

This is a preprint of an article whose final and definitive form has been published in *Psychology & Health* © 2003 [copyright Taylor & Francis]; *Psychology & Health* is available online at informaworld™ and the article can be accessed at <http://www.informaworld.com/smpp/content~content=a713648139~db=all~order=page>

The Use of Implementation Intentions and the Decision Balance Sheet
in Promoting Exercise Behaviour.

Andrew Prestwich

Rebecca Lawton

and

Mark Conner

University of Leeds, United Kingdom

Running Head: EXERCISE IMPLEMENTATION INTENTIONS

Address correspondence to:

Andrew Prestwich

Institute of Psychological Sciences

University of Leeds

LEEDS LS2 9JT

United Kingdom

email: a.j.prestwich@leeds.ac.uk; Tel. +44 (0) 113 343 8559

ABSTRACT

Although increasing exercise and fitness has often been associated with positive health outcomes, infrequent exercise participation has remained a problem. Since two distinct motivational and volitional phases to goal pursuit have been proposed (Heckhausen, 1991; Gollwitzer, 1993), a combined motivational (decision balance sheet, DBS) and volitional (implementation intentions) intervention was predicted to be more effective in increasing exercise behaviour than a control or either strategy alone. A total of 86 students were randomly assigned to one of the four conditions, and were all asked to try to exercise two more times a week than they currently did, over a four week period. Their fitness levels were measured through fitness tests conducted pre and post-intervention. A priori orthogonal contrasts indicated that the experimental strategies produced a greater increase in exercise frequency and total time spent exercising per week and accordingly showed greater fitness improvements than the control group. Moreover, the volitional groups taken together produced greater increase in time spent exercising and a marginally greater improvement in frequency than the DBS alone. The combined intervention led to improvements in fitness and marginal increases in frequency over the implementation intention alone group. It is proposed that for the combined group the DBS may have aided recall of the implementation intention or increased commitment to it, as remembering and then acting on the plan, in the stated place and time, mediated the implementation intention-behaviour relationship. The combined intervention produced the greatest fitness improvements, indicating that this strategy can lead to important health benefits. *Keywords:* Implementation Intentions; Decision Balance Sheet; Exercise behaviour; Volition; Motivation stability.

INTRODUCTION

Poor physical fitness has become a major concern for society, through its effects on public health. Inactivity has been shown to be associated with negative consequences such as coronary heart disease (European Heart Network, 1998) and stress (Twisk, Snel, Kemper & van Mechelen, 1999; Heslop et al., 2001). This, coupled with the potential benefits of exercise such as improvement in general well-being (Wielenga et al., 1998), suggests the importance of initiation and maintenance of exercise behaviour. Dytell, Trent and Conway (1991) showed that both exercise and fitness lead directly to positive health outcomes in males, whilst fitness tended to mediate the exercise and well-being relationship in females. Clearly an intervention that increases both exercise participation and fitness is of great importance. Even though exercise is important for health, infrequent exercise participation has remained problematic (Crespo, Keteyian, Heath & Sempos, 1996) even within late adolescence (Pate, Heath, Dowda & Trost, 1996).

Rational decision making procedures in which the individual evaluates the positive and negative consequences of engaging in exercise, have directly and consistently enhanced (Silva & Weinberg, 1984) or helped maintain (Nigg, Courneya & Estabrooks, 1997) exercise behaviour. Wankel, Yardley and Graham (1985) indicated the decision balance sheet (DBS) raised the awareness of the consequences of exercise and significantly raised exercise participation. The application of the DBS requires participants to write down the anticipated consequences of exercise in terms of gains and losses to self and important

others; and approval and disapproval of self and others. Desired responses, which encourage initiation and discourage exercise problems, are then verbally reinforced. Self-disclosure to an accepting interviewer is thought to be central in enhancing commitment or motivation towards the goal (Janis, 1975). More recently, it has been argued that articulating the reasons for concern and the arguments for change for themselves in an interview setting is more effective for the individual than straightforward advice giving. This is because most people do not enter consultation in a state of readiness to change their exercise patterns (Rollnick, Heather & Bell, 1992). This principle has been successfully applied within motivational interviewing (Heather, Rollnick, Bell & Richmond, 1996), a technique which incorporates the elements of advantage and disadvantage reasoning used in the DBS. These studies have indicated the usefulness of involving participants in decisions before and after the initiation of a health-related programme.

Having thought through the consequences of their decision to act in a particular way, individuals using the DBS could be said to hold a strong degree of intention formation, or well formed intentions. Bagozzi and Yi (1989) showed that the degree of intention formation moderated the relationship between intention and behaviour, such that individuals who had considered the consequences of performing a novel behaviour showed a significantly stronger relationship between their intentions and behaviour. Hence the DBS may improve the initiation of exercise through an increase in motivation and intention formation.

Since the DBS focuses on the formation of an intention it is best described as a motivational technique. Intentions reflect one's motivation to act and according to the Theory of Planned Behaviour (Ajzen, 1985) represent the direct precursor to behaviour. However, Heckhausen (1991) and Gollwitzer (1993) posited two distinct phases to goal striving, of which only the first is motivational, involving the assessment by the individual of the pros and cons of performing the behaviour. The second, volitional phase, involves the planning of goal pursuit. Jones, Abraham, Harris, Schulz and Chrispin (2001) provided support for the addition of volitional cognitions into current social cognitive models of behaviour such as the TPB, by indicating that planning had both a moderating and mediating effect on the intention-behaviour relationship for sun screen use. Planning has been shown to be effective in enacting goal-directed behaviour (Leventhal, Singer & Jones, 1965; Leventhal, Watts & Pagano, 1967). The DBS, in identifying the consequences of exercise, may be more than simply motivating in that it may prompt the identification of future problems, aiding planning in the second, volitional phase. This is important since the formation of a strong goal intention on its own may not be sufficient to have a large impact on behaviour (Gollwitzer, 1993; Gollwitzer & Brandstatter, 1997) since intentions have been shown to account for 28% of the variance in behaviour (Sutton, 1998).

