

AN EXAMINATION OF MOTIVATIONAL AND SOCIAL
PSYCHOLOGICAL PROCESSES RELATED TO MENTAL WELL-BEING
DURING PHYSICAL ACTIVITY BEHAVIOUR CHANGE

BY

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ABSTRACT

Physical activity (PA) is a modifiable behaviour that carries implications for the mental health of the UK. Theory-driven research highlights that the reasons why we participate in PA, not just the act of participation, carry important consequences for human psychological growth, optimal functioning and well-being. Implementing cross-sectional, longitudinal, and experimental designs, this thesis, tests the application and predictive utility of Self-determination theory in the health domain of PA behaviour change.

Results highlight that the social-environment surrounding individuals before, during and after an exercise referral programme, along with one's motivational regulations, have important consequences for intentions to be physically active and mental well-being. A SDT-based observational instrument operationalised the environment afforded by exercise professionals during one-to-one PA interactions. This more objective measure may provide further insight into the psychological processes responsible for behavioural and psychological outcomes. Finally, this thesis commences investigations into the moderating role of motivation on the limited self-control resource and the ability to employ counteractive control strategies that help one to achieve important health goals.

Knowledge of the processes responsible for psychological health and behavioural intentions before, during and after PA interventions along with the ability to employ self-control, may carry important practical implications for future PA interventions.

I dedicate this thesis to the loving memory of my sister

Amanda Susanne Rouse

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LIST OF PAPERS

This thesis is comprised of the following papers. Study Design, data collection, statistical analysis and writing was conducted by Peter Rouse. Prof Joan Duda and Dr Nikos Ntoumanis advised on study design, data analysis and paper editing. Dr. Kate Jolly and Prof. Geof Williams advised on study design.

1. Rouse, P. C., Ntoumanis, N., Duda, J. L., Jolly, K., & Williams, G. C. (In Press). In the beginning: Role of autonomy support on the motivation, mental health and intentions of participants entering an exercise referral scheme. *Psychology and Health*.
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During the period of postgraduate study at the University of Birmingham's School of Sport and Exercise Sciences the following papers and conference abstracts were published.

1. Rouse, P. C., Ntoumanis, N., & Duda, J. L. (2008). The development of an observational assessment tool examining environmental support within physical activity consultation. *Journal of Sports Sciences*, 26(1), S136.
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GENERAL INTRODUCTION

Background

Within the media, public health sector, and policy making communities, attention has been increasingly drawn to the obesity epidemic and corresponding sedentary lifestyles that are escalating in society. The promotion of physical activity (PA), of a sufficient intensity, duration, and frequency, has been identified as a means to counteracting these worrying trends. Moreover, low levels of PA have been linked to a range of health-related outcomes including all-cause mortality (Lee, 2001), coronary heart disease (CHD) and hypertension (Talbot, Morrell, Metter, & Fleg, 2002), some cancers (Thune & Furberg, 2001), and the aetiology of type II diabetes mellitus (Helmrich, Ragland, Leung, & Paffenbarger, 1991). Regular PA is also implicated in the maintenance of functional capacity, muscular skeletal health (Vuori, 2001) and enhanced psychological well-being (Lawlor & Hopker, 2001; Sjosten & Kivela, 2006).

In order to achieve the desired outcomes from PA, Haskell and colleagues (Haskell et al., 2007) have recommended the minimum frequency and duration of moderate to vigorous PA necessary to gain such health benefits. These recommendations have been endorsed by the UK government (Haskell et al., 2007) and the American College of Sports Medicine. Specifically, it is suggested that, with the aim to promote and maintain health, adults aged 18-65 years need to engage in moderate-intensity aerobic (endurance) PA for a minimum of 30 minutes (in durations of at least 10 minutes) on at least five-days each week or vigorous-intensity aerobic PA for a minimum of 20 minutes on three days each week. A large percentage of the UK population, however, does not meet these current active living recommendations and thus are less likely to accrue the aforementioned health benefits that an active lifestyle might provide (Department of Health, 2004).

In addition to the physiological benefits that have been shown to be associated with regular PA, evidence supports the efficacy of PA for the promotion of mental well-being (Biddle, Fox, & Boutcher, 2000; Hamer, Stamatakis, & Steptoe, 2009). The World Health Organisation (WHO) defines mental health as “a state of well-being in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” (Herman, Saxena, & Moodie, 2005; p.2). Recent health initiatives (e.g., ‘Healthy Lives, Healthy People’) along with recent government guidelines and strategies (e.g., ‘No Health Without Mental Health’) have placed emphasis on the importance of supporting the nations mental health due to observed deteriorating states of mental well-being for the population as a whole (Fox, Boutcher, Faulker, & Biddle, 2000). Further, mental illness has been described by the Department of Health as the largest single cause of disability in our society, costing the British economy £77 billion a year (Department of Health, 2011).

Depression is considered the most prevalent indicator of mental ill health (Department of Health, 2011). Many patients clinically diagnosed with depression are treated with drug therapy, however, not all patients respond well to this treatment, or adequately cope with the apparent side effects (National Institute for Health & Clinical Excellence, 2009). Further, the latest NHS guidelines also recognise the distressing and disabling impact of sub-threshold depressive symptoms (i.e., below the DSM-IV and ICD-10 diagnosis threshold). It is thought that at least two thirds of British adults experience depressive symptoms sufficient to interfere with their normal everyday activity (National Institute for Health & Clinical Excellence, 2009). Therefore, alternative and cost effective therapies, such as regular PA, could play an important role in supporting the mental health of the UK as well as other countries around the world. In a review of five studies with strong research designs that investigate exercise as a treatment for patients with clinically defined depression, Mutrie (2000) concluded that both

aerobic and non-aerobic activity can reduce clinically defined depression. Further, Fox, Boutcher, Faulkner and Biddle (2000) highlight that increases in exercise participation may have a substantial impact on sub-threshold levels of mental ill-health in the general public.

Research has also demonstrated that participating in regular exercise can support or enhance mental health. Positive affect and feelings of vitality are symptoms of positive mental well-being and can be accrued from participating in regular PA. For example, previous research has demonstrated positive relationships between moderate levels of exercise and these positive aspects of mental well-being (Arent, Landers, & Arent, 2000; Raedeke, 2007; Stroth, Hille, Spitzer, & Reinhardt, 2009). Further, Thogersen-Ntoumani, Fox and Ntoumanis (2006) showed that PA was positively associated with indicators of employee mental well-being such as physical self-worth and physical satisfaction. Thus, it appears that interventions examining alternative treatments, such as PA, could have important implications for the psychological and emotional well-being of our population and reduce pressure on public services such as the NHS.

Exercise Referral

The UK Government has employed council led exercise referral schemes to promote PA and support healthier lifestyles (Fortier, Tulloch, & Hogg, 2006). Exercise referral schemes make initial use of the personal relationship that exists at a primary care level between a General Practitioner (GP), physiotherapists or practice nurse, and patient. Generally, patients deemed to possess at least one major risk factor for cardiovascular disease (e.g., being overweight, smoking) are assigned to a health and fitness advisor (HFA) located at a community leisure centre.

Research investigating the effectiveness of ER programmes is limited and the available findings provide mixed evidence (Williams, Hendry, France, Lewis, & Wilkinson, 2007).

Low adherence levels and small changes in outcomes appear typical of ER schemes. Lee, Griffin, and Simmons (2009) used anonymised audit data to conduct an evaluation of an ER scheme in West Suffolk and showed that only 50% of patients referred to the scheme attended the follow-up assessment at the end of the 10 week programme. In a critical review, Dugdill, Graham, and McNair (2005) found that adherence rates were even lower (35-45%). Further, although Dugdill et al., found significant clinical improvements, the differences were small, and not of a magnitude sufficient to convey any health benefits. Finally, a systematic review that included six randomised control trials by Williams, Hendry, France, Lewis, and Wilkinson (2007) highlighted poor adherence as an apparent characteristic of ER schemes but for those who did complete the programme, increases in PA were achieved (post programme). For example, results revealed a statistical increase in the number of sedentary participants becoming moderately active. However, little is known about the impact of ER schemes on long-term PA engagement and the mental health of individuals who have participated in such programmes (Jolly et al., 2009).

Exercise referral schemes provide an appropriate medium to investigate the psychological processes responsible for behaviour change regarding PA engagement and associated indicators of health well-being. As a consequence of a recent appraisal of the evidence on the effectiveness of exercise referral schemes for the National Institute for Health and Clinical Excellence (NICE; 2006, p. 23), it was concluded that: “Exercise referral schemes can have positive effects in the short-term (6 to 12 weeks), but are ineffective in increasing activity levels in the longer term or over a very long time frame (over 1 year).” As a result, NICE (2006) recommended that “practitioners, policy makers, and commissioners should only endorse ER schemes to promote physical activity that are part of a properly designed and controlled research study to determine effectiveness” (p. 6). In response to the guidance proposed by NICE, an exploratory randomised control trial was conducted within an

exercise referral scheme that compared a theory-based intervention arm with a usual practice arm. In this thesis, Studies 1, 2 and 3 involved data collected within this trial.

Previous theory-driven research shows that the reasons why we participate in behaviour, not just the act of participation, carry important consequences for human psychological growth, optimal functioning and mental health (Deci & Ryan, 2000). Therefore, PA interventions could benefit from a greater understanding of the psychological processes responsible for exercise participation and related consequences for mental well-being. Silva et al., (2008) highlight that increased theoretical and methodological clarity could accelerate the identification of effective behaviour change techniques and the development of evidence-based practice in health psychology. A limitation of current PA research is the failure to implement theory-based interventions that allow systematic assessments of effectiveness (Estabrooks et al., 2011). Despite recent efforts (e.g. Edmunds, Ntoumanis & Duda, 2008), many PA interventions still attempt to achieve outcomes such as behaviour change and positive mental well-being without considering the underlying behavioural processes (Masse, Nigg, Basen-Engquist, & Atienza, 2011). Self-Determination Theory (SDT; Deci & Ryan, 1985) provides a theoretical framework that has been successfully used in the health promotion domain (Silva et al., 2010a) and can shed further light on the psychological processes underlying behavioural change.

SDT is particularly pertinent to supporting mental well-being through PA behaviour change because it is an organismic dialectic theory that specifies three innate psychological needs (i.e., autonomy, competence and relatedness) that are essential for ongoing psychological growth, integrity and well-being. Other behaviour change theories, such as theory of planned behaviour and trans-theoretical model of behaviour change, fail to consider the role of human psychological needs, whereas, SDT draws from two different intellectual

traditions that studied the concept of human needs. Similar to the Hullian tradition (Hull, 1943), SDT defines the three needs as innate and organismic necessities rather than acquired motives. SDT's conception of human needs is also similar to the Murray tradition (Murray, 1938), in that the needs are defined at a psychological rather than physiological level (Deci & Ryan, 2000). Therefore, SDT draws on the strengths of these two traditions but is also different to these, and other behaviour change theories, because it is embedded in an organismic metatheory (Deci & Ryan, 2000). That is, SDT provides a full motivational sequence which includes a modifiable environmental factor that explains the processes underpinning psychological and behavioural outcomes. Further, in contrast to other theories (e.g., standard social science model) SDT takes a eudaimonic (Waterman, 1993), rather than hedonic perspective with regards to well-being. Eudaimonia is concerned with living well and actualising one's own human potential. Hedonism, considers the human to be initially empty and thus malleable with well-being described as a state of high positive affect and low negative affect (Deci & Ryan, 2008). Therefore, when attempting to support mental well-being, 'a state in which every individual realises his/her own potential, can cope with normal stresses of life, and can work productively and fruitfully' (Herman, Saxena, & Moodie, 2005), a theory with a eudaimonic perspective appears most relevant. Therefore, SDT is a particularly relevant theory to examine how attempts to change one's PA behaviour can additionally support one's mental well-being and PA intentions.

The purpose of this thesis is to test the theoretical propositions of SDT in the domain of PA behaviour change. Specifically, this thesis tests whether the reasons why an individual participates in PA behaviour has consequences for PA intentions and psychological well-being. Additionally, this thesis examines whether variation in motivation differentially protects one from the impact that a limited self-control resource has on mental health and the ability to stick to important health goals, such as increasing PA levels.

Self-Determination Theory

Self-Determination Theory (Deci & Ryan, 1985) is a contemporary theory of motivation centred on the social psychological processes underlying variability in behavioural adoption, maintenance, and optimal functioning/well-being. SDT is concerned with the “why” of behavioural regulation and, in particular, centres on the degree to which people’s motivation toward behavioural engagement and behaviour change (such as increasing levels of PA) is self-determined or controlled by external factors or internalised contingencies (such as guilt). Further, SDT assumes that all humans are proactive organisms that have a natural and innate tendency to develop a unified or integrated sense of self (Ryan & Deci, 2002). That is, humans have a natural tendency towards internalising their reasons for behaviour. The concept of internalisation is theorised as the means of achieving personal development; a process of transforming external regulations into internal regulations. A notable strength of SDT is the proposition that social-environmental support for self-determination can support or hinder the internalisation process (Deci, Egharri, Patrick, & Leone, 1994). Thus, the theory identifies a variable that can be manipulated to influence the processes responsible for behaviour change and psychological well-being.

Why we engage in a behaviour matters.

Organismic integration theory (OIT), a sub-theory of SDT, proposes a taxonomy of behavioural regulations that vary in their degree of self-determination. Deci and Ryan (2002) highlighted that SDT differs from other theories of motivation, such as Bandura’s (1996) Social Cognitive Theory, by proposing that motivations are based on a relative autonomy continuum. SDT proposes that *Intrinsic motivation* occurs when there is an inherent interest or enjoyment for an activity without a desire for any operationally separable consequences (Deci & Ryan, 2000). OIT also assumes that four different qualities of extrinsic motivations exist ranging from those that reflect external control and coercion on the right to those that are

self-endorsed and personally valued on the left (Ryan & Deci, 2007; see Figure 1.1).

However, the extent to which the external regulations are self-determined varies according to their position on the continuum.

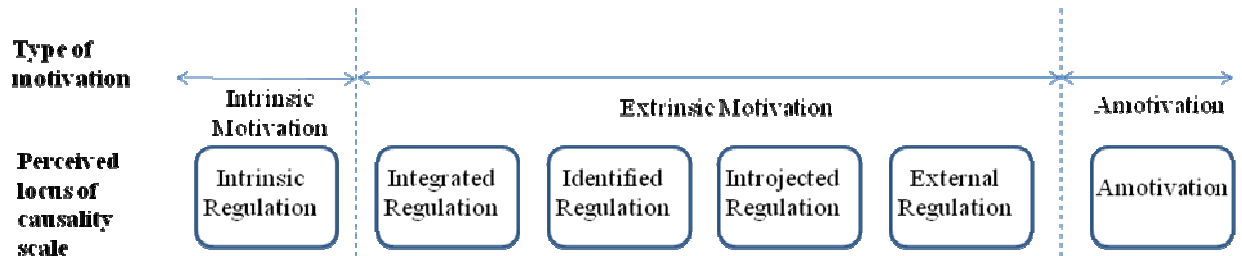


Figure 1.1 The continuum of self-determination (Deci & Ryan, 2000).

External regulation is the least autonomous and most controlling form of motivation.

An individual with extrinsic motivation participates in an activity to obtain a separable outcome (e.g., rewards), because of external pressure, or to gain social approval. An example external regulation for participating in PA is because a council initiative pays the individual to change this health behaviour. Although external regulations can support change initially, the behaviour can be temporary (i.e., until the external stimulus is removed) and has been associated with more negative outcomes such as anxiety. Subsequent on the continuum is *introjected regulation*, which reflects behaviours performed to avoid guilt and anxiety, or to attain ego enhancements (Ryan & Deci, 2000a). Therefore, an individual may participate in PA because he or she feels guilty if they do not. Regulatory actions that are introjected occur because one feels he or she has to, not because one wants to (Deci et al., 1994).

