self-concordant motivation consumed more multivitamin tablets ($M = 11.33$, $SE = .57$) than participants who were prompted to adopt self-discordant motivation, termed the 'less self-concordant' group ($M = 8.11$, $SE = .61$) ($t(1) = 5.68$, $p < .05$) and participants in the control group ($M = 9.88$, $SE = .38$, $t(1) = 3.98$, $p < .05$). Interestingly, participants who were prompted to adopt a less self-concordant form of motivation consumed fewer multivitamin tablets than participants in the control condition ($t(1) = 2.00$, $p < .05$). Moreover, participants who were prompted to form implementation intentions consumed more multivitamin tablets ($M = 11.41$, $SE = .43$) than participants in the control group ($M = 8.14$, $SE = .43$, $t(1) = 5.83$, $p < .05$).

Most important, the analysis of covariance revealed a statistically significant motivation by implementation intentions interaction ($F(2) = 4.18$, $p < .05$, $\eta^2 = .04$). In accordance with Hypothesis 1, planned comparisons revealed that self-concordant participants who formed implementation intentions consumed more multivitamin tablets than participants in all other groups ($t(1) = 16.83$, $p < .05$) (see Table 2 and Figure 1). In accordance with Hypothesis 2, the analysis of covariance also revealed

Table 2. The effects of implementation intentions and self-concordance on multivitamin intake

Motivation	Implementation intentions	<i>M</i>	<i>SE</i>
Self-discordance	No ($N = 22$)	5.50	.84
Control	No ($N = 28$)	8.16	.56
Self-concordance	No ($N = 63$)	10.81	.95
Self-discordance	Yes ($N = 59$)	10.88	.58
Control	Yes ($N = 20$)	10.75	.99
Self-concordance	Yes ($N = 38$)	13.24	.73

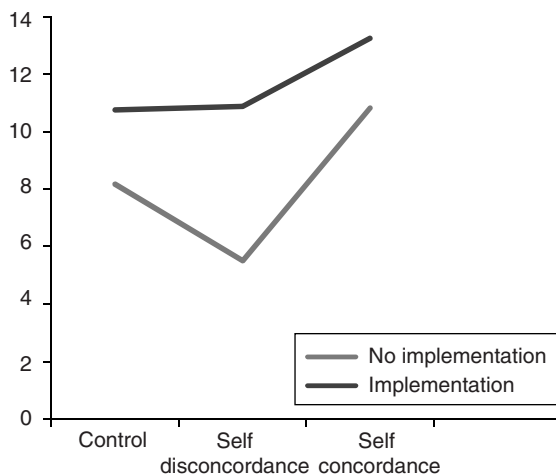


Figure 1. Effects of implementation intentions and self-concordance on multivitamin intake.

that participants who were allocated to the 'less self-concordant' group and formed implementation intentions consumed more multivitamin tablets than participants assigned to the 'less self-concordant' and did not form implementation intentions ($t(1) = 4.02, p < .05$). Interestingly, the 'less self-concordant' group that was prompted to form implementation intentions did not consume less multivitamin pills than self-concordant participants who did not form implementation intentions ($t(1) = 0.11, p > .05$) or participants who formed implementation intentions but were not prompted to adopt any particular motivational orientation ($t(1) = 0.04, p > .05$). However, the less self-concordant group that formed implementation intentions consumed more multivitamin tablets than participants in the control group ($t(1) = 3.01, p < .05$). Yet, in accordance with previous research testing tenets of self-determination theory, we found that individuals who did not furnish self-discordant motivation with implementation intentions consumed less vitamin tablets than participants in the control group ($t(1) = 2.12, p < .05$) whereas the converse was true for participants who did not furnish self-concordant motivation with implementation intentions ($t(1) = 2.06, p < .05$).¹

Discussion

The purpose of the present study was to examine the effects of implementation intentions and self-concordance on multivitamin intake. One finding that emerged from the present study was that self-concordance and implementation intention exercises facilitated enhanced compliance rates to behaviour. These results are consistent with self-determination theory (Deci *et al.*, 1999) and Gollwitzer's (1990) action phase