Following Leventhal's work, Gollwitzer (1993) developed the idea of implementation intentions, which involve the predecision of when, where and how a goal will be pursued. They are a self-regulatory strategy and take the form "I will do x in place y at time z ". Implementation intentions have been argued to work because they heighten the

accessibility of environmental cues to act (Aarts, Dijksterhuis & Midden, 1999) and thus enhance memory to perform the specified behaviour (Sheeran & Orbell, 1999). This increases the likelihood of initiating behaviour in a suitable, pre-planned situation.

Since implementation intentions specify the behaviour and the situation within a mental link, commitment to perform the goal-directed behaviour in the specified situation is created (Gollwitzer, 1993). Through implementation intentions, behaviour is said to occur quickly, acquiring features of automaticity such as those found in habits (Bargh, 1997). Habits create strong links between situations and behaviours by repetition in stable contexts (Guthrie, 1959); implementation intentions can have similar effects (Aarts & Dijksterhuis, 2000; Gollwitzer & Brandstatter, 1997; Malzacher, 1992, cited in Gollwitzer, 1999) creating 'cognitive habits' through one mental act. Once the behaviour has begun, implementation intentions have also been shown to protect goal pursuit from distractions (Schaal, 1993, cited in Gollwitzer & Schaal, 1998; Koole & Spijker, 2000). Thus they appear a useful strategy to aid the initiation and maintenance of goal-directed behaviour.

Implementation intentions have increased the performance of a range of behaviours including vitamin C intake (Sheeran & Orbell, 1999) and cervical cancer screening (Sheeran & Orbell, 2000). Implementation intentions can also change habitual behaviour. For example, Bamberg (2000) showed that implementation intentions could be used to increase the use of a new bus service, which conflicted with typical, habitual travel behaviour, as participants were asked to change their everyday travel mode choice in order to use the new service. This is important for changing exercise behaviour since

being sedentary may have become a routine or habitual. Milne, Orbell and Sheeran (2002) showed implementation intentions used with the Protection Motivation Theory (PMT; Rogers, 1975) significantly increased exercise behaviour over one week, although targeting the components of the Protection Motivation Theory, without the use of implementation intentions, did not. This indicated that a motivational intervention used with implementation intentions, a volitional strategy, may be more effective than using motivational interventions, such as the DBS, alone. However, an implementation intention only group, that would allow the comparison of implementation intentions used alone or alongside a motivational intervention, was not used in the Milne et al. (2002) study. The DBS has been shown on several occasions to be effective in improving exercise participation and adherence (e.g. Hoyt & Janis, 1975; Wankel & Thompson, 1977; Wankel et al., 1985). Therefore comparing the comparative success of the DBS against implementation intentions alone or used in conjunction with the DBS, would represent a more stringent test of the efficacy of implementation intentions.

Since the DBS is essentially a motivational technique and implementation intentions are volitional, then a combined approach should be the most effective in successful goal pursuit. The DBS should provide well-formed intentions and may continue to motivate throughout the attempted performance of the behaviour. In the Milne et al. (2002) study, the PMT variables increased intentions that were stable over time. This maintenance of motivation would be of vital importance for the continued effectiveness of implementation intentions over an extended period of time, since implementation

intentions have only been shown to work when intentions to act are strong (Orbell, Hodgkins & Sheeran, 1997).

Implementation intention studies have rarely used stringent, objective measures of behaviour. In a meta-analysis by Sheeran (2002), prospective studies using self-report measures ($r_+ = .35$) showed significantly greater effects than those employing objective measures ($r_+ = .26$); so studies that show clear, objective, beneficial effects of implementation intentions are of importance. Implementation intentions have rarely been shown to lead to objective health benefits and their effectiveness against other successful strategies has not been directly tested. They have been assumed to be useful over an extended period, as they have been proposed to create 'cognitive habits' but, as with Milne et al. (2002), most studies have looked at behaviour within a maximum three week period. This study aimed to address the issue of whether implementation intentions can aid health over a period of four weeks.

All participants were asked to try to exercise two more times a week than they currently did. This study incorporated four conditions, one in which participants were asked to form an implementation intention as to when and where they would do their extra exercise, another where they completed a decision balance sheet, whilst a third group did both. Participants within a control were asked only to try to exercise two more times a week. A fitness test was performed at the beginning of the study and again after four weeks of exercise, in order to attain an objective measure of exercise behaviour, reflected by fitness change. A diary recording the exercise, time, date, place and duration of

exercise was used to assess whether implementation intentions increased the number of times participants exercised per week in the specified situation, *without* reducing the duration of each session. This is crucial because an increase in frequency of exercise that results in shorter exercise sessions may not prove to be beneficial to health, as total time spent on exercise per week may not change. Successful initiation and maintenance of exercise would require both the successful remembering of critical situational cues and remaining strongly motivated after a small number of sessions, which may have been perceived as difficult. Implementation intentions aid memory for critical cues and the decision balance sheet was anticipated to provide the necessary motivation. It was predicted therefore, that those in the combined group would show a greater increase in the frequency and time spent exercising than the implementation intention alone group, and thus show the greatest fitness improvements. Furthermore, strong intenders often fail to achieve intended goals (Gollwitzer, 1993) and fairly strong intention levels were expected in volunteers responding to an advertisement for a study into increasing exercise. Therefore, it was predicted that the implementation intention groups together, would have greater increases in exercise frequency, time spent exercising each week and show greater fitness improvements than the DBS alone group. Finally, given the past research supporting combined motivational and volitional (Milne et al., 2002), implementation intention (Sheeran & Orbell, 2000) and DBS (Wankel et al., 1985) interventions; taken together the interventions should lead to a greater increase in exercise frequency, time spent exercising and fitness than the control.