Identified regulation, a more self-determined type of motivation, reflects engagement due to valuing the benefits associated with participating in a behaviour, along with an acceptance that a behaviour is personally important (Deci & Ryan, 2000). If an individual has identified regulations towards participating in PA, he or she may personally value the benefits that can be accrued from increasing their cardiovascular fitness. *Integrated regulation* is the

most self-determined external regulation. An individual is motivated by integrated regulation when the reasons for participation have been evaluated and become aligned with one's own personal beliefs and values that are already part of the self (Deci & Ryan, 2002). In such circumstances, the individual participates in PA because it is a part of his or her identity and the behaviour represents the person that he or she wants to be. Finally, it is theorised that the four extrinsic regulations are anchored by *amotivation* which represents a state in which one lacks any intention or desire to conduct the behaviour in question. Deci and Ryan (2000) theorise that the four external regulations along with intrinsic motivation and amotivation cluster to form autonomous (intrinsic, integrated¹ and identified) versus controlled (introjected, external and amotivation) regulations. The different regulatory styles are held to be intercorrelated, most strongly associated with the regulations that are theoretically closest

¹ Footnote:

Integrated regulation is the most autonomous form of external motivation and is, consequently, very similar to intrinsic motivation (Markland & Tobin, 2004). A consequence of this conceptual similarity is a difficulty in developing psychometrically sound questionnaires that can distinguish between intrinsic motivation, integrated regulations as well as identified regulations. For example, questionnaire items from these sub-scales may cross-load or fail to load well on the appropriate factors. The problematic nature of measuring integrated regulation was highlighted in an exchange between the authors of the Sport Motivation Scale (SMS; (Pelletier et al., 1995)) and Mallet, Kawabata, Newcombe, Otero-Forero, and Jackson, (2007). Mallet et al., criticised the factorial validity and reliability of the SMS and argued that the exclusion of the integrated regulation was inconsistent with SDT. However, in response to an attempt by Mallet et al. to develop a revised version of the questionnaire, Pelletier, Vallerand, and Sarrazin (2007) showed that existing empirical data supported the original version of the SMS and that the new integrated regulation subscale, developed by Mallet et al., failed to obtain discriminant validity. Pelletier et al., subsequently developed a new integration subscale. Pelletier and Sarrazin (2007) comment that integrated regulation represents a complex latent construct that is hard to assess. Similar to the sport context, measures of motivation in the exercise context have failed to include an integrated subscale. For example, the BREQ-2 (the questionnaire employed in this thesis to measure exercise regulations) measures all theorised motivations except for integrated regulation. Therefore, the current thesis does not consider the determinants and psychological consequences of integrated exercise regulations.

to them in terms of their position on the autonomy continuum (Ryan & Connell, 1989). SDT posits that when one's regulations for participating in any given activity are more autonomous, optimal psychological functioning and eudemonic well-being (i.e., the presence of vitality, self-actualisation and the absence of anxiety, depression and somatic symptoms) will ensue. Support for this contention has been provided in a variety of contexts.

Extensive research conducted by Williams and colleagues in the health domain highlighted that autonomous regulations are associated with improved glycaemic control among diabetics (Williams, Freedman, & Deci, 1998), greater adherence to medical prescriptions (Williams, Rodin, Ryan, Grolnick, & Deci, 1998) and increased levels of smoking cessation (Williams et al., 2006b). Previous research has also shown that more autonomous motives for exercise correspond to positive outcomes such as persistence (Pelletier, Fortier, Vallerand, & Briere, 2001) and enhanced well-being (Edmunds, Ntoumanis, & Duda, 2008). In a PA promotion context, evidence is growing regarding the implications of self-determined regulations for enhanced well-being as well as physical activity engagement (Edmunds, Ntoumanis, & Duda, 2006; Silva et al., 2010b; Wilson, Rodgers, Blanchard, & Gessell, 2003; Wilson & Rodgers, 2004). For example, in their longitudinal study of ER participants, Edmunds, Ntoumanis, and Duda (2007) demonstrated that intrinsic motivation positively associated with general positive affect. In contrast, introjection was found to negatively related to subjective vitality. Edmunds and colleagues concluded that when individuals felt self-determined with regard to exercise engagement, enhanced well-being was experienced within and beyond the exercise context.

At the other end of the self-determination continuum and in contrast to autonomous motivations, controlled regulations are theorised to be accompanied by conflict, tension, and pressure (Deci et al., 1994). Although less is known about the consequences of controlled

motivations, when one holds controlled regulations this is expected to lead to a loss of eudemonic well-being, optimal functioning and increased anxiety and depression (Ryan & Deci, 2000c). For example, in the case of participants from an exercise on prescription scheme, Edmunds, Ntoumanis, and Duda (2007) showed that external regulations were negatively related to exercise commitment and feelings of subjective vitality. Research by Wilson and colleagues revealed no significant relationship between external exercise regulations and exercise intentions, behaviour or physical fitness (Wilson et al., 2003; Wilson & Rodgers, 2004).

SDT's identification of distinct regulations with specifiable consequences for experiences and outcomes, such as learning, performance, personal experience, and well-being (Ryan & Deci, 2000b) has popularised the theory in a variety of life domains. The focus of the present thesis is testing the theoretical propositions of SDT as applied to the context of a PA intervention within an ER programme. Specifically, Study 1 (Chapter 2) examines the relationship between motivational regulations and indicators of psychological health and behavioural intentions of those about to commence an ER scheme. Study 2 (Chapter 3) moves beyond the cross-sectional designs commonly found in the exercise science literature (e.g. Edmunds et al., 2006) by testing a SDT-based motivational sequence that is related to indicators of mental health (e.g., subjective vitality and depressive symptoms) again in an ER programme over a 6 month period of time (i.e., baseline, post-programme and 6 months follow-up).

Basic human psychological need satisfaction matters.

A critical proposition in SDT (Deci & Ryan, 2000) is that all humans possess three innate and universal basic psychological needs or nutrients, namely, autonomy, competence and relatedness that are essential for continuing psychological growth and development. Deci and Ryan (2000) specified that each need plays a necessary role in optimal development and that

psychological health requires satisfaction of all three needs. The need for *Autonomy*, is satisfied when one perceives a sense of ownership over his/her behaviour (Deci & Ryan, 1985). *Competence* refers to an individual's feeling of effectiveness in one's interactions with the social environment and in achieving valued outcomes (Deci and Ryan, 2000). Finally, *Relatedness* refers to feeling connected with others in a respected and secure manner (Ryan & Deci, 2000a). When the social environment is autonomy supportive and satisfies these basic human needs more self-determined regulations are theorised to ensue, whereas environments that are controlling, thwart the basic psychological needs leading to more controlled regulations. Deci and Ryan (2000) contend that, although the satisfaction of each need has specifiable outcomes, only when all three needs are satisfied can true optimal human functioning be achieved.

Research has supported the role of basic psychological need satisfaction for the facilitation of more autonomous exercise regulations, adherence to exercise programmes and psychological well-being (Edmunds, Ntoumanis, & Duda, 2007). Among participants who reported participating in regular exercise classes, need satisfaction was related to autonomous exercise motives and total exercise (mild, moderate and strenuous; Edmunds et al., 2006). Wilson, Rogers, Blanchard, and Gessell (2003) revealed that competence and autonomy need satisfaction were positively correlated with more autonomous behavioural regulations for participating in a 12-week prescribed exercise programme. Further, in a rare examination of the basic psychological needs across an ER context, Markland and Tobin (2010) found that exercise referral clients reported higher levels of identified regulation, one of the most autonomous reasons for participating in exercise, when their needs for autonomy, competence and relatedness were satisfied. The present thesis also aims to delineate the relationships between satisfaction of the basic psychological needs and their relationship with motivation regulations and indicators of mental health. Specifically, the purpose of Study 3 (Chapter 4)

was to examine the relationships between the three basic needs and motivational regulations for being physically active in participants engaged in an ER programme.

Environmental support for self-determination.

Although SDT assumes that people are intrinsically oriented toward growth and health, and will naturally internalise regulations regarding behaviours, social-environmental support (or lack of) can influence this tendency (Deci et al., 1994). Socio-environmental support for the basic psychological needs facilitates the process of internalisation, a process of transforming external regulations into internal regulations. Specifically, SDT postulates that environments that contain autonomy supportive interactions and are void of controlling interactions will facilitate the internalisation process.

Autonomy support is an environmental characteristic created by an individual or individuals that is clearly defined and characterised in the SDT literature. Throughout this thesis, Williams, McGregor, Sharp, Levesque, Kouides, Ryan, and Deci's (2006b) conceptualisation of autonomy support has been employed. Williams et al., (2006b) define autonomy support as features of the social environment created by a significant other(s) that satisfy the three basic psychological needs, such as eliciting and acknowledging perspectives, supporting self-initiative, offering choice, providing relevant information and minimising pressure and control. SDT's identification of a socio-environmental factor (i.e., autonomy support or need support), that can be manipulated to affect the processes that underpin and explain behaviour, makes it a relevant factor to examine with respect to health behaviour change.

Although previous research has focussed on the positive motivational outcomes associated with autonomy support, SDT assumes that environments can also be controlling and thwart the basic psychological needs (Ryan & Deci, 2000c). Currently, few studies have

investigated the characteristics of controlling environments and its motivational consequences. However, Bartholomew, Ntoumanis, and Thogersen-Ntoumanis (2010) recently developed the first psychometric instrument to measure controlling environments afforded by sports coaches. According to Bartholomew and colleagues, controlling environments generate feelings of pressure and coercion and the individual uses a position of authority to control the behaviour of others. Such controlling characteristics are theorised to thwart basic psychological need satisfaction and carry negative consequences such as the promotion of controlling motivations, increased drop-out and ill-being. Although little research into what constitutes controlling behaviour in the health domain has been conducted, controlling environments may result in negative consequences for health behaviour change interventions.

Socio-environmental support plays a critical role in the motivational sequence for two reasons. Firstly and as stated above, environments can be manipulated to affect the motivational sequence. For example, Williams and colleagues demonstrated that individuals (e.g., physicians and counsellors) can be trained in how to create more autonomy supportive environments (Williams, Gagne, Ryan, & Deci, 2002; Williams et al., 2006b). Secondly, need supportive environments rather than controlling environments carry positive consequences. Evidence suggests that autonomy supportive environments can play an important role in supporting the internalisation of behaviour regulations for changing health related behaviours and PA specifically. In an exercise setting, Edmunds, Duda, and Ntoumanis (2007) revealed that psychological need satisfaction mediated the relationship between autonomy support provided by an ER advisor and autonomous exercise regulations. Further, Fortier, Sweet, O'Sullivan, and Williams (2007) measured participants' perceptions of autonomy support provided by family physicians and showed a significant positive relationship with autonomous motivation six weeks into an autonomy supportive counselling intervention.

Research also reveals important consequences of socio-environmental support for psychological health and well-being. Williams, Lynch, and Glasgow (2007) highlighted the predictive utility of perceived autonomy support on positive and negative indicators of emotional well-being (i.e., subjective vitality and depressive symptoms) in diabetes patients. Williams et al., (2006b) showed that autonomy support from a health care practitioner *and* by important others independently predicted changes in percent calories from fat and tobacco abstinence. However, Williams et al., did not distinguish between those referred to in the ‘important other’ group. Thus, it remains unclear whether autonomy support from different important others make similar or unique contributions toward indicators of mental well-being and behavioural intentions regarding health behaviour change. Study 1 (Chapter 2) investigated the role of existing important other autonomy support on the reasons for becoming physically active in terms of participants about to commence a 12-week PA programme. While previous research on behavioural change and PA promotion has focussed on pre-identified and selected important others as a composite group, my aim was to investigate whether different and specific important others, such as partners, family members and physicians, make important and unique contributions to an individual’s motivation for changing behaviour. Further, Study 2 (Chapter 3) examined the independent relationships between autonomy support with respect to the satisfaction of the three basic psychological needs.

Despite early theorising that autonomy supportive environments satisfy all three basic psychological needs (Williams et al., 2006b), recent conceptualisation and terminology has appropriately shifted to ‘need support’ to account for the relationship between the social environment and competence and relatedness (Markland & Tobin, 2010). Although I am aware of the change in terminology, the term autonomy support is employed throughout this thesis because I used the Health Care Climate Questionnaire (HCCQ; Williams et al., 2006) to

measure environmental support which was initially presented as a measure of autonomy support.

As a consequence of the development in my understanding of the dimensions of need supportive environments, structure has been identified as the environmental factor that can satisfy the need for competence. Reeve (2002) identified structure as revolving around clear expectations, optimal challenges and timely and informative feedback. Involvement has been posited as an independent contextual element that nurtures relatedness. Involvement refers to the quality of the interpersonal skills and the dedication of psychological resources (such as time and energy) to a relationship (Reeve, 2002). It is theorised that only environments that satisfy all three basic psychological needs by affording autonomy support, structure and involvement will the most autonomous forms of motivation be supported.

SDT-based Physical Activity Interventions

SDT driven PA behaviour change interventions have demonstrated success at achieving change in target outcomes. A randomised control trial conducted in Portugal compared an SDT-based weight control intervention, with a comparison group who received a health education programme (Silva et al., 2008; Silva et al., 2010a). Participants randomly assigned to a SDT-based weight control intervention received 30 sessions covering nutrition, body image as well as PA. During all sessions, the intervention team created an autonomy supportive environment. Results revealed that at 12 months (immediately after the intervention) the weight control group showed significantly more weight loss and significantly higher levels of PA than the control arm. However, results have not yet been published to show whether these effects persist in the long-term (i.e., 3 or 6 months after the intervention finished). Further, in addition to being primarily grounded in SDT, Silva and colleagues' intervention programme also employed a wide variety of behaviour change techniques (e.g., implementation intentions). In a systematic review of behaviour change

techniques that promote PA and healthy eating, Michie, Abraham, Whittington, McAteer, and Gupta (2009) highlighted that it is not necessarily the number of techniques that determine effectiveness. Michie and colleagues noted that a large number of techniques can lead to a loss in intervention quality and fidelity. In contrast, they found that quality of intervention content was associated with effectiveness.

In a randomised control trial, Fortier, Sweet, O'Sullivan, and Williams (2007) compared a light counselling intervention with an intensive counselling intervention. In the light condition (control) participants received a brief autonomy supportive PA counselling intervention, provided by a GP or Practice Nurse. In addition to this brief intervention, the intensive condition (intervention) received 6 autonomy supportive PA counselling sessions provided by a PA counsellor. During the intensive sessions, the PA counsellor used goal setting, facilitated solutions to barriers, helped participants source social support and linked participants to community services. In addition, follow-up sessions were conducted that summarised progress and discussed relapse prevention techniques. Results revealed that participants assigned to the experimental condition reported higher levels of autonomy support, and had higher levels of autonomous motivation mid-intervention. Autonomous motivation mid-way through the intervention corresponded to higher PA levels post-intervention. Fortier and colleagues (2011) also showed that participants with more autonomous forms of motivation had higher PA levels but those with a high quantity of motivation (i.e., assessed by the question, "how motivated are you to participate in PA for more than 20 minutes during your free time for at least 1, 2, 3, ..., 7 days per week?"), in addition to more autonomous motivations, demonstrated the highest levels of PA.

Measuring Socio-environmental Support

PA interventions, such as ER programmes, are a suitable vehicle for SDT-based interventions because they rely on one-to-one interactions, between a health fitness advisor (HFA) and client, to make meaningful changes in PA behaviour. However, currently there is reliance upon self-reported measures of the social environmental support, with little attention being paid to gathering more objective data through observations. Across a variety of contexts (including sport, education and healthcare), studies that examine the role of autonomy support have predominantly employed self-report questionnaires. For example, Williams et al., (2006b) employed the HCCQ to assess patients' perceptions of the autonomy supportive environment afforded by health care practitioners regarding tobacco use. The present thesis also employed the HCCQ and requested participants to provide self-reports pertaining to the HFA's autonomy support towards his/her PA engagement. Despite the importance of self-reported data and their widespread use to measure psychological constructs in the social sciences for many years, this method of data collection also carries limitations. For example, participants may misunderstand what is meant by questionnaire items and their reports may be inaccurate due to memory distortion or for reasons of social desirability. Finally, participants may lack the knowledge or the expertise to provide detailed and accurate measurements. Therefore, the development and subsequent use of more objective methods of examining environmental support could supplement self-reports and facilitate theoretical advancements.

More objective measures of social-environmental factors when examining one-to-one PA interventions are also needed to complement self-reports and provide vigorous evaluations of the effectiveness of PA consultations. Although previous research has developed and employed observational instruments to examine group-based climates in education settings (i.e., created by the teacher when interacting with his/her class; Reeve, Jang, Carrell, Jeon, &

Barch, 2004; Tessier, Sarrazin, & Ntoumanis, 2008), no research that I am aware of has developed a protocol to examine one-to-one interactions between exercise professionals and their clients. Greater theoretical and clinical advancements could be made by employing more objective measures of one-to-one interactions between health professionals and their clients (Paulson, Post, Herinckx, & Risser, 2002). Therefore, the purpose of Study 3 (Chapter 4) was to describe the development of a SDT-based observational instrument that examines the social environmental support afforded by HFAs in a more objective manner. Secondly, this study determined the inter-rater reliability and tested the concurrent and convergent validity of the new instrument. More specifically, Study 3 entailed training observers to rate filmed consultations from an initial interaction between a HFA and his/her client participating in an ER scheme.

Self-control, Ego Depletion and Resistance to Temptations

The purpose of Studies 1 and 2 were to investigate consequences (in terms of psychological well-being) of the reasons why individuals choose to exercise. In contrast, Study 4 (Chapter 5) examined whether the reasons why we exercise can protect individuals from giving in to temptation and choosing a sedentary task (as opposed to a physically active option) when cognitively depleted. When deciding whether to participate in PA, a large number of factors may influence whether one decides to be physically active or sedentary. One such factor is self-control. Previous research suggests that acts of self-control impair our ability to perform subsequent acts of self-control. This phenomenon is known as ego depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Ego depletion occurs because human self-control is a limited resource, analogous to a muscle that becomes tired. This fatiguing quality could carry important consequences for health behaviour change.