¹ An analysis of covariance that included participants who brought the packets of multivitamin tablets with them revealed similar results. Specifically, the analysis of covariance indicated statistically significant main effects for self-concordance ($F(2) = 7.78, p < .05, \eta^2 = .07$) and implementation intentions ($F(1) = 26.51, p < .05, \eta^2 = .12$). Most critical, the interaction between implementation intentions and self-concordance was also statistically significant ($F(2) = 3.94, p < .05, \eta^2 = .04$). These results therefore corroborate the view that whether or not participants brought the multivitamin packets with them did not influence results of the study.

model, and suggest that techniques that prompt individuals to strategically decide when and where to perform behaviour as well as the motives behind those strategic decisions are important determinants of behaviour (Gollwitzer & Sheeran, 2006; Koestner *et al.*, 2002). Interestingly, our manipulation of motivation produced results that are very much in line with tenets of self-determination theory. As shown in Figure 1, individuals who reflected on self-discordant reasons consumed fewer multivitamin tablets than participants in the control group. These findings are in line with an abundance of evidence corroborating the deleterious effects that self-discordant forms of motivation have on compliance rates (Deci *et al.*, 1999). Conversely, our findings also corroborate the well-established positive effects that self-concordance has on adherence (Deci *et al.*, 1999): individuals who reflected on self-concordant reasons consumed more multivitamin tablets than individuals in the control group.

The present study supports and extends the well-established findings on the interactive effects of implementation intentions and self-concordance manipulations on intentional behaviour by providing a complete 2×3 factorial test of the implementation intention by self-concordance interaction. In accordance with Hypothesis 1, results demonstrated that self-concordant individuals who formed implementation intentions consumed more multivitamin tablets than participants in any other of the other five groups (see Table 2 and Figure 1). These results compare favourably with Koestner *et al.*'s (2002, 2006) studies that showed beneficial effects of implementation intentions for self-concordant individuals. However, it is important to note that previous research did not provide a rigorous test of the combined effects of implementation intentions and self-concordance on behaviour because the implementation intentions or self-concordance manipulations did not to produce main effects or because combined effects did not control for main effects of self-concordance, implementation intentions, and intentions (Koestner *et al.*, 2006). In effect, failure to control for main effects reduces the robustness of previous experimental tests because empirical substantiation of combined effects requires consideration of main effects (Aiken & West, 1991). Therefore, by controlling for main effects of self-concordance and implementation intentions in estimating self-concordance by implementation intentions combined effects, the present study is the first to provide a rigorous test of the self-concordance by implementation intentions interactive effects. These interactive effects of self-concordance and implementation intentions on behaviour also support the notion that although self-concordance and implementation exercises alone can be expected to produce main effects on behaviour, self-concordance, and implementation intentions work synergistically and lead to particularly pronounced effects on behaviour.

The present study not only evaluated effects of implementation intentions among self-concordant participants, but also observed implementation intention effects among individuals who displayed 'less self-concordant' forms of motivation. In accordance with Hypothesis 2, the present study demonstrated that implementation intention exercises enhanced compliance rates to behaviour among those participants. This finding is consistent with Brandstätter *et al.*'s (2001) studies that pointed out that implementation exercises were particularly beneficial for people who possess poor self-regulatory skills (see also Gollwitzer & Schaal, 1997). Given that the ability to use volitional resources for action-control is impaired when motivation becomes less self-concordant (Deci *et al.*, 1999; Moller *et al.*, 2006; Sheldon & Elliot, 1999), results of the current studies suggest that implementation intention exercises helped participants who reflected on self-discordant reasons (the less self-concordant group) to gain control over the initiation and regulation of behaviour.