METHOD

Participants

Participants were recruited via an e-mail distributed to undergraduates and staff at a U.K. university. For those who participated at both time points information relating to their fitness improvement was provided as feedback. A total of 86 participants (48.8% males, 51.2% females) completed all measures at Time 1. The age range was 16 to 41 ($M=21.31$, $SD=4.39$). Table 1 shows the number of participants who completed each of the measures at both time points. In total, 22 participants were recruited for the implementation intention and combined groups whilst 21 participants were recruited for the control and DBS groups. A Chi-squared analysis showed that there was no differential drop-out rate across conditions ($\chi^2=5.11$, $df=3$, $p>.05$). One-way ANOVAs did not detect any differences between those participants who dropped out of the study at Time 1 compared to those who remained, on measures of age, attitude, subjective norm, or past exercise behaviour (frequency or time). However, participants who dropped out had significantly stronger intentions [$F(1, 84)=6.09$, $p<.05$] and perceived behavioural control [$F(1, 84)=5.30$, $p<.05$] to exercising more frequently. There were no differences across the experimental groups for any Time 1 measures. Those participants who did not return within two weeks of the follow-up date did not complete a time 2 fitness test, as it was felt that any fitness change would be too unreliable. Chi-squared analyses showed that there was no difference in the number of people re-tested or not, across groups ($\chi^2=2.23$, $df=3$, $p>.05$). There was also no difference between those who were re-tested

and those who were not, in change in frequency of exercise [$F(1, 66)=.211, p>.05$] or time spent on exercise per week [$F(1, 60)=1.08, p>.05$]. Chi-squared analyses showed that there was no difference in the number of people completing time spent exercising per week at time 1 and time 2 and those who did not, across groups ($\chi^2=1.65, df=3, p>.05$), and the number of people for which time per session could be calculated at both time points and those for whom it was not possible, across groups ($\chi^2=2.18, df=3, p>.05$).

Study Design and Procedure

The study was presented as an assessment of attitudes to, and performance of, exercise behaviour. Participants were informed that participation would involve fitness tests and data collection at two time points, separated by approximately four weeks.

At Time 1, participants answered questions about their age, sex, current and past exercise behaviour, intentions towards and perceived behavioural control of exercising more, before performing a fitness test (fixed rate shuttle jogging over a 7 metres distance in time with a bleep), which used a heart rate monitor. This test was designed so that it was not over-demanding and thus would not have detrimental effects in terms of encouraging participants to remain in the study and undergo a second fitness test. Following the test participants were randomly allocated to one of four groups, implementation intention and decision balance sheet, implementation intention only, decision balance sheet only, or control.

The fitness test for females lasted five minutes and a further minute for males. This is because even after males and females are matched for body mass and fat-free body mass in trained and sedentary individuals, men generally have a superior $\text{VO}_2 \text{ max.}$ fitness measure (Keller, 1989). Therefore, varying durations of exercise were used in an attempt to eliminate sex-differences in effort required to successfully complete the fitness test. When comparing subsequent sex differences for change in exercise frequency [$F(1, 66)=.177, p>.05$], time spent on exercise per week [$F(1, 60)=1.38, p>.05$] and fitness [$F(1, 32)=2.43, p>.05$], all differences were non-significant.

For similar reasons, to reduce the effects of different fitness levels further, for each gender there were two levels of difficulty (the more difficult selection involved running the distance every 3 seconds, whilst participants in the easier condition used an extra 1 second per lap). Participants selected the level of difficulty of the test, and repeated it at Time 2. The level of fitness test, chosen by the participant, was based on their own perceived ability on the test, after the test was described by the experimenter. Subsequent analyses detected no significant differences in the level of fitness test chosen and changes in frequency of exercise [$F(1, 66)=.986, p>.05$], fitness [$F(1, 32)=.570, p>.05$] or the time spent on exercise per week [$F(1, 60)=3.37, p>.05$].

All participants were asked to try to exercise two *more* times per week than currently, for at least twenty minutes per session (and told that no matter how much longer than twenty minutes their session was, it only counted as one session). They had to try to exercise in an individual (i.e. non-team) activity. This was to eliminate the motivational impact of

exercising as part of a group (Zander, 1975). Measures of participants' intention and PBC to do this, along with past exercise behaviour, were then taken.

Participants in the DBS groups were then asked to complete a decision balance sheet grid concerning increased exercise. The procedure was similar to that used in the Wankel and Thompson (1977) study. Respondents were asked to think of and record the anticipated gains and losses, which may arise from their exercising two more sessions per week. These anticipated outcomes were recorded under the headings: gains to self; losses to self; gains to important others; losses to important others; approval from others; disapproval from others; self-approval; self-disapproval; any others. After completing the form, the participants were asked to think about their responses, and then to read them aloud to the interviewer. As the items were read, the interviewer responded with positive feedback.¹ Participants were then asked to retain their completed decision balance sheet.