Hagger, Wood, Stiff, and Chatzisarantis (2009) highlighted that behavioural change attempts in terms of many health related behaviours, including PA, are rooted in self-

regulatory failure. For example, if an individual is attempting to quit smoking, lose weight or increase PA levels, a reduction in self-control strength due to a long day at work, could increase the chances of failure. The individual attempting to change the health behaviour whose self-control resource has been depleted may subsequently fail to resist the chocolate brownie in the fridge, the packet of cigarettes in the drawer or the comfortable sofa in the lounge. Therefore, understanding the processes responsible for such failures could carry significant implications for health interventions. The magnitude of recent studies investigating the ego depletion model has corroborated the proposed fatiguing quality of the self-control resource and its importance for health behaviour change (Hagger, Wood, Stiff, & Chatzisarantis, 2010).

Despite the apparent application to health behaviours and the magnitude of research interest, little attention has been paid to the effect of ego depletion on the ability to resist temptations (e.g. eating unhealthy foods, remaining sedentary) and adhere to focal goals (e.g., lose weight, improve cardiovascular fitness). Muraven, Tice, and Baumeister (1998) employed a depleting task that required participants to suppress their emotional response to a movie, and demonstrated that participants performed worse at a physical handgrip task compared to those who did not suppress their emotional response. Previous research has also shown that participants who resisted temptation by choosing a radish rather than a cookie or no food were less persistent at an unsolvable task (Baumeister et al., 1998). However, no research that I am aware of has employed the ability to avoid temptations as an outcome variable. Therefore, it is not clear whether ego depletion reduces the ability to resist temptations and stick to a focal goal. In a separate line of research however, Fishbach and colleagues (Fishbach & Converse, 2010; Trope & Fishbach, 2000) have suggested that humans employ counteractive control strategies as a mechanism to help stick to focal goals and resist temptations.

Counteractive Control Theory

Counteractive Self-control Theory (Trope & Fishbach, 2000) suggests that self-control efforts can be employed to resist temptations away from the attainment of important long-term goals. More specifically, it is proposed that when short-term temptations are present, individuals employ counteractive strategies that increase the likelihood of sticking to the long-term goal. Counteractive control strategies are categorised as *choice alternatives* or *counteractive evaluations*. Choice alternatives place contingent rewards on behaviours to support acts that facilitate the achievement of meaningful and important long-term goals. For example, an individual may buy a new pair of shoes if he/she goes to the gym twice a week for a month. In contrast, counteractive evaluations bolster the perceived value of the long-term goals or reduce the value of the short-term temptations. In this circumstance, when an individual is faced by a temptation such as a comfortable arm chair in front of the television, he or she may boost the value placed on improving cardio-vascular fitness. Previous research has provided supportive evidence for the use of these strategies. Trope and Fishbach (2000) conducted a series of studies that demonstrate the use of counteractive control strategies when one is faced by a threat to a valued goal. For example, in a study that was proposed to be investigating the risk of heart disease that included a cardiovascular test, results revealed that when faced by a threat to a valued goal (i.e., the unpleasant nature of the physical test), participants who placed value on good health would make a bonus contingent on completing the unpleasant test. Trope and Fishbach argue that this demonstrates the contingent use of the bonus to ensure that the valued goal was accomplished, and not prevented by the unpleasant nature of the test. Further, Fishbach, Zhang, and Trope (2010) also showed that dieters expressed more negative evaluations of fattening foods (i.e., a temptation) and positive evaluations of healthy foods (i.e., valued goal) compared to non-dieters. Fishbach and colleagues suggest that these findings represent counteractive control strategies that help individuals to achieve their valued

goals and resist temptations away from their goals. However, as yet untested is what prevents one from employing these counteractive control strategies? Fishbach and Trope (2008) indicate that future research is necessary to clarify the effect that previous acts of self-control (i.e., ego-depletion) has on the ability to employ counteractive control strategies to resist short-term temptations and stick to valued long-term goals. In this thesis, Study 4 (Chapter 5) examined whether ego depletion reduced participants ability to employ counteractive evaluations that support their ability to stick to a focal goal and resist temptations when depleted.

Moderating the effect of ego depletion on temptations.

Maximising the ability to employ self-control when faced by sedentary temptations could have important implications for the effectiveness and mental health outcomes of future PA behaviour change interventions. Previous research has indicated that one's motivation for participating in a cognitive task can reduce the effect of ego depletion, resulting from that task, on an individual's ability to employ self-control on a subsequent task. Baumeister, Bratslavsky, Muraven, and Tice (1998) originally proposed that acts of volition, including active choice, depleted the self-control's limited resource. Baumeister and colleagues supported this assumption with research indicating that participants who were provided with "choice" also showed a decline in performance on a subsequent self-control task. This contention that choice depleted the self-control resource contradicted motivational theories such as SDT (Deci & Ryan, 2000). However, Moller, Deci, and Ryan (2006) argued that the study design implemented by Baumeister et al., (1998) investigated the impact of controlled choice rather than autonomous choice; a differentiation that according to SDT is of conceptual importance and empirical utility (Deci & Ryan, 2000). Subsequently, research has supported the SDT proposition that autonomously motivated self-control is less depleting than extrinsically motivated self-control (Moller, Deci, & Ryan, 2006).

Muraven (2008) demonstrated that the reasons why participants employ acts of self-control (e.g., resisting eating cookies) determine the level of ego depletion. Specifically, participants with more controlled motives for employing self-control performed worse at a subsequent handgrip task than those with autonomous motives. Muraven (2008) concluded that exerting self-control for autonomous reasons is less depleting than exerting self-control for controlled reasons. Recent research has further demonstrated that manipulations of the motivational environment surrounding the individual exerting self-control can moderate the effect of ego depletion on self-control. In particular, Muraven, Gagne, and Rosman (2008) revealed that participants in an autonomy supportive environment whilst completing a cognitively depleting task performed better on a subsequent concentration task compared to those in a controlling or neutral environment. In addition, lack of autonomy support led to lower feelings of vitality, particularly after exerting self-control. Therefore, not only can motivation and the psychological environment moderate the effect of ego depletion but it may also hold implications for experiencing positive mental well-being. However, as yet it remains unclear whether the same moderating effect of motivation would exist for any observed effect of ego depletion on the ability to employ counteractive control strategies. Therefore, Study 4 (Chapter 5) examined the role that an autonomy supportive condition and personal motivational regulations have on acts of self-control and feelings of subjective vitality.

Thesis Aims

To summarise, this thesis examines the tenets of SDT in the health domain of physical activity behaviour change. The aims of this thesis are:

1. To investigate differential effects of autonomy support on self-reported mental health and PA intentions as a function of who provides autonomy support in participants about to enter an exercise referral scheme (Chapter 2).

2. To test longitudinally the applicability of SDT's proposed motivational sequence (i.e., autonomy support to need satisfaction to well-being outcomes) during and 3 month post the completion of a 12 week exercise referral programme (Chapter 3).
3. To describe the development and validation of an SDT-based observational instrument that examines environmental support afforded by health and fitness professionals to clients within one-to-one PA promotion consultations (Chapter 4).
4. Finally, within a laboratory-based experimental protocol, to examine the moderating role of autonomy support and autonomous motivation on the ability to resist temptations for a sedentary task and stick to a physically active task in the face of ego-depletion; to also test whether feelings of subjective vitality are maintained by more autonomous motivational regulations in the face of cognitive depletion (Chapter 5).

**IN THE BEGINNING: ROLE OF AUTONOMY SUPPORT ON
MOTIVATION, MENTAL HEALTH AND INTENTIONS OF
PARTICIPANTS ENTERING AN EXERCISE REFERRAL
SCHEME**

Abstract

Self-determination theory (Deci & Ryan, 2000) highlights the relationship autonomy supportive environments have with exercise motivation and positive health outcomes, yet little is known about whether differential effects occur as a function of which significant other is providing this support. Further, no research has examined the relationship between motivation and the social environment with participants' mental health and intentions to be physically active before entering an exercise intervention. Study participants were 347 British adults about to start an exercise referral scheme. Regression analyses revealed that the relationships between autonomy support and mental health and physical activity intentions differed as a function of who provided the support (offspring, partner, physician), with offspring having the weakest effects. A structural model was supported indicating that autonomy support and more autonomous regulations was associated with more positive mental health outcomes and stronger intentions to be physically active. Knowledge of the social environmental and personal motivation of those about to commence an exercise programme can provide important insights for professionals supporting such efforts.

Introduction

Despite overwhelming evidence supporting the benefits associated with regular physical activity (PA; Blair, 2009) people show remarkable resistance to adopting and especially maintaining this positive health behaviour (Williams et al., 2002). Research grounded in self-determination theory (SDT; Deci & Ryan, 1985) has highlighted the positive influence that autonomy support can have on facilitating health behaviour change as well as associated physical and psychological health benefits (Williams et al., 2002). To date within the SDT-based literature centred on PA promotion, emphasis has been placed on the degree of autonomy support offered by exercise instructors in the case of individuals engaged in exercise classes (Edmunds et al., 2008; Wilson & Rodgers, 2004) or perceptions of the autonomy support provided by fitness advisors among those who are participating in ER schemes (Edmunds et al., 2007). However, when people are about to start “down the road” toward the adoption of an active lifestyle, they are influenced by a variety of significant others and each may make a unique contribution towards their initial motivation toward behavioural change, intentions to be more active, and associated psychological and emotional state. Further, previous studies have not considered the potential effect of the social environment operating *before* someone initiates a structured PA promotion programme. In sum, little is known about the contribution made by different important others on the motivation and well-being of individuals in the beginning- when they are about to commence a PA programme. The overarching aim of the present study is to address these gaps in the literature.

Self-Determination Theory

Self-determination theory (Deci & Ryan, 2000) is concerned with why we engage in specific behaviours and focuses on the degree to which people’s motivation toward engagement in activities, such as PA, are more or less self-determined or controlled by external or internal pressures. SDT proposes that when an activity is not intrinsically motivating, behaviour is

guided by a variety of extrinsic regulations which are assumed to lie on a self-determination continuum (Ryan & Deci, 2002). External regulation is the least autonomous and indicates a behaviour that is conducted for tangible and intangible rewards, externally referenced reinforcement, or as an outcome of pressure from external sources. As we progress along the continuum, introjected regulation represents the motive to perform a behaviour to avoid guilt and shame, or attain feelings of contingent self worth and social approval. Identified regulation reflects engagement due to an understanding, acceptance and valuing of the benefits associated with participating in the behaviour. The most self determined regulation, intrinsic motivation, reflects an inherent interest in the activity in hand and does not necessitate any operationally separable consequences (Deci & Ryan, 2000). Deci and Ryan (2000) indicate that these regulations cluster to form autonomous (intrinsic and identified) versus controlled (introjected and external) regulations. SDT further proposes an amotivated state in which an individual lacks any intention or desire to conduct the behaviour. Previous research has shown that more autonomous motives for exercise correspond to positive outcomes such as adherence (Pelletier et al., 2001) and enhanced well being (Edmunds et al., 2008). Therefore, environments that support the development of autonomous self-regulations are considered important for optimal physical and psychological health.

Autonomy support.

In this study I focus on the concept of autonomy support because it provides the framework for understanding how significant others can support behavioural change without undermining the receiver's locus of causality. Autonomy support is clearly defined with respect to a behaviour set that an individual may exhibit that holds implications for the formation of self-determined regulations. Williams et al., (2006b) conceptualised autonomy support as features of the social environment created by a significant other(s), such as eliciting and acknowledging perspectives, supporting self-initiative, offering choice, providing relevant

information and minimising pressure and control. For example, a health and fitness advisor that creates an autonomy supportive environment offers his/her client the opportunity to choose which activity he/she will engage in (Williams, Cox, Kouides, & Deci, 1999; Pelletier et al., 2001), acknowledges positive and negative feelings towards becoming physically active in an empathetic manner (Edmunds, Duda, & Ntoumanis, 2007), understands the client's perspective (Pelletier et al., 2001; Reeve & Jang, 2006) and encourages ownership and self initiative towards becoming physically active (Deci & Ryan, 2000). SDT proposes that when an autonomy supportive environment is created the reasons for conducting a behaviour become more self determined or autonomous over time. Previous work in the physical domain has provided evidence for this assumption (Edmunds et al., 2008; Hagger et al., 2009).

Health behaviours have been the focus of previous research investigating autonomy supportive environments. Williams and colleagues (Williams et al., 1998; Williams et al., 1999) studied the relationship between autonomy support with a series of health behaviours (smoking, weight control, and medication adherence) and revealed that perceptions of autonomy support positively predicted autonomous reasons and its change over time for engaging in the specified health-related behaviour. Williams, Lynch, and Glasgow (2007) also highlighted the predictive utility of perceived autonomy support on positive and negative indicators of emotional well-being (i.e., subjective vitality and depressive symptoms) in diabetes patients. When validating the Important Other Climate Questionnaire, Williams et al., (2006a) found that 6 month change in percent calories from fat and tobacco abstinence were each predicted independently by autonomy support from the health care practitioner *and* by important others. However, Williams et al., did not distinguish between those referred to in this latter group. Thus, it remains unclear whether autonomy support from different significant others make similar or unique contributions toward affective outcomes and

behavioural intention regarding health behaviour change. In terms of PA behaviours specifically, research has been conducted that investigates the implications of autonomy supportive environments created by exercise professionals (e.g., Edmunds et al., 2008; Fortier, Sweet, O'Sullivan & Williams, 2007). However, these studies fail to examine as well as distinguish between the support provided by family, friends and medical staff, which is the focus of the present research.

A major purpose of this study is to investigate the role of existing 'important other' autonomy support on the reasons for becoming physically active in terms of participants about to commence a 12-week PA programme. While previous research on behavioural change and PA promotion has focussed on a pre-identified and selected important others as a composite group, my aim here is to investigate whether a variety of specific important others, such as partners, family members and physicians, make important and unique contributions to an individuals' motivation for becoming physically active as they enter a PA promotion programme.

Behavioural intentions and affective outcomes.

Autonomous motivational regulations are important for health behaviour change because of their positive association with beneficial outcomes such as persistence, intentions and indices of mental health. When an individual is amotivated or motivated by controlled regulations, negative outcomes often ensue. For example, in a sample of ER participants, Edmunds, Ntoumanis, and Duda (2007) found intrinsic motivation to be positively related to general positive affect while introjection, a controlling regulation, was negatively related to subjective vitality. Autonomous regulations have also been found to be positively related to behavioural intentions. Wilson and Rodgers (2004) showed that exercise regulations of an intramural sport sample accounted for 49% of the variance in behavioural intentions to exercise. Furthermore, autonomous regulations demonstrated the strongest positive associations with exercise

intentions in a study of undergraduate students (Maltby & Day, 2001). Standage and Gillison (2007) revealed that students' autonomous motivation towards physical education was associated with global indicators of well-being such as self-esteem and health related quality of life. Therefore, reasons for participating in PA may not just be associated with outcomes specific to PA, but can also be related to a more global level of well-being. This would be important in helping ER schemes achieve the aim of improving the physical and mental health of their clients.

Autonomy support has also been shown to facilitate positive attitudes and PA intentions in research conducted in the physical domain (Chatzisarantis, Hagger, & Smith, 2007; Chatzisarantis, Hagger, & Brickell, 2008; Lim & Wang, 2009). In two studies examining the association between perceived autonomy support and PA intentions, Chatzisarantis et al., (2007) supported a positive relationship between these two constructs in both school children and university students. In a physical education setting, Lim and Wang (2009) found external regulations to be negatively associated with PA intentions, while autonomous regulations were positively linked with these intentions.

Study Aims

No SDT-grounded research, that I am aware of, has investigated the differential predictive utility of different important others' autonomy support on positive and negative indicators of emotional well being (i.e., subjective vitality and depressive symptoms) and PA intentions, as a function of who is providing the support. Therefore, my study of participants about to enter an ER scheme investigated whether differential effects on self-reported mental health and PA intentions occur as a function of who provides autonomy support. To this end, I requested participants to identify one important other who is most pertinent to their attempt to become physically active and provide a rating of the autonomy support that this important other

provides. Due to the lack of previous research and the explorative nature of the present study, no hypothesised relationships were made a priori.

The second purpose of this study was to test a SDT-based structural model. My hypothesised model is based on research conducted in teaching, coaching and exercise settings (Edmunds et al., 2007; Pelletier et al., 2001; Williams et al., 1999). I expected that autonomy support provided by an important other identified by each participant will be positively correlated with autonomous exercise regulations and negatively correlated with more controlling exercise regulations and amotivation. Further, I predicted that more autonomous regulations would be positively associated with an indicator of good mental health (vitality) and behavioural intentions to be physically active. In contrast, I expected that autonomous exercise regulations would be negatively correlated with an indicator of poor mental health (depressive symptoms). Finally, I hypothesised that more controlled exercise regulations and amotivation would have the reverse relationships with these outcomes. It was anticipated that the indicators of good and poor mental health would be negatively associated.

Method

Participants

Participants ($n= 347$) were individuals about to participate in an ER scheme in a large city within the UK. Seventy three percent were female (M age = 48.40 SD =13.84) and 27% male (M age = 52.40 years SD = 13.19). The majority of participants (90.3%) were either overweight or obese (M BMI = 33.21 SD = 6.70), and 28.3% were from a non-white UK ethnic group. About 20% of participants were identified as having probable clinical depression, and 34.8% marked by high anxiety. Entrance onto the ER scheme was based on being identified by a physician or practice nurse at a primary care level as a) marked by at least two risk factors of cardiovascular disease (e.g., being overweight, smoking), b) currently not participating in regular PA, and c) perceived to have the motivation to increase his/her PA

levels. The sample was self-selected from a larger sample of referred patients who were invited to participate in the study.