It is important to note here that participants who reflected on self-discordant reasons and formed implementation intentions consumed fewer multivitamin tablets relative to participants who reflected on self-concordant reasons and formed implementation intentions. Therefore, although results support the notion that implementation exercises are beneficial for individuals who reflect upon self-discordant reasons, results corroborate the view that the combination of self-concordance and implementation intentions led to the greatest compliance rates (Koestner *et al.*, 2002). Therefore, the combination of self-concordance and implementation intentions should be treated as the optimal form of intervention and should be preferred whenever promotion of behaviour is the objective of the intervention. However, results of the present study also suggest that when self-concordance is difficult to facilitate, because the target behaviour is mundane, dull, and/or repetitive (see Deci & Ryan, 1985; Deci *et al.*, 1994), implementation exercises may provide a short-term solution and facilitate effective goal pursuit. For example, some health behaviours (e.g., physical activity) may be more interesting and enjoyable than others (e.g., visiting the local GP) and a health behaviour (e.g., physical activity) that is enjoyable and important for a group of individuals (e.g., young people) may be less important and less interesting for other groups (e.g., elderly). Such variation in self-concordance across individuals, settings, and behaviour types suggests that self-concordance may be difficult to facilitate in some cases (Deci & Ryan, 1985), and practitioners may be faced with the task to motivate health behaviour in the domain of self-discordance. Results of the present study suggest that in these difficult situations, implementation intentions can be of great benefit and help practitioners overcome the difficulties associated with self-discordant motivation. Implementation intentions can be beneficial for self-discordant participants because they prevent deliberation of unfavorable feelings and perceptions associated with self-discordant motivation.

Limitations and conclusions

One limitation of the present study is concerned with failure of our experimental manipulations to induce a state of self-discordance. However, it is also important to note that our so-called 'less self-concordant' group consumed fewer multivitamin pills than the group of participants who were not exposed to self-reflection exercises. These differential effects exerted by the control and the 'less self-concordant' groups may support the notion that our manipulations have been successful in inducing self-discordance but self-report measures of self-concordance might have not been adequate in identifying changes in self-discordance. In any case, we believe that future research should attempt to replicate results of the present study by using different methods of manipulating and/or measuring self-discordance (Deci *et al.*, 1994). Another limitation of the present study is that it does not explain how the combination of self-concordance and implementation intentions influences behaviour. We think that ego depletion and levels of ego energy and effort may explain the combined effects of self-concordance and implementation intentions (see Hagger *et al.*, 2010). This is because self-concordance has been consistently associated with enhanced levels of ego-energy and effort (Moller *et al.*, 2006) whereas implementation intentions have been associated with 'savings' in ego energy which is valuable in the translation of intentions into actions (Webb & Sheeran, 2003, 2007). Moreover, it is important to acknowledge the unequal size of groups involved in our analysis (see Table 2). However, an additional analysis using Waller and Duncan's *post hoc* test, a test that has

been specifically designed to control for unequal group sizes, revealed the same results as our original analysis.

Finally, it is important to recognize that our manipulations of implementation intentions used a global format rather than a more specific 'if-then' format (Chapman *et al.*, 2009; Sniehotta, 2009). Global implementation intentions differ from implementation intentions that use an 'if-then' format in that global formats simply prompt participants to report a place and a time. In contrast, 'if-then' formats prompt individuals to link an action opportunity (e.g., time or place) to a behaviour by explicitly asking individuals to report a place and a time within an 'if-then' format (e.g., 'as soon as I am in _____ (please cite a situation) I will take a multivitamin tablet'). This distinction between global formats and 'if-then' formats is important to highlight because some laboratory studies have documented that 'if-then' formats produce stronger behavioural effects than global formats. This is because 'if-then' formats forge stronger mental links between cognitive representations of action opportunities and cognitive representations of actions than global formats (Oettingen, Honig, & Gollwitzer, 2000). However, Chapman *et al.* (2009) have recently reported that the superiority of 'if-then' plans holds only among individuals who engage in the target behaviour on a regular basis (e.g., habitual exercisers, habitual healthy eaters). Among individuals who do not engage in the target behaviour on a regular basis, global implementation intentions produce slightly greater effects. Therefore, our choice to use a global format should not have underestimated implementation intention effects because our study targeted individuals who did not consume multivitamin pills on a regular basis. Most relevant, the effect size describing effects of implementation intention was medium to large ($d = .60$) and compares favourably with implementation intention effects obtained in laboratory settings or naturalistic settings (Chapman *et al.*, 2009; Gollwitzer & Sheeran, 2006).

In conclusion, the unique contribution of the present study is concerned with the demonstration that implementation exercises influence behaviour regardless of whether motivation is self-concordant or self-discordant. These results support the generality of implementation intention effects across different motivational domains and suggest that implementation intentions are a useful strategy effecting behavioural change. Further, the present study demonstrates that compliance rates to interventions can be maximized to levels greater than those produced by self-concordance and implementation intentions alone by interventions furnishing self-concordant motivation with implementation intentions.

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