Participants in the implementation intention groups, after the measurement of PBC, intention and past behaviour, were asked to specify the time, place and type of extra exercise that they would engage in over the following four weeks. In the combined intervention participants first completed their decision balance sheet then formed an implementation intention.

Participants were asked to record their exercise behaviour in a self-report diary. This provided the dependent measures of frequency and duration (per session and per week) of

¹ This procedure is consistent with Janis' (1975) research, which demonstrated the motivational significance of self-disclosure to an accepting interviewer.

exercise. The fitness test repeated at the end of the study, at the same intensity and for the same duration, provided the objective fitness dependent variable.

Measures

Questionnaire

After recording the sex and age of the participant, the questionnaire provided a definition of exercise ('The word exercise in this questionnaire means physical activity that you engage in for at least twenty minutes. It would include activities such as swimming or jogging, but not everyday activities such as walking to the shops'). The phrase 'exercise more' was described as referring to '*exercising by yourself (i.e. in a non-team sport) two more times a week than you currently exercise*'.

Items assessed intention and perceived behavioural control, along with measures not reported here, using 7 point bipolar scales. Past and current exercise behaviour were also measured.

Five items measured *intention* to exercise: 'I intend to exercise more during the next four weeks' ('definitely do not- definitely do' '1-7'); 'How likely is it that you will exercise more during the next four weeks?' ('unlikely- likely' '1-7'); 'I am determined to exercise more over the next four weeks' ('strongly disagree- strongly agree' '1-7'); 'I want to try to exercise more over the next four weeks' ('unlikely- likely' '1-7'); and 'I will try to exercise

more over the next four weeks' ('unlikely- likely' '1-7'). These items provided a satisfactory Cronbach's alpha value ($\alpha = .86$).

Five further questions assessed *perceived behavioural control*: 'I am confident that if I exercise more over the next four weeks I could keep to it' ('strongly disagree- strongly agree' '1-7'); 'Whether I do or do not exercise more over the next four weeks is entirely up to me' ('strongly disagree- strongly agree' '1-7'); 'I don't know if I can exercise more over the next four weeks' ('strongly disagree- strongly agree' '1-7'); 'For me to exercise more during the next four weeks will be' ('easy- difficult' '1-7'); and 'I am confident that I could exercise more over the next four weeks if I wanted to' ('strongly disagree- strongly agree' '1-7'). These items produced a Cronbach's alpha of .54. This was improved to $\alpha = .60$, by deleting the second item.

To measure *past behaviour* participants completed a table indicating the type, place, time and duration of their exercise over each of the three weeks preceding the study. During the study, *behaviour* was measured by a diary in which participants were asked to record the type, place, time and duration of their exercise over the four week period. The *Frequency of exercise* per week (in Table 1) was calculated at both time points to include only planned physical or sporting activity of at least moderate intensity. *Time per session* was recorded for those sessions that met these same criteria. *Time per week* was calculated from frequency and time per session data.

Fitness was measured by calculating participants' average heart rate over the test. The first three minutes of exercise were ignored, because other factors (such as anxiety) may

have influenced the average heart rate at this stage. A fitness improvement was assumed with a corresponding decrease in this measure between Time 1 and Time 2. The correlation between the average number of extra exercise sessions per week and the fitness improvement following the study (time2 fitness- time1 fitness) was non-significant ($r=.13$, $N=34$, $p=.47$). The correlation increased but remained non-significant when the participants were re-tested within four days of the end of the four-week experimental period ($r=.21$, $N=18$, $p=.40$).

RESULTS

Table 1 presents the mean of participants' intentions and perceived behavioural control to exercising two more times per week than they typically did before the study. It also displays the frequency and duration of exercise before and during the intervention. From this, time exercising per week was calculated. Pre- and post-intervention fitness and time spent exercising per session² measures, are also included.

Table 1 Here

The mean exercise frequency, time spent on exercise per week and fitness levels increased within each experimental group from Time 1 to Time 2. To test whether the increases in frequency, time spent exercising per week and fitness changes were significant, a priori orthogonal contrasts were used. Partition of the variance into a priori orthogonal contrasts is a powerful way to analyse the data that reduces the probability of

² Time per session has only 53 participants at each time point whilst time per week has 62 participants. These differ because it was not possible to calculate time per session for someone who did not exercise at time 1 and/or time 2. However, for these individuals, their time spent exercising per week could be recorded as zero.

making Type 1 errors. Changes in frequency of exercise per week, total time spent on exercise per week, time spent on each exercise session and fitness were the dependent variables, whilst the between-subjects factors was the group to which the participant was assigned. Four groups make up to three contrasts possible, thus allowing the test of whether the experimental interventions lead to significantly greater improvements than the control, secondly, the comparison of the implementation intention pair against the DBS and finally, the implementation intention alone group can be tested against the combined intervention.

The frequency, time spent exercising per session and average heart rate improvement measures all had homogeneity of variance ($p > .05$). However, the change in time spent exercising per week measure did not have homogeneity of variance ($p < .05$) and as such, the adjusted significance levels are reported for this variable. One-tailed significance values are used.

Contrast 1: Combined + Implementation Intention + DBS vs. Control

The experimental interventions showed a significantly greater increase in exercise frequency [$t(63)=2.25, p < 0.05$], time spent exercising per week [$t(58)=2.68, p < 0.01$] and fitness [$t(30)=1.92, p < 0.05$] than the control group. There was no difference in the amount of time spent exercising per session [$t(49)=.44, p > 0.05$].