Measures

Important other autonomy support.

Autonomy support was assessed through the previously validated Important Other Climate Questionnaire (IOCQ; (Williams et al., 2006a) derived from the Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Deci & Ryan, 1996). Participants were asked an open ended question that aimed to identify one important other who was particularly influential in their attempt to become physically active (i.e., “Who is the most important person in your effort to becoming healthier through physical activity?”). The perceived level of autonomy support provided by the identified important other was assessed using six items (e.g., “I feel that my important other understands how I see things with respect to my physical activity”). Each item was responded to using a 7-point Likert-type scale (*strongly disagree* = 1; *strongly agree* = 7). Previous research in a sport setting has demonstrated good internal reliability using the IOCQ (Adie, Duda, & Ntoumanis, 2008).

Reasons to exercise.

Participants’ motivation for engaging in exercise was measured using the Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004). Participants were requested to respond to the BREQ-2 in terms of their reasons for wanting to engage in PA. The BREQ-2 measures four different exercise regulations (i.e., intrinsic, identified, introjected and external), as well as amotivation. All the BREQ-2 subscales have been shown to have good internal consistency in previous research conducted in an ER scheme ($\alpha = .70 - .91$; Edmunds, Ntoumanis, & Duda, 2007). Each subscale was measured with four items except the introjected subscale which comprised three items. An example item for Intrinsic regulations is, “I engage in physical activity because it is fun”; Identified “I value the benefits

of physical activity”; Introjected “I feel very guilty when I don’t exercise”; External “I regularly engage in physical activity because other people say that I should”, and Amotivation “I don’t see the point in being physically active”. All items were anchored by 0 (*not at all true*) and 4 (*very true*).

Subjective vitality.

The six item version of the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997; Bostic, Rubio, & Hood, 2000) was employed as a positive indicator of mental health and well-being. Participants responded to how, over the last two weeks they felt, using a scale anchored by 1 (*not at all true*) to 7 (*very true*), and an example item is “I feel alive and full of vitality”. The SVS has shown good internal consistency in past work in the exercise context with Cronbach alphas ranging from 0.84 - 0.86 (Bostic, Rubio, & Hood, 2000).

Depressive symptoms.

Depressive symptoms were assessed with the 7-item subscale from the Hospital Anxiety and Depression Scale (HADS-D; Zigmond & Snaith, 1983). The items (e.g., “I have lost interest in my appearance”) were scored on a four-point scale ranging from 0 (*not present*) to 3 (*considerable*). Previous research that has utilised the HADS-D with the general public, has revealed Cronbach’s alpha values ranging from .67 to .90 (Bjelland, Dahl, Haug, & Neckelmann, 2002), thus supporting the internal consistency of this subscale.

Physical activity intentions.

Participants’ intentions to engage in regular PA (at least 5 days a week for a total of 30 minutes each day during the next three months, to match government recommendations) were assessed with three items (e.g., “I intend to regularly engage in physical activity during the next 3 months). These items were rated on a scale ranging from 1 (*strongly agree*) to 7 (*strongly disagree*). Previous research has successfully employed similar measures of PA intentions ($\alpha = .77$; Hagger, Chatzisarantis, & Biddle, 2001).

Procedure

Ethical approval to conduct the study was obtained from the local university ethics review committee. Participants were sent via post a multi-section questionnaire containing the instruments described above, and were asked to complete each section before arriving for their first consultation on the ER scheme. Instructions informed the participants that there were no right or wrong answers and asked to respond truthfully. They were also reassured that their admission on the ER scheme was unrelated to their participation in the study. The questionnaire took approximately 20-25 minutes to complete.

Data Analyses

To examine whether the individual providing autonomy support is associated with PA intentions and indicators of well-being, a series of hierarchical regression analyses were conducted to explore the independent and interactive effects of perceived autonomy support as a function of who provides that support on three dependent variables: PA intentions, vitality and depression. The three most commonly cited significant others (partner, physician/nurse and offspring) were included in the analysis. Partner ($n=126$) was most frequently identified as the significant other important in participants' planned attempt to become more physically active. Offspring ($n=47$) and physician/nurse ($n=43$) were also frequently cited, and all three combined represented 74% of the important others identified. There were no significant differences in mean levels of autonomy support between the three important others $F(2,205) = .51$ $p>.05$. Additional important others (e.g., friends $n=18$) were identified by too few participants to allow meaningful analysis. Therefore, data from two hundred and sixteen participants (M age= 50.12 ± 13.4 years) were included in the regression analyses.

Due to the categorical nature of the variable important other autonomy support, dummy coding was employed as it is the most frequently utilised procedure when

investigating interactions between categorical and continuous variables (Aiken & West, 1991). Two dummy variables were created. Partner was selected as the comparison group because this significant other represented the most frequently selected category (Field, 2005) and was coded as zero in both dummy variables. Dummy Variable 1 identified autonomy support provided by physician/nurse which was coded as 1 (offspring = 0). In the second dummy variable, offspring was coded as 1 (physician/nurse = 0). Following the recommendations by Aiken and West (1991), autonomy support scores were standardised before analyses were conducted. In step 1 of each regression, the standardised scores for autonomy support by a significant other were entered with Dummy Variable 1 (Physician/Nurse) and Dummy Variable 2 (Offspring). In step 2 of each regression, the interaction terms between each dummy variable and autonomy support variables were added. Entering these simultaneously with the original variables, the interaction variables test the difference between the slope of the group with a non zero value and the reference group (Cohen, Cohen, West, & Aiken, 2003). In terms of interpreting the results of the regression analysis, the regression coefficient for the main effect is the β for autonomy support provided by a partner. The β 's for the two dummy variables are the differences between autonomy support provided by partner and the other important others (i.e., physician/nurse and offspring). The regression coefficients for the two interactions are the differences between the autonomy support slope for each important other and that of partner (Cohen et al., 2003).

Although the significant interactions will reveal whether the effect of autonomy support varies as a function of who provided it, they do not identify where these differences lie (Aiken & West, 1991). Post-hoc probing of the significant interactions was conducted to examine whether the slope of the simple regression lines differed significantly from zero for each dependent variable. Therefore, to probe the significant interactions, the standard errors of

the simple slopes of the regression equations were calculated and t-tests for the significance of the simple slopes were computed (Aiken & West, 1991).

Structural Equation Modelling (SEM), utilising the statistical software package EQS 6.1, was used to test a SDT-based structural model. The robust maximum likelihood estimation method of analysis was implemented which provides a correction for non-normality (Byrne, 2006). Model fit was evaluated using the Comparative Fit Index (CFI), the Standardised Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). A hypothesised model is thought to show a good fit to the data if the CFI is equal to or above .95, and the SRMR and RMSEA are equal to or less than .08 and .06, respectively (Hu & Bentler, 1999). Consistent with previous research (Sebire, Standage, & Vansteenkiste, 2009) and to reduce non-normality in the data (Little, Cunningham, Shahar, & Widaman, 2002), the number of observed variables was reduced by forming parcels. Parcels were created using factor loadings as a guide. The largest factor loading was paired with the smallest to provide balance between the parcelled indicators (Little et al., 2002). Three parcels were created for perceived autonomy support, PA intentions and depressive symptoms. In-line with Deci and Ryan's (2000) theoretical writings, an autonomous latent variable was created by combining intrinsic motivation and identified items, and a controlled motivation latent variable by combining external regulations and introjected items. Autonomous and controlled motivations were indexed by four parcels each. Amotivation was represented by four observed variables while five items were used as indicators of vitality. Although multi-group invariance testing would have been desirable following the regression analyses, unfortunately, I did not have sufficient sample size to achieve this. I therefore, used the results of the regression analysis to guide my decisions. I included in the SEM, participants who identified as the most important other, their partner or their physician/nurse because the beta values for these important others were significant and similar to each other in

the regression predicting PA intentions. In contrast, in the same regression, the β for offspring was not significant and therefore I did not include in the SEM participants who identified offspring as the most influential significant other.

Results

Table 2.1 (descriptive statistics, bi-variate correlations and internal reliability coefficients) reveals that participants perceived their important others (average of all three important others) to be providing a high level of autonomy support. Further, the BREQ-2 scores indicate that autonomous regulations were moderately high in my sample and amotivation scores were low. Mean scores for vitality were moderate, those for depressive symptoms were low while scores for PA intentions were high. Bi-variate correlations between the latent variables were in accordance with theoretical postulates. Perceived autonomy support was positively associated with autonomous motivation, negatively with amotivation, and positively with vitality. Autonomous motivation was positively associated with vitality and PA intentions. Indicating acceptable levels of internal consistency, the alpha coefficient for the IOCQ was .93, while the alpha coefficient for the motivational regulation subscales and outcome measures ranged from .70 - .89 and .85 - .94, respectively.

Regression Analyses

With respect to PA intentions, Step 1 was significant $F(3, 203) = 9.56; p < .01$; important other autonomy support accounted for 12.4% of the variance in participants' intentions. In Step 2, the interaction between dummy two (offspring) and autonomy support was also significant ($\beta = -.67; p < .05$). For depressive symptoms, Step 1 was significant $F(3, 204) = 3.79; p < .01$; important other autonomy support accounted for 5.3% of the variance in participants' depressive symptoms. In Step 2, the interaction between dummy one (physician/nurse) and autonomy support was significant ($\beta = .22; p < .05$).

Table 2.1

Reliability Analyses (Cronbach's Coefficient α), Descriptive Statistics, and Bi-variate Correlations for Perceived Autonomy Support, Motivational Regulations for Exercise, Mental Health and Physical Activity Intentions (n=216)

<i>Variables</i>	α	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Perceived autonomy support	.93	5.26	1.48							
Partner	.93	5.23	1.40							
Physician/Nurse	.94	5.45	1.62							
Offspring	.92	5.13	1.57							
2. Autonomous regulations	.89	2.50	.89	.24**						
3. Controlled regulations	.77	1.16	.82	.07	.33*					
4. Amotivation	.70	.35	.57	-.20**	-.38**	.11				
5. Vitality	.92	3.62	1.58	.17*	.34**	.01	-.16*			
6. Physical activity intentions	.94	5.02	1.71	.42**	.21**	.08	-.13	.14		
7. Depression	.85	1.08	.62	-.12	-.04	.19*	.07	-.62**	-.05	

Note: * $p < .05$. ** $p < .01$

Table 2.2

Dummy Variable Interactions and Main Effects of Perceived Autonomy Support (Partner, Physician/Nurse and Offspring) on Three Outcomes

		Physical Activity Intentions				Vitality				Depressive Symptoms			
		β	SE_B	t	F	β	SE_B	t	F	β	SE_B	t	F
Main Effects		(3,203) 9.56*				(3,204) 2.20				(3, 204) 3.79*			
	Intercept	5.13	.15			3.66	.14			.96	.05		
	Partner Autonomy Support	.61	.12	5.12*		.26	.11	-1.59		-.07	.04	2.31*	
	Physician/ Nurse vs Partner	-.54	.30	-1.80		-.29	.28	3.05*		.32	.11	-1.02	
	Offspring vs Partner	-.28	.29	-.95		-.24	.28	.96		.10	.10	-.87	
Full Model		(5,201) 7.23*				(5,201) 1.90				(5, 202) 3.50*			
	Intercept	5.13	.15			3.66	.14			.96	.05		
	Partner Autonomy support	.75	.16	4.68*		.43	.15	2.80*		-.16	.06	-2.81*	
	Physician/ Nurse vs Partner	-.59	.30	-1.97*		-.24	.28	-.86		.60	.11	2.84*	
	Offspring vs Partner	-.30	.29	-1.03		-.24	.27	-.87		.10	.10	.98	
	Physician/ Nurse x Autonomy Support Interaction	.12	.30	-.41		-.42	.27	-1.55		.22	.10	2.17*	
	Offspring x Autonomy Support Interaction	-.67	.29	-2.34*		-.30	.27	-1.08		.18	.10	1.70	

Note: * $p < .05$

For vitality, step 1 was non-significant $F(3, 204) = 2.22; p > .05$, step 2 was also non-significant $F(5, 202) = 1.90; p > .05$. See Table 2.2 for full details of each hierarchical regression analysis.

Post hoc probing.

Figure 2.1 shows the emerging interaction plots. Post-hoc probing revealed that autonomy support provided by partners ($b = .75; t = 4.71; p < .05$) and physicians ($b = .87; t = 2.54; p < .05$) significantly predicted PA intentions. In contrast, autonomy support provided by offspring ($b = .07; t = .22; p > .05$) did not significantly predict these intentions. Further, autonomy support provided by partners significantly and inversely predicted depressive symptoms ($b = -.16; t = -2.94; p < .05$); autonomy support provided by physicians/nurse ($b = 0.01; t = .72; p > .05$) and offspring ($b = .01; t = .16; p > .05$) did not predict depressive symptoms.

Structural Equation Modelling

Due to the lack of a relationship from offspring in the regression analyses, only data collected from participants who identified a partner or physician/nurse as the main providers of autonomy support are included in my structural equation modelling (SEM).

Our hypothesised model ($n=169$; partner $n= 126$ and physician/nurse $n= 43$) was tested and revealed an inadequate fit to the data CFI= .92; NNFI=.90, RMSEA= .06 (90% CI= .05-.08), SRMR=.10. I proceeded in a model generating fashion to modify and re-estimate the relationships. In model assessment, misspecifications in my hypothesised model were investigated through the Wald and Lagrange Multiplier (LM) tests. Inspection of the modification indices revealed that co-varying autonomous regulations and controlled regulations, as well as autonomous regulations with amotivation, and finally vitality with depressive symptoms would improve the model fit. The positive relationship between autonomous regulations and controlled regulations indicates that my participants may have

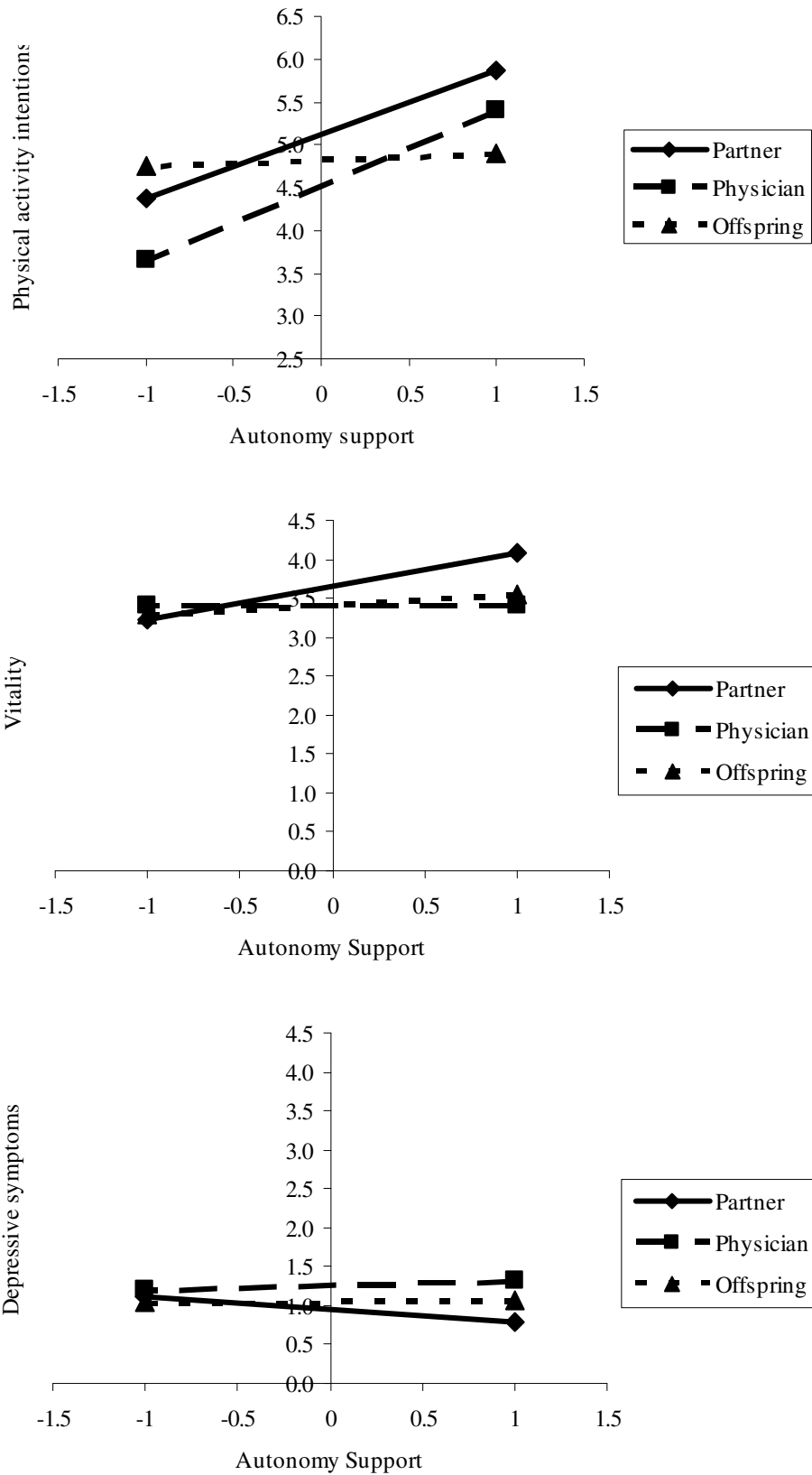
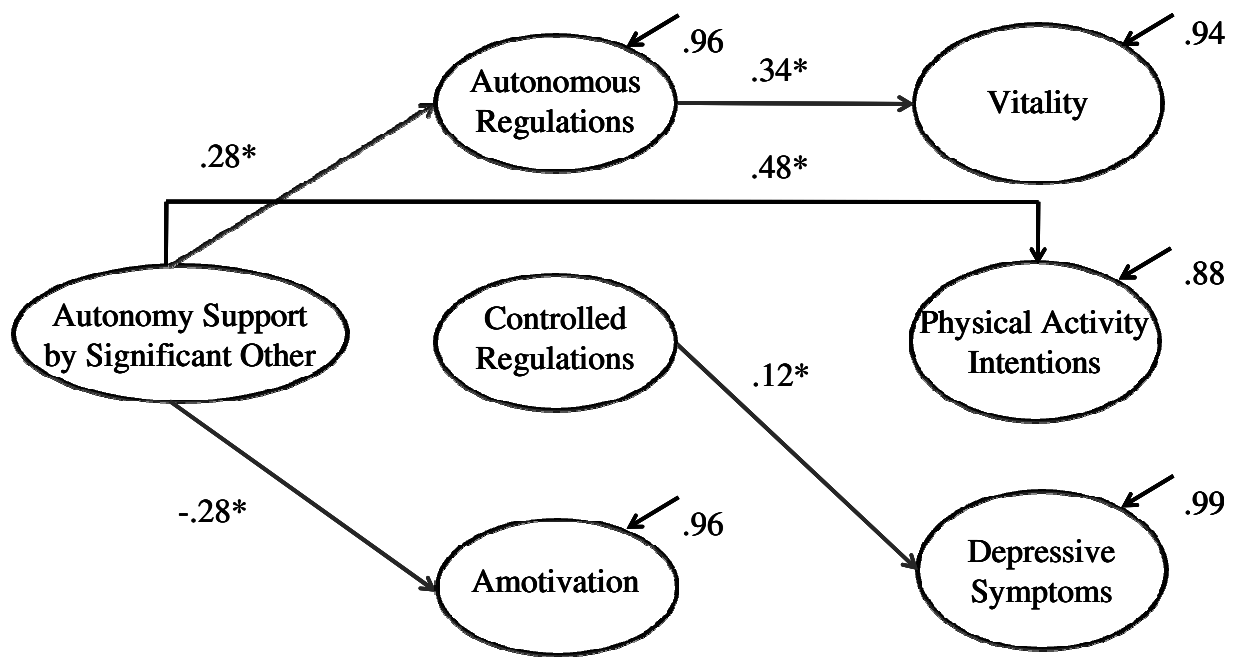