Contrast 2: Combined + Implementation Intention vs. DBS

The implementation intention groups had a marginally greater increase, than the DBS group, in exercise frequency [$t(63)=1.41$, $p=.08$] and a significantly greater increase in the total amount of time spent exercising per week [$t(58)=2.00$, $p<0.05$]. There was no difference in fitness improvements [$t(30)=-.129$, $p>0.05$] or the amount of time spent exercising per session [$t(49)=-.688$, $p>0.05$].

Contrast 3: Combined vs. Implementation Intentions

The combined group increased the frequency of their exercise marginally more than the implementation intention alone group [$t(63)=1.61$, $p=.06$]. There was no difference in the total amount of time spent exercising per week [$t(58)=0.895$, $p>0.05$] and per session [$t(49)=-.447$, $p>0.05$]. However, the combined group showed a significantly greater fitness improvement [$t(30)=2.41$, $p<0.05$] than the implementation intention only group.

Mediational Analysis

A regression analysis was then carried out to test whether the effects of being in the implementation intention only or combined group on subsequent exercise behaviour, were mediated by the frequency of the match between the time, place and exercise specified within the implementation intention and actual behaviour. Mediation would support Gollwitzer (1993), who showed that implementation intentions work through the formation of strong mental links between the planned and actual situation of behaviour performance. This would reflect the importance of memory for, and acting on, these specific situations prescribed within the implementation intention. However, it would

indicate that for exercise behaviour, strong motivation (aided through a motivational intervention) is necessary to remember and subsequently be sufficiently motivated to act at the specified situation.

In the following regression analysis, a dichotomous variable (combined condition versus implementation intention only group) was used along with the frequency of a match between actual time, place and exercise and those specified in the implementation intentions (called Memory for the Implementation Intention), as predictors of time 2 exercise frequency. This was to test whether memory for the implementation intention mediated the effects of being in the implementation intention versus combined group on behaviour. Mediation was estimated by first regressing time 2 exercise frequency on the dichotomous group variable (i.e. combined or implementation intention only group); and secondly by regressing time 2 exercise frequency on the group and implementation intention memory variables. A second mediation analysis takes into account the effect of exercise behaviour before the study, by using time 1 exercise frequency as an additional predictor of time 2 exercise frequency.

Table 2 here

In the first equation, being in the combined versus implementation intention group marginally significantly predicts time 2 exercise behaviour ($\beta=.340$, $p=.06$). However, when the frequency of the match between specified and actual place, time and exercise (memory for implementation intention) is added, the impact of being in the combined

versus implementation intention group becomes non-significant ($\beta=.096$, $p=.63$), whilst the added variable is significant ($\beta=.433$, $p=.04$).

A similar mediational pattern is shown when past behaviour is used as a (significant) predictor of time 2 exercise frequency. When entered alongside past behaviour ($\beta=.393$, $p=.02$) on the first step to control for time 1 exercise frequency, the group (combined versus implementation intention) variable marginally significantly predicts time 2 exercise frequency ($\beta=.304$, $p=.07$). Holding the effects of past behaviour and being in the combined versus implementation intention group constant, results in memory for the implementation intention being a significant predictor ($\beta=.578$, $p=.002$) of time 2 exercise frequency. Memory then mediates the relationship between *increase* in exercise over the study and being in the combined versus implementation intention group as being in the combined versus implementation intention group becomes a non-significant predictor ($\beta=.032$, $p=.85$) of exercise over the study. In line with Baron and Kenny's (1986) recommendations, the mediator (memory) was also regressed on the independent variable (being in the combined versus implementation intention only group). The independent variable significantly predicted memory ($\beta=.563$, $p<.005$) so memory can be considered to be a mediator variable.

These results imply that implementation intentions work by aiding the memory of specified pre-planned cues that promote exercise in that specified situation particularly when the intervention contains a motivational element. At least, the inclusion of the DBS

appears to improve the ability to detect and subsequently act at suitable, pre-planned opportunities.

DISCUSSION

The results of this study showed that the participants within the interventions (combined, implementation intention only and DBS) produced greater improvements than the control group in frequency and total time spent exercising per week, and displayed greater fitness improvements. The control group showed a slight decrease in exercise participation over the course of the study. The greatest improvements in exercise participation occurred for the individuals in the combined intervention, who completed a decision balance sheet and formed an implementation intention. Participants in this group increased exercise on marginally more occasions than those in the implementation intention only group and displayed greater fitness improvement, although the difference in the total amount of time spent on exercise per week was non-significant. Individuals who formed implementation intentions increased their exercise frequency marginally more and time per week significantly more than those completing a DBS only, although there was no difference in fitness improvement.

Importantly, the increases in the frequency of exercise led to corresponding increases in the amount of time spent on exercise each week. This meant that although the intervention groups exercised on more occasions than the control, each session did not significantly diminish in time. Moreover, those people in the combined intervention group, who showed marginally the greatest increase in exercise frequency, significantly

showed the greatest improvements in fitness. Although this appears to imply that an increase in exercise frequency is related to improved fitness, this is not supported by the correlation between increased frequency of exercise and improved fitness which is non-significant. Furthermore, the objective measure was an unusual measure of fitness with an unknown relationship to health. However, the findings do suggest that the combined intervention not only leads to marginal increases in self-reported exercise participation, but can also lead to significant improvements in fitness over a relatively short space of time (4 weeks). The superiority of the combined intervention, over the implementation intention only group, in fitness improvement, and the non-significant difference between the implementation intention groups and DBS-only condition, point to the importance of the DBS in fitness improvement. Its use, in conjunction with implementation intentions, may lead to more intense exercise that leads to pronounced fitness improvements. One possible explanation is that the DBS, being a motivational technique, leads to exercise of a greater intensity and so would be beneficial in cardiovascular parameters related to fitness (Ehsani, Ogawa, Miller, Spina & Jilka, 1991).

The finding that those participants with the strongest intentions and PBC were the ones most likely to withdraw from the study, although difficult to explain, does not undermine the results outlined above. In fact, this finding demonstrates that an intervention based on implementation intentions, together with a motivational intervention was effective even for individuals with weaker intentions and PBC.

The results provide support for the Milne et al. (2002) study. As with this study which showed the benefits of a combined approach, they showed that implementation intentions combined with a PMT intervention significantly increased exercise participation in a student sample when asking them to exercise *once* in the next week. However, whereas the Milne et al. (2002) study showed a combined motivational and volitional group to be significantly superior to a control and PMT intervention, this study suggests that a similar combined intervention can be marginally more beneficial than forming an implementation intention alone. The marginal difference in exercise frequency and significant difference in duration per week, between the implementation intention groups together and the DBS, provides support that implementation intentions are an effective strategy to increase exercise participation. The Milne et al. (2002) study showed a non-significant decrease in exercise participation in the control over the one-week of their study. Similarly, in this study the people in the control group showed little change in the frequency of their exercise sessions. This suggests that without intervention, people find it difficult to increase their exercise over an extended four-week period.

In this study the combined intervention marginally outperforms the implementation intention alone group, and the implementation intention groups exercise marginally more frequently and for more time each week than the DBS. This provides some evidence that there are two distinct phases to goal striving, as suggested by Heckhausen (1991) and Gollwitzer (1993). The marginal superiority of the combined intervention, over the use of implementation intentions alone, is of particular interest, especially since participants held fairly strong intentions to exercise prior to the study ($M=6.0$, on a 7-point scale).

Implementation intentions by themselves have rarely been applied to complex behaviours, i.e. those that require a number of steps for successful goal completion (for example see Sheeran & Orbell, 2000 on cervical cancer screening). Using a motivational technique, especially one that may continue to motivate throughout the study, may help to maintain this strong motivation. Keeping the DBS at home may have prompted participants to be prepared to act (i.e. hold relevant sporting kit) on their implementation intention in the specified situation. Alternatively, it may maintain strong motivation to act on the implementation intention when it is remembered, or increase the probability that it is remembered (the DBS may aid this by cueing rehearsal or acting as an environmental cue as participants were asked to keep hold of their completed forms). Measurement of intention at the end of the study would have provided evidence as to whether the DBS creates and maintains strong motivation, and thus highlights a weakness of this study. Furthermore, the use of the DBS as a prompt was not tested, but clearly as the mediation analyses showed, remembering and then subsequently acting on the implementation intention is important, and occurred more frequently in the combined condition than the implementation intention only group. Thus, for participants with implementation intentions as part of their intervention, memory for place, time and exercise was important in producing the increase in exercise over the study and was particularly useful in conjunction with the DBS. As a result this mediation analysis supports Gollwitzer (1993), who showed that the effect of implementation intentions are mediated through strong mental links between situations and behaviours. It also provides new evidence that to act on this cue a person benefits from a motivational technique, such as the DBS, which may create and sustain the necessary motivation to act on the cue.

Clearly remembering and then acting on the implementation intention is useful. The people in the combined group remembered and acted upon their plan more times than the people in the implementation intention group, and subsequently increased their exercise more. It may be suggested that the DBS by improving motivation to exercise just before the implementation intention was formed, also increased commitment to the implementation intention.

The design of this study means that it is possible only to speculate as to why the combined condition led to marginally significant benefits over the implementation intention only group. One further possibility was that the DBS, as a motivational intervention, aided the *stability* of the strong motivation shown initially by the combined group, whilst the participants in the implementation intention only condition, without the DBS, may have had unstable motivation during the intervention period. As implementation intentions have been shown to work only when the individual is highly motivated (Sheeran & Orbell, 1999), instability in intention strength might explain why the combined group exercised marginally more than the implementation intention only group and showed greater fitness improvement.

It might also be suggested that the fitness test itself produced increases in exercise participation. However, if this were the case, the effect should have operated across groups. Furthermore, even though fitness testing, along with knowledge of results, has been shown to increase intention to exercise; this leads to only minimal increases in

exercise (Godin, Desharnais, Jobin & Cook, 1987). Thus within this study, only a small impact of the fitness test was assumed, spread evenly across the randomly assigned participants in the four conditions.

This study has shown that using the DBS in conjunction with implementation intentions may have significant benefits for fitness. Dytell et al. (1991) showed that exercise leads directly to positive health outcomes in males, and that fitness mediated the relationship between exercise and health outcomes. Thus, the interventions employed here, through improving fitness, can aid positive health outcomes and well-being. The study reported here was based on students; future research could attempt to show the utility of combining implementation intentions with a motivational strategy, particularly one that would maintain strong motivation, in clinical populations.

This study has also shown that implementation intentions when combined with a motivational strategy may be successfully applied to complex behaviours and lead to objectively verifiable fitness improvements. This is important since there has been a lack of objective studies in this area, and those that do exist have been vulnerable to manipulation (e.g. vitamin C consumption, Sheeran & Orbell, 1999). The study also suggests that implementation intentions may be used to increase the performance of a desired behaviour over an extended period of four weeks. There remains however, a need for further objective studies to support the claim that implementation intentions are a useful strategy to increase frequency of performance, especially as some of the effects found in the present study were only marginally significant. Further long-term studies

are also needed to test the assumption that since implementation intentions work through the formation of instant ‘cognitive habits’ they are effective over long periods of time.