Figure 2.1 Significant interactions between three significant others' autonomy support in predicting physical activity intentions, vitality and depressive symptoms.

both controlling and autonomous reasons for becoming physically active. The modification indices suggested improvement would also be made by freeing model parameters. Non-significant relationships between latent variables were removed and a direct relationship between perceived autonomy support and PA intentions was added. All identified changes were considered in theoretical terms and with respect to previous empirical evidence before being implemented. For example, previous research has shown a direct link between perceived autonomy support and PA intentions (Chatzisarantis et al., 2007). My final model was found to provide an adequate fit to the data: CFI= .94; NNFI=.93, RMSEA= .06 (90% CI= .04-.06), SRMR=.085 (see Figure 2.2). This model indicated a significant and positive relationship between perceptions of autonomy support provided by one's important other and autonomous regulations and a significant but inverse relationship with amotivation. In turn, autonomous regulations revealed a positive association with vitality. Perceptions of autonomy support provided by an important other also revealed a direct positive relationship with PA intentions that was significant. Controlled reasons for participating in PA were significantly and positively associated with characteristics of negative mental health (i.e., depressive symptoms).



* = $p < .05$

Figure 2.2 The re-specified structural model showing the error terms and significant path coefficients between autonomy support, exercise regulations, mental health and physical activity intentions.

Note: For figure simplicity the correlations between the errors of the indicators of autonomous regulations and controlled regulations, autonomous regulations and amotivation, and vitality and depression are not shown.

Discussion

This explorative research highlights that the relationship between perceptions of autonomy support and the mental health and PA intentions of my participants varied according to which person offered that support. My structural model revealed that perceived autonomy support provided by partners or physician/nurses was associated with more autonomous reasons for becoming physically active and intentions to be physically active. Further, these autonomous motivations were linked to a positive mental health outcome whereas controlled motivations were associated with depressive symptoms when individuals were about to commence an ER scheme.

Autonomy Support Provider Matters

Previous research (Chatzisarantis et al., 2008) has requested participants to rate autonomy support afforded by a particular important other without differentiating between particular agents of support. In contrast, the present research asked participants to specify a single most influential important other, who is relevant to their forthcoming attempt to become physically active and rate his/her level of autonomy support. My results indicate that it may be important to specify the significant other providing autonomy support as the relationships between perceived autonomy support, mental health and PA intentions varied as a function of who imparted it.

Physical activity intentions.

Our regression analyses indicated that perceived autonomy support contributed to the prediction of PA intentions. This result is consistent with previous studies involving high school children, university students and young adults in which a positive relationship has also been found between autonomy support and PA intentions (Chatzisarantis et al., 2007; Chatzisarantis et al., 2008). The current research extended this work in an older population and also reveals that the significant other providing an autonomy supportive environment influences the strength of this relationship. Specifically, my results have shown that perceived autonomy support provided by partners and physician/nurse contributes to the prediction of PA intentions, but this was not the case for offspring autonomy support. Offspring's differential pattern of association with PA intentions may be explained by the lack of opportunities available for them to make meaningful contributions to their parents attempt to become physically active. Sixty-five percent of my sample was aged between 40-65 years suggesting that the majority of offspring referred to were approximately 10-25 years old. At this stage of the offspring lives, the amount of time and opportunities to support their parent's

attempts to be physically active may be minimal. Determining the approximate age at which offspring begin to have sufficient opportunities and experience to offer salient autonomy support would be a valuable addition to the literature. Further explanation for my current findings may lie in the balance between the importance placed on the interpersonal relationship and the actual expertise that offspring possess in order to provide effective autonomy support. Also, it may be that offspring motivate behaviour change (e.g., physical activity) more through relatedness support or competence support, than through autonomy support. This may be more likely because parents are typically the authority figure in this dyad, and thus may not experience extensive autonomy need support from their offspring as they potentially could in relationships with health practitioners or partners.

Depressive symptoms.

Perceptions of autonomy support provided by partners were negatively associated with depressive symptoms: in contrast the autonomy support afforded by one's physician/nurse or offspring was not associated with these symptoms significantly. The relationship between partner autonomy support and depressive symptoms may be dependent upon the type and quality of relationship that exists between the partners. Proulx et al., (2007) highlights that partner relationship discord predicts the onset of major depression, and that this relationship is particularly pertinent in women, the predominant gender in this sample. This possibility is further supported by Gaine and La Gaurdia (2009) who assessed the contributions of motivation to relationship well-being and found that when people are more willing to engage in various dimensions of their relationship (e.g., physical intimacy, instrumental support and disclose thoughts and feelings) greater levels of vitality are evidenced. In contrast, the more pressured or coerced they feel in their relationship the more poorly the relationship functions. The lack of a significant effect from physician/nurse to depressive symptoms contradicts that

found by Williams et al., (2005), who highlighted that autonomy support provided by US physicians was negatively linked to reported depressive symptoms among their patients. The frequency that the two (American versus English) samples tend to see the same physician may provide an explanation for these contradictory results. Participants in Williams et al.,’s study consistently visited the same physician. In contrast, participants in the present study may have visited a series of different physicians (i.e., whoever was available to see in their General Practice) therefore reducing the opportunity for them to build rapport and effectively impact affective outcomes such as depressive symptoms. However, it is important to note that although a significant relationship between autonomy support and depressive symptoms was observed in my study, the amount of variance explained in depressive symptoms was low. Further research is necessary to help elucidate whether cultural differences or patterns of visits to the physicians is related to the degree of association between one’s main health care provider and negative indicators of mental health.

Vitality.

Although a small significant bi-variate correlation was observed, perceived autonomy support was not significantly related to subjective vitality. Similar to depressive symptoms a small amount of variance was explained by autonomy support therefore it appears that other factors may be responsible. These data suggest that the autonomy supportive aspect of the environment is not particularly relevant to the targeted indicator of positive mental and emotional health. It is also possible that the relationship between autonomy support and vitality is indirect via the satisfaction of the basic psychological needs and motivational regulations (Vallerand, 1997). An explanation I return to shortly when I describe the results stemming from the SEM analysis.

Taken together, the results of my regression analyses indicate that different significant others may make a unique contribution to an overall autonomy supportive environment. Therefore, it is important that future studies identify all “important others” when tapping the wider environment relevant to behaviour initiation and change. For example, future research could request each participant to rate their perceptions of autonomy support for a range of significant others to allow normative comparisons.

An explanation of the process behind the differential effect between important others may lie in the possibility that basic psychological needs (Ryan & Deci, 2000c) are being satisfied to different degrees by different important people in our lives. Further, the psychological needs might have differential relationships with the identified outcomes (e.g., vitality, depression and intentions). Research has shown that autonomy support leads to the satisfaction of all three basic needs, but the level to which each need is satisfied may vary (Adie et al., 2008). For example, it is conceivable that autonomy support provided by a health and fitness advisor may lead to greater satisfaction of the need for competence, whereas autonomy support provided by a partner may satisfy the need for relatedness. In the context of sport, Adie et al., (2008) found that autonomy support provided by a coach led to the satisfaction of all three needs. However, relatedness demonstrated the largest path coefficient followed by autonomy, and then competence. Satisfaction of the basic psychological needs via PA engagement was not assessed at baseline in the present study due to the fact that the participants had not started the exercise programme. However, I would speculate, that when the quality and quantity of autonomy support is the same from different individuals (e.g., a friend versus a physician), then internalisation will be facilitated. Self-determination theorists indicate that the differential status that exists between the subject (or client, or student, or child) and the practitioner (or teacher or parent) may provide greater effect in internalisation

of autonomy and competence, but this has not been determined empirically. For example, if a physician and an acquaintance of the subject made the same autonomy and competence supportive comments about the issue of healthy levels of PA to the participant, the physician might be expected to facilitate greater levels of autonomous self-regulation for physical activity. In addition, personal perceptions and preference may also be predictive factors. Future research that assesses the degree of satisfaction of each basic psychological need as a function of who provides the support could test the aforementioned possibilities.

Testing a Process Model

Our model indicates that perceived environmental support and reasons for participating in PA are associated with well-being and PA intentions in the beginning before commencing an ER programme. Perceived autonomy support by partner and physician/nurse, was positively related to autonomous reasons for participating in physically active behaviours.

Predominantly middle aged adults, about to enter a PA intervention, showed more self-determined reasons for participating in PA when they perceived their important others to have been creating an environment that is autonomy supportive. This finding provides further support to literature showing a positive relationship between autonomy support and autonomous regulations for participating in PA (Wilson & Rodgers, 2004).

As predicted, autonomy support was negatively linked to being amotivated towards becoming physically active. This observed negative relationship indicates that when choice is provided, perspective of opinion is taken and there is an acknowledgment of positive and negative feelings towards the targeted behaviour by significant others, amotivation is an unlikely outcome. A similar relationship between amotivation and autonomy support has been found in relation to coach (Pelletier et al., 2001) and physical education teacher environments (Lim & Wang, 2009; Standage, Duda, & Ntoumanis, 2003). I further predicted that autonomy

support would negatively relate to controlling behaviours. However, in the final model, no significant path was found. An explanation for this null-finding may be that it requires more than the absence of perceived autonomy support to create controlled regulations. It is possible, that a controlling and actively need thwarting environment is necessary to form these types of regulations. In past research that has studied the relationship between autonomy support and controlled regulations, the path coefficients are far lower than those observed for autonomous regulations. For example, among young women, Wilson and Rogers (2004) reported model path coefficients between autonomy support provided by friends and intrinsic regulation and identified regulation of .56 to .58 respectively, compared to two non-significant path coefficients for external and introjected regulations (which were -.10 and .09, respectively). Further, as yet unexplored is how to assess undermining effects of the environment created by significant or important others. Future research might ask participants to consider rating more controlling behaviours of influential others that may undermine participants' efforts to be physically active.

Outcomes of autonomy support and motivation regulations.

Our revised model revealed that none of the regulations were associated with PA intentions. However, a direct link between perceived autonomy support and PA intentions was found. Previous research (Chatzisarantis et al., 2007) has indicated that autonomy support contributes to intentions regarding subsequent PA engagement. My structural model indicates that this path is not indirect via motivational regulations, as had been predicted, in participants who are about to enter a PA intervention. It is possible that their motivational regulations for participation become important once the intervention progresses and participants start to become physically active. However, when my participants perceived their "incoming" social environment to be autonomy supportive it was more likely that they possessed more positive

intentions to be physically active over the forthcoming exercise programme. Even when no direct link between autonomy support and intentions is included in SDT-based structural models, a correlation appears to be evident. For example, despite Lim and Wang's (2009) structural model revealing no significant path from autonomy support (teacher) to PA intentions, a significant positive correlation was observed. The relationship of autonomy support to intentions could be underpinned by the environmental dimension on the basic psychological needs. For example, when an individual is in an autonomy supportive environment his/her feelings of competence regarding the behaviour at hand may be enhanced which could then be related to your intentions. A mediating role for the basic psychological needs is consonant with the self-efficacy literature which predicts and has observed a positive association between self-efficacy and PA intentions (Tulloch et al., 2009). It is also possible that change in autonomous need satisfaction mediates the indirect relationship between autonomy support and PA intentions. Consonant with this supposition, results stemming from a recent randomised control trial (Teixeira et al., 2009) found autonomous motivations predicted successful behaviour change.

Our model also revealed a positive association between autonomous regulations and vitality. This finding corroborates previous research and supports the link between self-determined motivation and indices of well-being. For example, Nix et al., (1999) concluded that engaging in self-determined activity can enhance subjective vitality relative to engaging in more controlled activity. This observed relationship between autonomous regulations and vitality might explain the non-significant association revealed in this study between autonomy support and vitality. It is possible that individuals' motivation towards a behaviour is a more proximal determinant of their perceptions of vitality. In cases where autonomous motivation is high, individuals are more likely to value energy and volitionally engage in the behaviour.

Therefore, it makes sense that autonomously initiated participants are likely to feel invigorated in association with the prospect of becoming more physically active.

In contrast, when motivation for PA engagement is more controlled, my model indicates that depressive symptoms are more likely to be evidenced. This finding provides corroborative evidence for the potentially negative relationship between controlled motivations and psychological health (Vansteenkiste, Zhou, Lens, & Soenens, 2005). It is important to keep in mind, however, that the present findings are based on cross-sectional data. Thus, the present results merely suggest that when I participate in behaviours for external rewards or because of external or internal pressure (without self-endorsement) feelings of depression such as, being unable to look forward to participate in activities, are likely to ensue. It might be the case that individuals who experience depression are more likely to feel controlled motivation for participation in positive health-related behaviour.

Practical Implication

The current research provides a unique insight into the determinants and consequences of motivation among those at the beginning of their journey toward health behaviour change. The present findings may be extended to other health behaviours such as dieting, smoking cessation and medical adherence, and highlight that perceptions of autonomy support and the reasons for commencing behaviour change could be related to behavioural intentions and indicators of well-being from the offset. However, further research would be necessary to corroborate such extrapolations. My research also indicates that when designing autonomy support interventions, it is important to determine who the participants believe to be an important significant other. The present sample investigated was drawn from a population about to commence participation in an ER scheme. Knowledge of these participants' incoming perceptions of environmental support and motivation offers important information

for health fitness advisors regarding their clients' reasons for and potential supports for or barriers to commencing the adoption of the new behaviour. This knowledge can aid exercise professionals in how to continue with the most effective advice and guidance, in terms of achieving behavioural change combined with optimal physical and psychological functioning.

Strength and Limitations

The present investigation provides an important and unique contribution to the literature by indicating that the strength of the relationship between autonomy support and PA intentions varied as a function of who provided it. Specifically, this research paves the way for future studies exploring which important other's autonomy support has the greatest positive relationship with well-being and PA intentions. Such findings can inform future health initiatives that attempt to increase PA and well-being through social environmental intervention (e.g., the provision of informational programmes for the partners of individuals about to commence a behavioural change programme).

Although some non expected findings have been revealed, I have shown that participants arrive at the beginning of their exercise programmes with a variety of motivations and that these motivations are already linked to variability in their psychological health and well-being in theoretically consonant ways. Therefore, knowledge about their client's motivation could be critical for the exercise instructors to help progress the process of behaviour change and improve their mental health.