REFERENCES

Aarts, H., and Dijksterhuis, A. (2000). Habits as knowledge structures: Automaticity in goal-directed behaviour. *Journal of Personality and Social Psychology*, **78**, 53-63.

Aarts, H., Dijksterhuis, A., and Midden, C. (1999). To plan or not to plan? Goal achievement or interrupting the performance of mundane behaviors. *European Journal of Social Psychology*, **29**, 971-979.

Ajzen, I. (1985). From intentions to action: A theory of planned behaviour. In J. Kuhl and J. Beckman (eds.). *Action Control: From Cognitions to Behaviours*, pp. 11-39. NY: Springer.

Bagozzi, R.P., and Yi, Y. (1989). The degree of intention formation as a moderator of the attitude-behaviour relationship. *Social Psychology Quarterly*, **52**, 266-279.

Bamberg, S. (2000). The promotion of new behaviour by forming an implementation intention: Results of a field experiment in travel mode choice. *Journal of Applied Social Psychology*, **30**, 1903-1922.

Bargh, J.A (1997). The automaticity of everyday life. In R.S. Wyer, Jr. (Ed.). *The Automaticity of Everyday Life: Advances in Social Cognition*, *10*, pp. 1-61. New Jersey: Erlbaum.

Baron, R. M., and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, **51**, 1173-1182.

Crespo, C.J., Keteyian, S.J., Heath, G.W., and Sempos, C.T. (1996). Leisure-time physical activity among US adults: Results from the Third National Health and Nutrition Examination Survey, *Archives of Internal Medicine*, **156**, 93-98.

Dytell, R.S., Trent, L.K., and Conway, T.L. (1991). A causal analysis of interrelationships among exercise, physical fitness, and well-being in the U.S. Navy personnel. *US Naval Health Research Center Report*. Report No 91-27.

Ehsani, A.A., Ogawa, T., Miller, T.R., Spina, R.J., and Jilka, S.M. (1991). Exercise training improves left ventricular systolic function in older men. *Circulation*, **83**, 96-103.

European Heart Network (1998). *Social factors, work, stress and cardiovascular disease prevention in the European Union*. Brussels: European Heart Network.

Godin, G., Desharnais, R., Jobin, J., and Cook, J. (1987). The impact of physical fitness and health-age appraisal upon exercise intentions and behavior. *Journal of Behavioral Medicine*, **10**, 241-250.

Gollwitzer, P.M. (1993). Goal achievement: The role of intentions. In W. Stroebe and M. Hewstone (Eds.), *European Review of Social Psychology*, **4**, p141-185. Chichester, England: Wiley.

Gollwitzer, P.M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist*, **54**, pp. 493-503.

Gollwitzer, P.M., and Brandstatter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology*, **73**, 186-199.

Gollwitzer, P.M., and Schaal, B. (1998). Meta-cognition in action: The importance of implementation intentions. *Personality and Social Psychology Review*, **2**, 124-136.

Guthrie, E. R. (1959). Association by contiguity. In S. Koch (Ed.), *Psychology: A study of a science: General systematic formulations, learning, and special processes* (Vol. 2, pp. 158-195). New York: McGraw Hill.

Heather, N., Rollnick, S., Bell, A., and Richmond, R. (1996). Effects of brief counselling among male heavy drinkers identified on general hospital wards. *Drug and Alcohol Review*, **15**, 29-38.

Heckhausen, H. (1991). *Motivation and action*. New York: Springer-Verlag.

Heslop, P., Davey Smith, G., Carroll, D., Macleod, J., Hyland, F., and Hart, C. (2001). Perceived stress and coronary heart disease risk factors: The contribution of socio-economic position. *British Journal of Health Psychology*, **6**, 167-178.

Hoyt, M.F., and Janis, I.L. (1975). Increasing adherence to a stressful decision via a motivational balance-sheet procedure: A field experiment. *Journal of Personality and Social Psychology*, **31**, 833-839.

Janis, I.L. (1975). Effectiveness of social support for stressful decisions. In M. Deutsch and H. Hornstein (Eds.), *Applying Social Psychology: Implications for Research, Practice and Training*. Hillsdale, N.J.: Erlbaum.

Jones, F., Abraham, C., Harris, P., Schulz, J., and Chrispin, C. (2001). From knowledge to action regulation: Modeling the cognitive prerequisites of sun screen use in Australian and UK samples. *Psychology and Health*, **16**, 191-206.

Keller, B.A. (1989). The influence of body size variables on gender differences in strength and maximum aerobic capacity. Doctoral dissertation. University of Massachusetts, Amherst, MA.

Koole, S., and Van't Spijker, M. (2000). Overcoming the planning fallacy through willpower: Effects of implementation intentions on actual and predicted task-completion times. *European Journal of Social Psychology*, **30**, 873-888.

Leventhal, H., Singer, R., and Jones, S. (1965). Effects of fear and specificity of recommendation upon attitudes and behaviour. *Journal of Personality and Social Psychology*, **2**, 20-29.

Leventhal, H., Watts, J.C., and Pagano, F. (1967). Effects of fear and instructions on how to cope with danger. *Journal of Personality and Social Psychology*, **6**, 313-321.

Milne, S., Orbell, S., and Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology*, **7**, 163-184.