It is important to note that the present investigation only recruited participants who attended the ER scheme and therefore failed to sample individuals who received a referral to the scheme but failed to attend. Participants who had been recommended but showed no intention of participating in the intervention represent a critical population that is frequently neglected and indeed difficult to access in research studies. Future research that centres on the

motivation-related and health characteristics of non-attenders would be a welcome addition to the literature. It is also noteworthy that due to a restricted sample size, I was unable to implement more fine grained analysis techniques, such as multi-group invariance testing. Future research that included such analytical procedures would help establish any differential effects on motivational regulations as a function of who provides autonomy support.

A limiting aspect of the present study is the self report nature of perceived autonomy support, and PA intention. High scores on the HCCQ indicate that all participants rated their important others favourably resulting in less variance in the data. This limited variability may be attributable to a methodological artefact or because participants were requested to select a particularly influential important other. Thus, in future work in this area, it may be revealing to specify that “influential” can be both promotive and/or reflective of a negative association. Physical activity intention is self-reported and thus does not represent the actual PA that a participant achieves. Self-regulation of a behaviour may change over time when one moves from initiating to maintaining the behaviour in question. Thus, the actual self-regulation may be connected with behaviour, while the self-regulation may not be related or as strongly related to a behavioural intention. Autonomy support is theorised to aid the internalization of our reasons for participating in a behaviour and it is this change in autonomous self-regulation that predicts change in PA. The current cross sectional data only provides a single snapshot in time therefore, preventing an examination of the internalisation process. Future research with a longitudinal design would provide a means of examining the relationship between autonomy support and changes in PA over time.

In conclusion, the present research draws attention to the importance of the source of autonomy support in the strength of relationship with well-being and PA intentions. This study also provides a basis for future research designs that test the inter-relationships between

autonomy support, motivational regulations and indicators of well-being and ill-health before exercise interventions.

**A LONGITUDINAL INVESTIGATION OF MOTIVATION AND
MENTAL WELL-BEING ACROSS AN EXERCISE REFERRAL
SCHEME**

Abstract

Research grounded in SDT indicates that the motivation underpinning physical activity behaviour is related to psychological well-being. I test a SDT based model to delineate longitudinal effects of motivation and need satisfaction on mental and emotional well-being in participants assigned to an exercise on referral programme (ER). Data were collected as part of an exploratory randomised control trial at baseline T1 ($n = 347$), 3 months (T2; $n = 262$) when participants had completed the exercise referral programme and T3 ($n = 193$) three months subsequent. The majority of participants were middle aged ($M = 54.33 \pm 13.14$ years), female (73%) and overweight or obese ($M \text{ BMI} = 32.79 \text{ SD} = 6.13$). Path analyses ($n = 155$) revealed support for a SDT-based sequence (CFI= .98; NNFI=.97, RMSEA= .05 (90% CI= .00-.10) and SRMR = .07). Perceptions of fitness advisor provided autonomy support at T2 were positively related to autonomy, competence, and relatedness need satisfaction at T2. Perception of important other (e.g., partner) autonomy support (T1) was only significantly associated with relatedness (T2). Autonomy and relatedness (T2) were positively associated with self-determined motivation (RAI T2). Participants' relative autonomy (T2) was positively related to subjective vitality and negatively related to depressive symptoms at a 6 month follow-up (T3). Finally, autonomy (T2) was also positively associated with subjective vitality (T3). Results suggest that training fitness advisors and important others in how to create a need supportive environment may be beneficial for the mental and emotional well-being of ER participants.

Introduction

Study 1 revealed that significant relationships existed between important other autonomy support and indicators of well-being and PA intentions before one begins an ER programme. Study 2 moves beyond the cross-sectional design employed in the first study and makes a longitudinal assessment of the psychological processes that are associated with mental well-being in participants of an ER programme.

Exercise referral (ER) programmes were developed to help people become healthier by increasing their physical activity (PA; National Institute for Health & Clinical Excellence, 2006). Patients are referred from primary care according to eligibility criteria and assigned to a health and fitness advisor (HFA) for a one-to-one PA consultation. Although ER programmes aim to enhance the mental and psychological well-being of their clients, little attention has been paid to understanding and subsequently supporting the motivation of ER participants. Therefore, ER programmes would benefit from greater insight into the motivational processes by which PA engagement contributes to mental health.

One contemporary approach that holds promise for understanding the processes that lead to optimal functioning and mental health is self-determination theory (SDT; Deci & Ryan, 2000). Research grounded in SDT indicates that psychological benefits such as positive affect, vitality and well-being are linked to the reasons why people engage in behaviour, not just from the act of participation. Therefore, the present study tests a longitudinal SDT motivational model, in an attempt to delineate the processes predicting mental and emotional well-being (i.e. depressive symptoms and subjective vitality) in participants assigned to an ER programme.

Self-Determination Theory

SDT (Deci & Ryan, 2000) proposes a series of mini theories that emphasise the “why” of behavioural regulation and, in particular, centre on the degree to which motivation toward activities (such as physical activity) are self-determined or controlled by internal contingencies and external factors. SDT assumes that socio-contextual support contributes to the satisfaction of innate basic psychological needs and which in turn leads to more self-determined reasons for engaging in behaviour (Ryan & Deci, 2000a). It is also theorised that when behavioural regulations are more autonomous optimal functioning will be exhibited. Therefore, SDT holds promise for understanding the motivational processes involved in exercise participation and their relationship with the mental health of ER participants.

Motivational regulations.

Exercise is, for many, an inherently uninteresting behaviour that is motivated by expected extrinsic outcomes or contingencies (e.g., being told to participate in PA to reduce cholesterol by a General Practitioner). SDT proposes that various types of extrinsic motivations exist on a self-determined continuum ranging from those that reflect external control and coercion to those that are self-endorsed and personally valued (Ryan & Deci, 2007). External control (a form of self-regulation) is the most controlling type of regulation and refers to conducting an activity to obtain a separable outcome (e.g., rewards) or as an outcome of external pressure. Adjacent to external control on the self regulation continuum, is introjected regulation which reflects behaviours performed to avoid guilt and anxiety, or to attain ego enhancements (Ryan & Deci, 2000a). A more self-determined form of extrinsic motivation, identified regulation, reflects a behavioural engagement due to a conscious recognition and valuing of the benefits associated with a behaviour (Deci & Ryan, 2000). Intrinsic motivation, the most self-determined reason for participation originates from an inherent interest or enjoyment for the

activity without a desire for any operationally separable consequences (Deci & Ryan, 2000). SDT also holds that individuals may be amotivated. Amotivation occurs when one lacks any intention or desire to engage in the behaviour in question.

It is theorised that the extent to which regulations are self-determined (i.e., intrinsic and identified regulations) or controlled (i.e. introjected and external) will be related to the quality and level of affective outcomes (Deci & Ryan, 2000). Evidence is growing regarding the implications of self determined regulation for enhanced well-being as well as PA engagement (Edmunds et al., 2006; Wilson et al., 2003; Wilson & Rodgers, 2004). Previous research has highlighted the association between self-determined regulation and affective aspects of the exercise experience. In a school physical education context, Standage and Gillison (2007) revealed that students' self-determined motivation was associated with indicators of well-being, such as self-esteem and health related quality of life at a global level. In overweight patients referred to an ER programme, Edmunds, Ntoumanis, and Duda (2007) found that intrinsic motivation was positively related to positive affect, and introjection (a controlling regulation) was negatively related to subjective vitality. Further, Edmunds et al., concluded that when individuals felt self-determined with regard to exercise engagement, enhanced well-being was experienced beyond the exercise context. Therefore, previous research supports the premise that the quality of motivation one has towards becoming physically active is differentially related to positive mental health.

Need satisfaction.

SDT (Ryan & Deci, 2000a) proposes the basic needs mini-theory (BNT) as a means of addressing the critical issue of promoting more self-determined regulations for often uninteresting, and therefore extrinsically motivated behaviours (Ryan, 1995), as maybe the case with PA. BNT proposes that when a social environment satisfies three innate and

universal psychological needs (i.e., autonomy, competence and relatedness), psychological well-being and emotional health will ensue (Ryan & Deci, 2000a). The need for autonomy is satisfied by feelings of choicefulness, volition, and freedom from feelings of being pressured to behave or to think in a certain way by others or by oneself. Competence refers to an individual's need to feel efficacious and experience mastery over a challenging activity. Finally, relatedness, refers to a desire to belong and feel connected with others in a respected and secure manner (Ryan & Deci, 2000a). The three basic needs represent psychological nutrients that are essential for ongoing psychological growth, integrity and well-being (Deci & Ryan, 2000). If the social environment surrounding an individual who attempts to increase physically active behaviour satisfies these three basic psychological needs, more self-determined regulations for participation are theorised to ensue.

In a cross-sectional study of female ER participants, Markland and Tobin (2010) examined the differential mediating effects of psychological need satisfaction in the relationship between need support and behavioural regulations. Results indicated that exercise referral clients endorsed higher levels of identified regulations, one of the most autonomous reasons for participating in exercise, when their needs for autonomy, competence and relatedness were satisfied. Markland and Tobin's results provide support for SDT's proposition that satisfaction of the three basic psychological needs leads to more self-determined regulations. However, it is important to note that this study collected data in a retrospective manner (i.e., participants were adult women who had taken part in an ER programme during the previous year) and such data are prone to responder error and/or bias due to memory distortion. For example, it may be difficult to recall how you felt when commencing PA, once you have been active for a period of time.

Employing a longitudinal research design, Rahman, Thogersen-Ntoumani, Thatcher & Doust (2011) examined whether change in SDT based constructs (i.e., need satisfaction and motivational regulations) predicted psychological and behavioural outcomes in participants of an ER programme. Results revealed that change in participants ($n = 293$; M age = 54.49; 73.90 % female) psychological need satisfaction from entry to exit was significantly related to change in motivational regulations as predicted by self-determination theory (e.g., change in autonomy need satisfaction was negatively related to change in amotivation and positively related to intrinsic motivation). However, no significant relationship was observed between change in need satisfaction from entry to exit with change in motivational regulations from exit to six month follow up.

Socio-environmental support.

Contextual support for self-determination facilitates the process of internalisation.

Internalisation entails accepting a regulation as one's own (Deci et al., 1994); previous research indicates that autonomy support can assist this process (Deci et al., 1994; Grolnick & Ryan, 1989). Autonomy support is evidently an environment that elicits and acknowledges others' perspective, supports self-initiative, offers choice, provides relevant information and minimises pressure and self-control (Williams et al., 2006b). Competence support occurs when the clinician is positive about the client's success, and identifies an optimally challenging plan for change with the client. Relatedness support has to do with the practitioner having unconditional positive regard. Together, these represent need support and are assessed on the Health Care Climate Questionnaire in this thesis. Williams and colleagues demonstrated that individuals (e.g., physicians and counsellors) can be trained in how to be autonomy supportive (Williams et al., 2002; Williams et al., 2006b). In addition, Rouse and colleagues (2010) have indicated that different individuals can make unique contributions to

the social environment and can have a different association with affective outcomes in terms of individuals completing an ER scheme. Therefore, it may be important to identify who is providing environmental support when examining the relationship between autonomy support and need satisfaction.

Further, recent research in sport and exercise contexts has supported the theorised relationship between autonomy supportive environments and satisfaction of the basic psychological needs. For example, in a sample of adult sport participants, Adie, Duda, and Ntoumanis (2008) revealed that perceptions of coach autonomy support were positively associated with the satisfaction of all three psychological needs. In an exercise setting, Edmunds, Duda, and Ntoumanis (2008) revealed that psychological need satisfaction mediated the relationship between autonomy support provided by an exercise instructor and autonomous exercise regulations. Responding to Edmunds et al.,'s (2007) call for longitudinal methodologies that examine the internalisation process in an exercise setting, I examined over a six-month period the relationships between environmental support, basic need satisfaction, behavioural regulations towards PA behaviour and indicators of well-being (subjective vitality) and ill-being (depressive symptoms) in the case of ER participants.

Study Aims

The present study aims to move beyond the convenience sampling techniques and cross-sectional designs commonly found in the exercise literature (Edmunds et al., 2006) by testing a longitudinal SDT based motivational sequence on indicators of well-being and ill-being (e.g., subjective vitality and depressive symptoms) across an ER programme. My hypothesised model (see Figure 3.1) included two different measures of autonomy support (i.e., provided by an important other (IOAS) and health and fitness advisor (HFAAS)) as a continued exploration of the different roles that the individual providing the support may play

in the internalisation process (Rouse, Ntoumanis, Duda, Jolly, & Williams, 2010). Drawing from SDT, I predicted three positive direct relationships between perceptions of autonomy support provided by HFA (as measured at the end of the intervention to allow perceptions of support to develop) and satisfaction of the three basic psychological needs (autonomy, competence and relatedness; T2) at the end of the intervention (H_1). I further predicted the same relationships would exist between the basic needs and important other autonomy support as measured at baseline (H_2). Three direct effects were hypothesised between satisfaction of the three basic psychological needs and motivational self-regulations towards PA as measured by the relative autonomy index (RAI; H_3). Finally, I predicted that motivational self-regulations at the end of the intervention (RAI; T2) would positively predict a measure of well-being (subjective vitality; T3) and negatively predict an indicator of ill-being (depressive symptoms; T3) three months after the intervention had finished (H_4).

Method

The present study is based on data collected from an exploratory randomised control trial that aimed to train HFAs in how to create an autonomy supportive environment and to compare

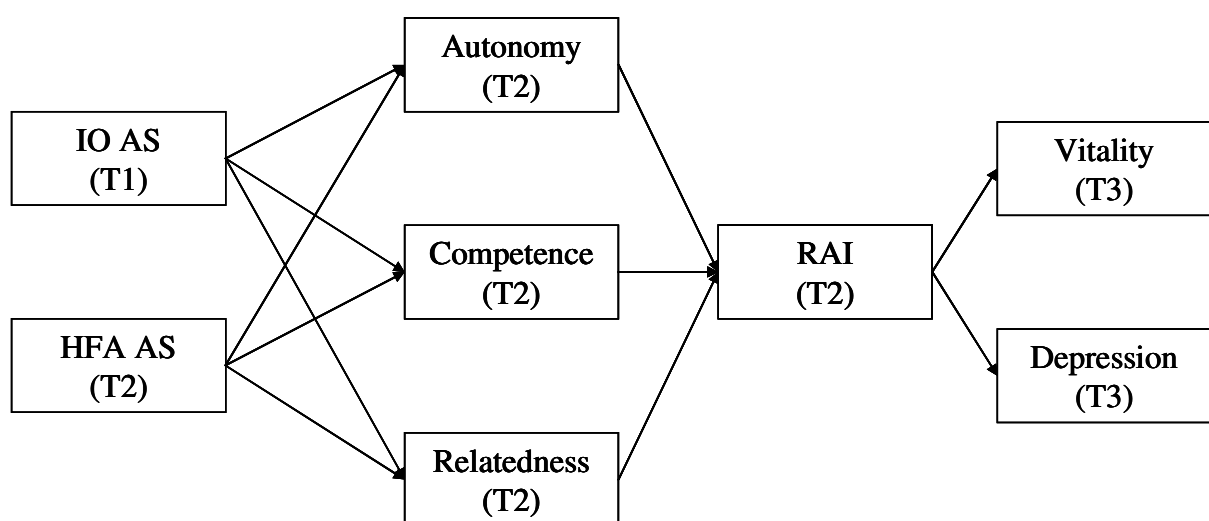


Figure 3.1 Model indicating the hypothesised relationships between the psychological variables.

Note: IO AS = Important other autonomy support; HFA AS = Health and Fitness Advisor; RAI= Relative Autonomy Index. T1= Baseline; T2= Post Intervention; T3= 3 months post intervention.

such an environment to standard practice. No significant differences were observed between the two conditions in the main variables measured, therefore, the present data is based on a merged data set. For a full description of the main trial protocol, see Jolly et al. (2009).

Participants

Participants ($n= 347$; 20.6% of those referred) were individuals who completed an ER programme in a large UK city and were recruited by thirteen HFAs. The majority of participants were middle aged ($M = 49.25$; $SD = 13.77$), female (73%) with 90.3% being overweight or obese ($M BMI = 33.21$; $SD = 6.70$). Excessive weight was not the only symptom for referral; 20% had probable clinical depression and 34.8% were marked by high anxiety as classified by the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). 155 participants (44.7%) completed data at all time points ($M age= 54.33$; $SD = 13.14$, 74.7% female). Gender ($Z(1)= .46$ $p >.46$), motivation ($t(347)=1.61$, $p.>.05$), vitality ($t(347)=.24$, $p.>.05$) and depressive symptoms ($t(347)=-.34$, $p.>.05$) did not differ between those who completed data at all time points and those recruited but failed to provide complete data. However, age ($t(347)=-6.65$, $p.<.01$) did significantly differ. Those who completed data at all time points were significantly older than those who did not.

Measures

Important other autonomy support.

Autonomy support provided by an important other was assessed through the previously validated Important Other Climate Questionnaire (IOCQ; Williams et al., 2006a). Participants were asked to identify an important other who provides support during their attempt to become physically active (i.e., “Who is the most important person in your effort to becoming healthier through physical activity?”). Six items assessed perceptions of autonomy support provided by the important other (e.g., “My important other listen to how I would like to do things regarding my physical activity and health”) and were rated using a 7-point scale (*strongly disagree* = 1; *strongly agree* = 7). Previous research in a sport setting has demonstrated good internal reliability using the IOCQ (Adie et al., 2008).

Health & Fitness Advisor autonomy support.

The environment created by HFAs was assessed using an adapted version of the HCCQ at the end of the 12 week exercise programme (Williams, Grow, Freedman, Ryan, & Deci, 1996). Participants were asked to rate their experience with their HFA with 10 items (e.g., “I feel my HFA understands how I see things with respect to my participating in physical activity”), using a scale ranging from 1 (*not at all true*) to 7 (*very true*).

Psychological need satisfaction.

The Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson, Rogers, Rogers & Wild, 2006) was employed to examine the degree to which the participants’ perceptions of their psychological needs for autonomy, relatedness and competence were satisfied during and after the ER programme. Participants rated 18 items on a six point scale ranging from 1 (*false*) to 6 (*true*). An example item for autonomy need satisfaction was “I feel free to be physically active in my own way”, competence “I feel capable of doing even the most

challenging physical activities”, and relatedness “I feel attached to those who participate in physical activities with me because they accept me for who I am”. Previous research in the exercise domain has shown good levels of internal consistency for the autonomy ($\alpha = .95$) competence ($\alpha = .93$) and relatedness ($\alpha = .94$) scales (Sebire et al., 2009).

Reasons to exercise.

The Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004) was utilised as a previously validated measure of the clients’ reasons for participating in PA. The four exercise regulations (i.e., intrinsic, identified, introjected and external) and amotivation measured by the BREQ-2 have shown good levels of internal consistency in previous ER research ($\alpha = .70 - .91$; Edmunds, Ntoumanis, & Duda, 2007). An example of an intrinsic motivation item is, “I find physical activity pleasurable”; identified “It’s important for me to regularly participate in physical activity”; introjected “I feel ashamed when I miss an exercise session/chance to be physically active”; External regulation “I take part in physical activity because my friends/family/partner say I should”, and amotivation “I don’t see the point in being physically active”. Nineteen items were rated on a scale anchored by 0 (*not at all true*) and 4 (*very true*). The motivational regulations were combined to create a relative autonomy index score, calculated using the following formula: (amotivation * -3) + (external regulation * -2) + (introjected regulation * -1) + (identified regulation * 1) + (intrinsic motivation * 2). Recent research in a sport and physical activity setting supports the factor structure and use of the computed RAI as a measure of motivation (Chatzisarantis & Hagger, 2009; McDonough & Crocker, 2007; Sebire et al., 2009).

Subjective vitality.

Previous research has successfully employed the short form of the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997) as an indicator of positive mental health. Participants

responded to six items (e.g., “I look forward to each day”) based on how they felt over the last two weeks on a scale anchored by 1 (*not at all true*) and 7 (*very true*). The SVS has demonstrated good internal consistency in a PA setting ($\alpha = .84 - .86$; Bostic, Rubio & Hood, 2000).

Depressive symptoms.

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) has been previously implemented as a method of measuring depressive symptoms in the general public. Participants rated seven items (e.g., “I have lost interest in my appearance”) measuring depressive symptoms on a four point scale ranging from 0 (*not present*) to 3 (*considerable*). Adequate levels of internal consistency have been shown ($\alpha = .67-.90$; Bjelland, Dahl, Haug & Neckelmann, 2002).

Procedure

Ethical approval to conduct the study was obtained from the local university ethics review committee. Data were collected at three time points across the ER programme; baseline (T1), 3 month exit (T2) and 6 month follow up (T3). Baseline data ($n = 347$; important other autonomy support) were collected prior to each participant commencing an initial one hour consultation with an assigned HFA. HFA autonomy support, need satisfaction and motivational regulations were measured at T2 when participants ($n = 262$) had completed the ER programme. T3 assessments (i.e., subjective vitality and depressive symptoms) were obtained at 6 months (i.e., three months after the ER programme had ended; $n = 193$). APA ethical guidelines were followed. Participants were also reassured that their admission to and continuation with the ER programme was unrelated to the participation in the study.

Results

Descriptive Statistics

Table 3.1 displays descriptive statistics for all psychological variables. Participants perceived their HFA (T2), and to a lesser extent their important others (T1) to be providing a high level of autonomy support. The mean scores for the satisfaction of the three basic psychological needs (T2) were relatively similar, with the autonomy score being slightly higher compared to those for competence and relatedness. The mean score for depressive symptoms (T3) was low, and that for vitality was moderate. Bi-variate correlations showed that HFA autonomy support (HFA AS) was positively correlated with the three basic psychological needs. However, perceptions of important other autonomy support (IOAS) only demonstrated a significant relationship with relatedness. The three basic psychological needs were significantly and positively associated with the RAI. Finally, the RAI was positively associated with subjective vitality and negatively correlated with depressive symptoms. All measures of the psychological variables indicated good levels of internal consistency with alpha coefficients being greater than .70.

Path Analysis

Path analysis (n=155; participants with data from all three time points) was conducted using EQS 6.1 (Bentler, 2004), implementing a Robust Maximum Likelihood method of analysis to estimate parameters of the model. A range of fit indices were used (Byrne, 2006): the Bentler-Bonnet Non-Normed Fit Index (NNFI), the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA) with its 90% confidence interval (CI), and finally, the Standardised Root Mean Square Residual (SRMR). Although no universally accepted cut-off values for the different indices exist: NNFI and CFI values that are equal or above .95,

Table 3.1

Reliability Analyses (Cronbach's coefficient α), Descriptive Statistics, and Bi-variate Correlations for the Psychological Variables.

	α	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1.IO AS (T1)	.94	5.07	1.53								
2.HFA AS (T2)	.97	6.07	1.26	.13							
3.Autonomy (T2)	.91	4.89	1.07	.10	.31**						
4.Competence (T2)	.92	4.12	1.19	.16	.31**	.48**					
5.Relatedness (T2)	.91	4.07	1.36	.19*	.26**	.42**	.58**				
6.RAI (T2)	.84	2.22	1.30	.04	.18*	.47**	.40**	.45**			
7.Depression (T3)	.84	.74	4.47	-.01	-.17*	-.22**	-.35**	-.31**	-.39**		
8.Vitality (T3)	.94	3.99	1.64	.11	.18*	.32**	.34**	.35**	.35**	-.71**	

Note: * $p < .05$; ** $p < .01$.; IO = Important Other; H&FA = Health & Fitness Advisor; RAI = Relative Autonomy Index

an RMSEA that is equal to or less than .06 and a SRMR that is equal to or less than .08 are taken to indicate a model with good fit to the data (Hu & Bentler, 1999).

The hypothesised model achieved good fit: CFI = .96; NNFI = .96, RMSEA = .08 (90% CI = .03-.13) and SRMR = .07. However, the Wald test indicated that dropping the non-significant paths between important other autonomy support and the needs for competence and relatedness and between competence and the RAI would improve model fit. The multivariate lagrange fit index identified that the addition of a path between autonomy need satisfaction (T2) and perceptions of vitality (T3) would improve the fit of a re-specified model. Conceptual justification underlying this path is offered in my discussion.

The re-specified model (Figure 3.2) displayed a better fit to the data than my hypothesised model: CFI = .98; NNFI = .97, RMSEA = .05 (90% CI = .00-.10) and SRMR = .07. This model revealed that perceptions of HFA autonomy support (T2) were positively related to satisfaction of the three basic psychological needs (T2). In contrast, important other autonomy support only demonstrated a significant positive relationship with the need for relatedness. In turn, satisfaction of the basic psychological needs for autonomy and relatedness was positively associated with motivational self-regulations (RAI; T2). In terms of affective outcomes, the RAI (T2) was positively related to vitality (T3) and negatively related to depressive symptoms (T3). In addition, autonomy need satisfaction (T2) was positively associated with subjective vitality (T3).

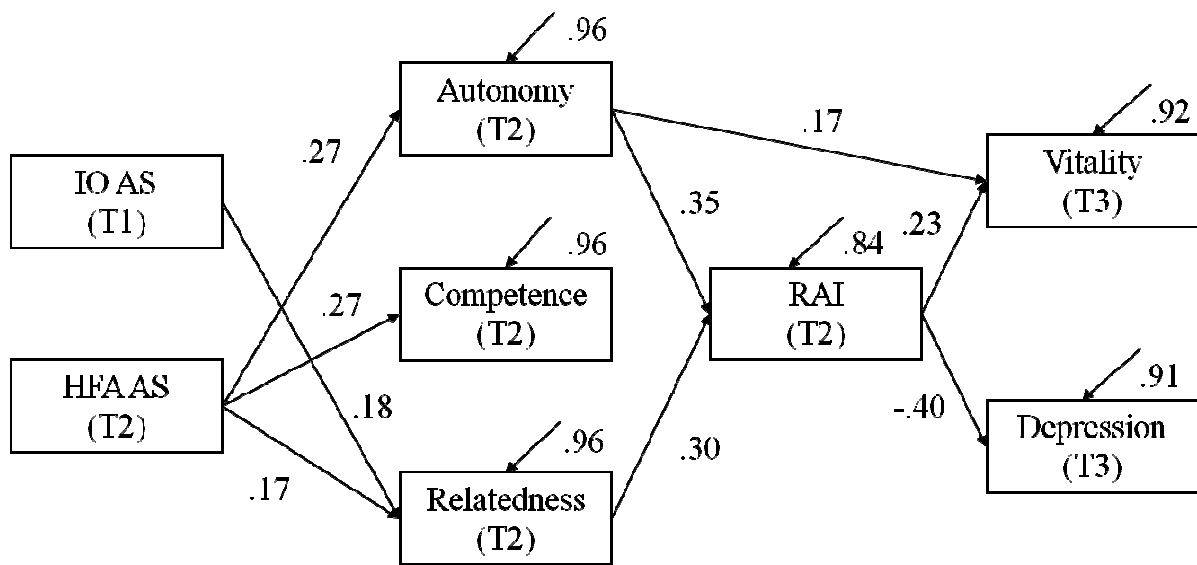


Figure 3.2 The re-specified path model showing the significant path coefficients between HFA autonomy support, important other autonomy support, need satisfaction, exercise regulations, vitality and depressive symptoms.

Discussion

The present study provides longitudinal support for a self-determination theory grounded motivational sequence regarding interdependencies between perceptions of the social environment created by diverse social agents, basic need satisfaction, motivation regulations, and positive and negative indicators of psychological health. Specifically, the findings suggest that the provision of autonomy support holds implications for changes in feelings of competence, autonomy and relatedness which, in turn, are pertinent to change in the reasons for participating in PA. These motivational processes are subsequently relevant to changes in the mental health of participants completing an ER programme.

Age was the only characteristic that was significantly different at baseline between participants that completed data at all three time points and non-completers. This suggests that older participants maybe more likely to complete data collections and limits the generalisability of results to the older participants recruited. This finding may be explained by

the time that older participants may have available (i.e., if retired) to complete the demands of a research program or they may be more conscientious.

Environmental Support and Need Satisfaction

Health and fitness advisor autonomy support.

Supporting hypothesis 1, my results indicated that when participants engaged in an ER programme perceived their HFA to be autonomy supportive, a positive association was observed with all three basic psychological needs. This significant relationship between autonomy support and basic need satisfaction supports previous cross-sectional research among exercise programme participants (e.g., Edmunds et al., 2006b) and longitudinal work conducted across an ER programme (Edmunds et al., 2007). Therefore, evidence appears to be building to affirm that exercise instructors/advisors who create need supportive environments can satisfy their clients' basic psychological needs.

Important other autonomy support.

Examination of the relationships between perceptions of IOAS and basic need satisfaction revealed only partial support for hypothesis two. IOAS demonstrated a positive relationship with relatedness need satisfaction, but not with autonomy and competence. Explanation for these non-significant relationships may lie in the lack of opportunity for important others to provide support, or the timing of when the opportunity arises. Alternatively, important others may not be able to offer the same quality and/or breadth of socio-environmental support afforded by HFAs. For example, support provided by an important other may often be detached from the act of participating in PA (e.g., they are unable to offer choice over the physical activities the client might engage in and don't have the capacity or awareness to enhance perceptions of competence at the task). Further, important others may not have the knowledge or skills to provide effective autonomy support (e.g., realising the motivational

significance of taking the other's perspective, providing a rationale, etc.). The important others themselves are unlikely to have had any training in how to best support attempts to become physically active. In contrast, HFAs receive at least some training in how to support their clients. Future research could attempt to provide training for important others to become more autonomy supportive.

The findings did indicate a significant relationship between IOAS and changes in relatedness need satisfaction. The latter has been identified as instrumental for commencing behaviour change in the initial stages of exercise adoption (Edmunds et al., 2007). The relevance of feeling more connected in the PA setting may be particularly important given the likelihood that PA participation may often be an extrinsically motivated behaviour due to its potentially uninteresting nature for this sample (i.e., overweight middle aged women). A possible reason for why this population initiates PA is because the behaviours are prompted, modelled, and/or valued by important others to whom one feels (or wants to feel) attached or related (Ryan & Deci, 2000a). Previous research from the PA domain highlights the positive relationship that social support can have with PA adherence (Carron, Hausenblas, & Mack, 1996). In particular, research shows that older females (i.e., 55 – 93 year olds) place greater importance on social motives for being physically active than males (Kolt, Driver, & Giles, 2004). This would indicate that relatedness, the need to belong and feel connected with others, may be central to the internalisation process (Ryan & Deci, 2000a) regarding physical activity engagement for older women. Autonomy support provided by important others, therefore, could play an important role at the beginning of an ER programme that aims to increase PA by facilitating participants' feelings that they are not alone.

However, despite the important role of relatedness, SDT proposes that all three needs should be satisfied to realise optimal functioning (Deci & Ryan, 2000). Further, Markland and Tobin (2010) showed that, in the absence of a mediating effect of autonomy need satisfaction, HFAs support for the needs for relatedness was associated with greater introjected regulation, thereby thwarting the fuller internalisation of exercise regulations. That is, in terms of participation in PA, feeling connected with others but not feeling a sense of volition, input and personal choice may contribute to engagement fuelled by internalised contingencies (I have to exercise to please or appease others) and feelings of guilt.

Psychological Need Satisfaction and Self-determined Motivation

The test of the hypothesised structural model revealed that the needs for autonomy and relatedness were positively related to participants' self-regulation for being physically active, indicating partial support for my third hypothesis. That is, feelings of ownership, choice and volition towards participating in PA along with a sense of connectedness to and closeness with others, were associated with more autonomous reasons for participating in PA. This finding supports recent research in a sample of ER participants. Rahman et al., (2011) revealed that change in need satisfaction across an ER programme was positively related to change in more autonomous motivations. It is important and interesting to note however that change in psychological need satisfaction did not predict change in motivational regulations from exit to six months suggesting that the effect of need satisfaction does not extend beyond the time period in which it occurs (Rahman, Thorgersen-Ntoumani, Thatcher, & Doust, 2011).

Similar to other contemporary theories of motivation, SDT considers elements of the self. For example, competence is an important component due to its similarity to constructs proposed by alternative theories such as self-efficacy and its importance to the frequently studied psychological constructs, such as the self (Epstein, 1973). Perceptions of one's self are determined by gathering and organising information that forms a self-description. Therefore, feelings of competence are likely to have an important role in determining self-esteem (i.e., a rating of how well the self is doing) and mental well-being (Fox, 2000). In the present study, competence need satisfaction (a sense of efficacy within the activity) did not relate to the RAI, although a significant and positive Pearson's correlation was observed between the two variables. This non-significant finding is contrary to my hypothesis, Self-determination theory (Deci & Ryan, 2000) and previous research. For example, Williams et al., (2006b) demonstrated a significant and positive relationship between perceived competence and autonomous motivation towards quitting smoking. However, health behaviours such as smoking cessation and dieting, differ from exercise behaviour because of the greater levels of skill required to achieve a feeling of competence when participating in different physical activities. In terms of developing perceptions of competence at exercise-related tasks, one must possess a sense that he/she has sufficient fitness (e.g., endurance, strength, etc.) to do the activity and have the knowledge to safely and effectively do the task (e.g., how to use a piece of gym equipment). Also, in terms of participation in some physical activities, it is also necessary to possess the necessary motor skills (e.g., have the competences to be able to ride a bike, or have a light game of tennis). Therefore, when embarking on "the road" to PA behaviour change, it makes sense that participants' perceptions of other aspects of the experience (e.g., feelings of choice/input and relatedness) may be more central to more self determined reasons for participation in the activity.

Despite the apparent contradiction between the present findings and the work of Williams and colleagues, the present discrepant results are not unique. For example, in terms of randomised control trials, Cox, Smith, and Williams (2008) and Fortier, Sweet, O'Sullivan, and Williams (2007) respectively observed a non-significant relationship between competence need satisfaction and self-determined motivation. Markland and Tobin (2010), on the other hand, provided evidence that supports the existence of a relationship between competence need satisfaction and exercise motivational regulations in ER participants. Due to the retrospective nature of data collection, it is possible that Markland and Tobin's participants might have progressed to a level of exercise participation and internalisation that necessitates the satisfaction of the need for competence.