Nigg, C.R., Courneya, K.S., and Estabrooks, P.A. (1997). Maintaining attendance at a fitness center: An application of the decision balance sheet. *Behavioral Medicine*, **23**, 130-137.

Orbell, S., Hodgkins, S., and Sheeran, P. (1997). Implementation intentions and the theory of planned behaviour. *Personality and Social Psychology Bulletin*, **23**, 945-954.

Pate, R.R., Heath, G.W., Dowda, M., and Trost, S.G. (1996). Associations between physical activity and other health behaviours in a representative sample of US adolescents. *American Journal of Public Health*, **86**, 1577-1581.

Rogers, R.W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology*, **91**, 93-114.

Rollnick, S., Heather, N., and Bell, A. (1992). Negotiating behaviour change in medical settings: The development of brief motivational interviewing. *Journal of Mental Health*, **1**, 25-37.

Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, **12**, 1-36.

Sheeran, P., and Orbell, S. (1999). Implementation intentions and repeated behaviour: Augmenting the predictive validity of the theory of planned behaviour. *European Journal of Social Psychology*, **37**, 231-250.

Sheeran, P., and Orbell, S. (2000). Using implementation intentions to increase attendance for cervical cancer screening. *Health Psychology*, **19**, 283-289.

Silva, J.M., and Weinberg, R.S. (1984). *Psychological Foundations of Sport*. Champaign, Illinois: Human Kinetics Publishers, Inc.

Sutton, S. (1998). Predicting and explaining intentions and behaviour: How well are we doing? *Journal of Applied Social Psychology*, **28**, 1317-1338.

Twisk, J.W., Snel, J., Kemper, H.C., and van Mechelen, W. (1999). Changes in daily hassles and life events and the relationship with coronary heart disease risk factors: A 2-

year longitudinal study in 27-29-year-old males and females. *Journal of Psychosomatic Research*, **46**, 229-240.

Wankel, L.M. (1987). Enhancing motivation. For involvement in voluntary exercise programs. In M.L. Maehr and D.A. Kleiber (Eds.). *Recent advances in motivation and achievement: Vol.5. Enhancing Motivation*, 239-286. Greenwich, CT: JAI Press.

Wankel, L.M., and Thompson, C. (1977). Motivating people to be physically active: Self-persuasion vs. balanced decision making. *Journal of Applied Social Psychology*, **7**, 332-340.

Wankel, L.M., Yardley, J.K., and Graham, J. (1985). The effects of motivational interventions upon the exercise adherence of high and low self-motivated adults. *Canadian Journal of Applied Sport Science*, **10**, 147-155.

Wielenga, R.P., Erdman, R.A.M., Huisveld, I.A., Bol, E., Dunselman, P.H.J.M., Baselier, M.R.P., and Mosterd, W.L. (1998). Effect of exercise training on quality of life in patients with chronic heart failure. *Journal of Psychosomatic Research*, **45**, 459-464.

Zander A. (1975). Motivation and performance of sports groups. In D.M. Landers (Ed.) *Psychology of sport and motor behavior II*, pp. 25-29. University Park, PA: Pennsylvania State University Press.

Table 1: Means and Standard Deviations of the Measured Variables for the Control and Experimental Groups

	Intention (1-7)	PBC (1-7)	Frequency of		Time per week		Time per		Fitness (average heart rate, b/p/m)	
			Exercise p/w (N=67)		in mins (N=62)		session (N=53)		(N=34)	
			T1	T2	T1	T2	T1	T2	T1	T2
Combined (N=19)	5.93 (.73)	4.99 (.87)	1.93 (1.39)	3.38 (2.05)	133.5 (143.9)	224.0 (220.3)	61.6 (31.2)	55.0 (31.3)	163.7 (15.4)	154.7 (17.7)
Implementation Intention (N=18)	5.91 (.71)	4.97 (.77)	1.83 (1.94)	2.49 (1.46)	85.1 (80.1)	137.3 (118.5)	57.9 (33.7)	56.1 (27.2)	174.1 (16.9)	171.5 (15.6)
DBS (N=13)	5.86 (1.09)	5.21 (.93)	2.26 (1.63)	2.63 (1.49)	147.7 (121.2)	165.5 (116.0)	66.1 (23.5)	69.3 (20.4)	173.5 (13.5)	168.0 (13.8)
Control (N=18)	5.91 (.57)	4.92 (.77)	2.59 (1.66)	2.50 (1.49)	177.7 (157.4)	144.0 (98.1)	65.2 (27.8)	59.7 (25.6)	165.7 (16.7)	164.0 (14.2)
Total	6.00 (.74)	5.12 (.87)	2.14 (1.66)	2.76 (1.66)	135.1 (131.0)	167.0 (147.7)	62.6 (29.0)	59.1 (26.7)	169.6 (15.8)	165.2 (15.8)

Note Table 1: Time per week (mins)= Frequency of Exercise per week x Time per session is NOT directly calculable from the table, due to incomplete form completion by participants. The number of participants completing frequency and time measures differ to the overall sample size as a result of missing data.

Table 2: Summary of Regression Analyses for Memory of Place, Time and Exercise as a Mediator of the relationship between being in the implementation intention only group versus the combined condition and exercise over the study.

	M_1	M_2
	Without mediator	With memory as a mediator
Combined or Imp. Int. only group	.340*	.096
Memory for implementation intention	—	.433**
Combined or Imp. Int. only group	.304*	.032
Past behaviour	.393**	.507***
Memory for implementation Intention	—	.578***

Note: The values quoted in the table are standardized linear regression coefficients. *** $p < .005$ ** $p < .05$ * $p < .1$