Self-determined Motivation and Mental Health

Support was found for my fourth hypothesis that more self-determined motivation (as measured with the RAI) toward participating in PA at the end of the intervention (T2) would be positively related to subjective vitality and negatively related to depressive symptoms three months later (T3). Therefore, if participants finish and leave an ER programme with more autonomous reasons for being physically active, they were more likely to report greater feelings of energy and aliveness and less likely to feel depressed 3 months following the conclusion of the programme. This finding corroborates previous research and SDT's tenets regarding the relationships between motivational regulations and well-being. For example, Standage and Gillison (2007) revealed that students' motivation towards physical education was associated with global indicators of well-being such as self-esteem and health related quality of life. In an ER setting, Edmunds et al., (2007) showed that more autonomous forms of motivational regulations for participating in PA were positively associated with general positive affect at the end of the scheme.

The present findings highlight the importance of behaviour regulations for the more long-term well-being of those prescribed to an ER programme. The implication is that exercise interventions can achieve beneficial psychological outcomes, such as feelings of vitality, not only by increasing actual PA behaviour (Biddle et al., 2000), but also by fostering internalised reasons for participating in PA.

It is noteworthy that within the current standard practice of the ER programme targeted in this study, the HFAs received little or no training in how to support their client's motivation towards becoming physically active. The present findings indicate that perceptions of environmental support are related to the process of internalisation and mental health of ER clients. Therefore, providing HFAs with training in how to create a need supportive environment would help achieve the dual and related aims of enhancing clients' level of PA and enhancing their psychological well being.

In the present study, a significant relationship was also observed between autonomy need satisfaction and subjective vitality. Despite the fact that this relationship was not hypothesised, previous research (Cox, Smith, & Williams, 2008) has revealed a significant path between autonomy need satisfaction and indicators of well-being. These results are in support of basic needs theory (Ryan & Deci, 2000a). Vallerand's hierarchical model (Vallerand, 1997) specifies indirect paths from need satisfaction to various outcomes via motivation regulations. In contrast, basic needs theory (Deci & Ryan, 2000) argues that need satisfaction can directly relate to indices of well-being as well as self-determined motivation. My findings related to the hypothesised model indicate that autonomy need satisfaction can have a prospective relationship with subjective vitality which is not fully exerted via the RAI. This finding is supported by Rahman et al., (2011) who found significant relationships

between change in psychological need satisfaction and changes in well-being outcomes (e.g., health related quality of life) in participants of an ER programme. However, contrary to my findings, Rahman et al., also found that change in motivational regulations did not significantly predict change in well-being outcomes.

Practical Implications

The present research highlights that self-determined regulations during an ER programme are associated with the mental health of ER participants three months after completing the programme. Therefore, interventions that target PA behaviour change may have additional benefits if they include attempts to internalise motivational regulations towards PA. My findings also affirm that environmental support afforded by HFAs and important others are related to satisfaction of the basic psychological needs.

Concluding Comments

The longitudinal nature of the present research design allows a stronger test of potential relationships and addresses the call for firstly research designs other than cross sectional within the exercise motivation literature (Chatzisarantis & Hagger, 2009) and secondly longitudinal examinations of the SDT-based motivational sequence that include perceived autonomy support in ER programmes (Rahman et al., 2011). However, it is important to recognise that the present path analysis does not investigate the relationship between change in the mediators and outcomes. Future research, that examines the relationships between change in constructs such as need support and motivational regulations with change in outcome variables such as mental well-being and PA behaviour would help elucidate the most effective methods of supporting mental health and PA behaviour. A further limitation of this study is the relatively small sample size. A greater sample size would have allowed the inclusion of more parameters in my model. For example, a more detailed analysis of the

relationships between basic needs and the individual motivation regulations, rather than using the composite RAI, would have been afforded. Although my study recruited a representative sample of those who typically enter ER programmes (i.e., middle aged, overweight women), the specific nature of this sample limits the generalisability of my findings. Further research that tests a SDT motivational model in males and different age groups who are attempting PA behaviour change is warranted. Finally, the content and quality of the interactions during one-to-one autonomy supportive interactions have most frequently been assessed by self-reports. Future research would benefit from, and theoretical advancements could be achieved by employing observed assessments of the environment afforded during these interactions.

In conclusion, the present study has provided longitudinal support for a SDT motivational sequence that identifies some of the processes related to mental and emotional well-being in participants assigned to an ER programme. The challenge remains to facilitate meaningful changes in PA behaviour and associated mental health benefits through effective SDT-based PA interventions.

**THE DEVELOPMENT AND VALIDATION OF THE NEED
SUPPORT IN EXERCISE INTERACTIONS-
OBSERVATIONAL PROTOCOL**

Abstract

The aim of this study is to describe the development and psychometric characteristics of an observational instrument that examines four aspects of environmental support (or lack of) provided during physical activity promotion consultations (i.e., autonomy support, involvement, structure and control) as identified by Self-Determination Theory (Deci & Ryan, 2000). The Need Support in Exercise Interactions-Observational Protocol (NSEI-OP) is a theory-based instrument that examines the psychological environment afforded by exercise professionals. Data on the reliability and validity of this assessment tool were collected within an exploratory randomised control trial comparing a standard exercise on referral practice arm with a SDT-based intervention arm. Intra-class correlation coefficients (ICC) indicated moderate to high inter-rater reliability for overall environmental support and autonomy support, involvement and structure dimensions, but low reliability for controlling behaviours. Providing support for concurrent validity, health and fitness advisors who were observed to have created a consultation environment low in its need supportive features score were perceived by their clients as being less supportive, as measured by the Health Care Climate Questionnaire (Williams et al., 2006b). Significant differences were revealed between arms in overall need support and structure, but no differences emerged in autonomy support or involvement afforded by health and fitness advisors. These findings suggest that the NSEI-OP is capable of identifying variability in consultation delivery. In conclusion, I have provided preliminary evidence of the reliability and construct validity of the NSEI-OP to examine the interactions between exercise professionals and their clients.

Introduction

Studies 1 and 2 highlight the potentially important role that autonomy supportive environments, created by exercise professionals and important others, could have in supporting physical activity (PA) intentions and participants' mental well-being. Study 3 aims to operationalise the behaviours that agents of support such as Health and Fitness Advisor conduct during one-to-one interactions that are need supportive. So far these interactions have only been assessed using self-reports therefore, future research and applied practise could benefit from an observational instrument that is systematically developed to examine these interactions.

Regular PA has been identified as one important behavioural strategy to counteracting the increasing obesity and sedentary lifestyle trends within the UK (Biddle & Mutrie, 2001) and other Western countries. In an attempt to increase the population's PA levels, a variety of interventions have been developed and employed, including one-to-one PA promotion consultations by exercise professionals. Self-reported measures have been implemented as the predominant method of examining the characteristics of the social environment created by PA consultants. However, objective measures of the quality of such environments are needed to provide a more vigorous evaluation of the contributions of such interventions for PA behaviour change and well-being. PA interventions frequently fail to incorporate assessments of fidelity that examine whether health professionals adhere to the intended protocol. Yet, measures of fidelity are essential to establish an evidence-base regarding effective and reliable methods of intervening (Hardeman et al., 2008a; Michie, 2005; Paulson et al., 2002). Through theory driven PA interventions I can systematically examine the processes that are responsible for effective behaviour change and other achievable outcomes such as mental health. A

theoretical model that has been recently and successfully employed in the domain of behaviour change is Self-Determination Theory.

Self-Determination Theory

According to Self-Determination Theory (SDT; Ryan & Deci, 2002), the reasons why we participate in behaviour vary along a self-determination continuum from more autonomous regulations to more controlling regulations. Autonomous motivation is evident when one chooses to engage in and enjoys a particular behaviour, for its own sake or because one personally values the benefits associated with that behaviour. In contrast, controlled motivation is observed when one engages in a behaviour due to an external stimulus (such as monetary reward or pressure), or to avoid feelings of guilt. SDT further assumes that all individuals have three inherent psychological needs (i.e., the needs to feel competent, autonomous, and related to others) and the degree to which these needs are perceived to be satisfied determines whether motivation is more autonomous or more controlling.

The need for *Autonomy* is satisfied when one perceives a sense of ownership over his/her behaviour and is the originator of his/her actions (Deci & Ryan, 1985). *Competence* need satisfaction occurs when one feels effective in his/her interactions with the social environment (Deci and Ryan, 2000). Finally, satisfaction of the need for *Relatedness* occurs when one feels connected to others, and perceives that he/she can provide and receive love from others in a respected and secure manner (Ryan & Deci, 2000a).

Social environments, such as those created by a health and fitness professional, can facilitate the satisfaction of these three needs and support more autonomous motivations whilst indirectly supporting healthy human functioning (Ryan & Deci, 2002). Investigations into adaptive environments necessary for the promotion of self-determination have focussed on the concomitants of a dimension of the environment referred to as *autonomy support*.

Williams et al., (2006b) conceptualised autonomy support as an interpersonal factor that entails the acknowledgement of others' perspective, support of self-initiative, offering of choice, provision of relevant information and minimizing of pressure and control.

Attempts have been made to promote autonomy supportive environments in a variety of health behaviour interventions. Williams and colleagues (Williams, 2002; Williams et al., 1999; Williams et al., 1998) studied the role of autonomy support provided by physicians and revealed that perceptions of autonomy support positively predicted autonomous reasons for engaging in diverse health behaviours such as smoking, weight control, medication adherence and glycaemic control. Williams, Lynch, and Glasgow (2007) also highlighted the predictive utility of perceived autonomy support provided by important others on positive and negative indicators of mental well-being (i.e., subjective vitality and depressive symptoms) in diabetes patients. Williams et al., (2006a) found that 6 month change in percent calories from fat and tobacco abstinence were each predicted independently by autonomy support from the health care practitioner *and* by important others. Therefore, previous research supports the usefulness of autonomy supportive environments to facilitate positive outcomes when attempting to change health-related behaviours.

More recently, SDT-based conceptualisations of the social environment have expanded to also include the support for competence and relatedness. In a teaching context, Reeve (2002) identified the environmental dimension of *structure* which reflects the provision of clear expectations, optimal challenges and timely and informative feedback. Research from educational settings (e.g., Reeve & Jang, 2006) underlines the importance of providing structure to support feelings of competence. Reeve (2002) further highlighted the existence of a third independent contextual element, *involvement*, which nurtures relatedness. Involvement refers to the quality of the interpersonal relationship that exists between two or more

individuals and the dedication of psychological resources (such as time and energy) to the relationship by the authority figure (Reeve, 2002). Mageau and Vallerand (2003) indicated that for one to feel relatedness, one must feel that people in the immediate social environment are interpersonally involved.

Research has studied the implications of the degree to which environments are characterised by structure and involvement, mainly in educational settings (Reeve, Jang, Carrell, Jeon, & Barch, 2004a). However, Edmunds, Ntoumanis, and Duda (2008) conducted a study that examined these environmental dimensions, as well as autonomy support, in the context of structured exercise classes. More specifically, Edmunds and colleagues (2008) manipulated the class environment to be more autonomy supportive, structured and interpersonally involving and compared the responses of the students in this need supportive environment with those who participated in a class that was taught via a more typical teaching style. The degree to which this aim was achieved was assessed by tapping the class participants' perspectives of the instructor-created environment at baseline, 6 weeks, and 10 weeks via the Perceived Environmental Supportiveness Scale (Tobin, 2003). Results revealed that participants in the need-supportive environment arm displayed a significant increase in perceiving the class environment to be higher in structure and involvement whereas those in the standard class provision exhibited significant decreases in perceived instructor-provided autonomy support over time. In contrast to the control arm, relatedness and competence need satisfaction, positive affect and attendance increased significantly over time in the need supportive arm.

Minimising or reducing pressure and control are also important in creating need supportive environments (Williams et al., 2006b). When external control is dominant, psychological needs are undermined. A controlling interpersonal style is characterised by

coercion, pressure and using authority to impose specific and preconceived ways of thinking and behaving (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010). Although past studies have predominantly focussed on the motivational consequences of autonomy supportive environments, research is starting to explore the role of active need thwarting through acts of external control. SDT-based research, within a sport context, has shown that controlling environments carry a variety of negative consequences when attempting health behaviour change. For example, controlling environments have been positively associated with external motivation, drop-out and ill-being and negatively associated with indicators of well-being (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2011). These situational characteristics or motivational climates are similar to those defined and employed in research that examine task and ego environments (Ames, 1992). Previous research identify perceived motivational climate, as defined by achievement goal theory (Ames, 1992; Nicholls, 1989), as relevant to the satisfaction of the basic psychological needs. For example, Reinboth and Duda (2006) revealed that sport climates that are more task-involving and less ego-involving are related to enhanced need satisfaction.

Recently, the SDT literature has moved to include more objective measures of environmental climates created by important others, such as teachers, in group settings. Reeve and colleagues (2004b) developed a SDT-based rating sheet to score the environmental support afforded by teachers as part of a study that examined the relationship between autonomy support and student engagement. Observation scores revealed that trained teachers created a more autonomy supportive environment after training and, as a consequence, students' engagement in the class activities increased. In a class setting, Tessier, Sarrazin, and Ntoumanis (2008) had observers rate three aspects of the environment (i.e., autonomy support, neutral and controlling) created by physical education teachers. Observed scores

revealed that teachers in an experimental group, who received a training programme in need support, used significantly more autonomy supportive behaviours than teachers in a control condition. The purpose of the present study is to move towards more objective measures of one-to-one interactions in important domains such as health behaviour change.

Assessment of the Social Environment in Consultations

The degree of environmental support provided by health care advisors or exercise professionals during one-to-one consultations have most frequently been measured with self-reports. This is not surprising, as SDT states that it is an individual's perception or functional significance (i.e., the motivationally relevant psychological meaning) of the environment that has the greatest consequences for an individual's motivation (Deci & Ryan, 1987). Further, self-report is the most frequently employed methodology in the social sciences because it allows an understanding of an individual's thoughts, feelings and behaviour (Schwarz, 1999). However, self-reports are also fallible (Schwarz, 1999). For example, participants are required to draw on their memory which can become distorted, they may alter their judgments for reasons of social desirability and self-presentation, and finally, participants may misunderstand the question being asked of them. Therefore, it is important to supplement self-reports with more objective data.

One method of assessing environmental support afforded by health or exercise professionals in health behaviour change consultations is to have trained individuals rate the contextual environment using an observational protocol. During one-to-one interactions, Williams, Gagne, Ryan, and Deci (2002) demonstrated that trained observers can distinguish between autonomy supportive and controlling environments created by physicians and counsellors during interactions with their patients about smoking cessation (Williams et al., 2002). To my knowledge, no research has developed a SDT-based observation instrument

suitable to rate environmental need support afforded by exercise professionals during one-to-one PA consultations.

Intervention Fidelity

Progress to clinical practice and theoretical advancements could be made when research studies employ and report measures of intervention fidelity (Paulson et al., 2002). SDT-based interventions that examine the processes responsible for behaviour change would benefit from study designs that are implemented with fidelity to the intended protocol. Orwin (2000) defined fidelity as “the adherence of actual treatment delivery to the protocol originally developed”(p.S310). When fidelity data are not collected, it is difficult to ascertain whether non-significant results show: a) an ineffective intervention, b) that the intervention was not delivered as it was intended, and/or c) that the intervention content altered in unspecified ways (Dumas, Lynch, Laughlin, Smith, & Prinz, 2001). Demonstrating the fidelity of an intervention is a key methodological requirement but until recently fidelity has been largely overlooked in previous research (Dumas et al., 2001).

An example of why assessing intervention fidelity in SDT-based PA research is important can be provided with reference to a PA randomised control trial by Fortier, Sweet, O’Sullivan, and Williams (2007). In the study of Fortier and colleagues, health care providers, operating in a primary care facility, were trained to create an autonomy supportive environment and provided all participants with a brief autonomy supportive PA consultation. In addition, a PA counsellor provided the experimental arm with six supplementary PA consultation sessions across a three-month period. Results showed that patients in the experimental arm reported higher levels of perceived autonomy support and demonstrated higher levels of autonomous motivation during and at the end of the intervention. Despite these findings, and contrary to SDT, perceptions of autonomy support did not predict

autonomous motivation in the experimental condition. One explanation Fortier and colleagues provided for this unexpected finding was that the PA counsellor did something else to enhance/maintain autonomous motivation, such as support relatedness, that was not captured in the measure of perceived autonomy support. Indeed Fortier et al., called for further PA interventions that investigate both the amount and quality of autonomy support, to better understand the underpinnings of the changes in key motivational processes as assumed in SDT. Drawing from SDT in extending the proposal made by Fortier and colleagues (2007), it is also important to examine other relevant dimensions of the counselling environment (e.g., the degree to which the consultation is marked by structure, involvement and controlling features).

Therefore, it would appear that future SDT-based PA interventions would benefit from a multi-dimensional objective examination of the social environment created by exercise professionals. Such an observational tool would provide a means to examining the fidelity of SDT-grounded interventions centred on promoting more need supportive PA consultations. Moreover, an observational measure of the degree to which a consultation is need supportive should allow further insight into potential different relationships between the objective environment with resulting motivational processes (e.g., need satisfaction/thwarting, motivation regulations) and expected outcomes.

Study Aims

The primary aim of the present study is to describe the development of a SDT-based observational instrument that examines the environmental support afforded by health and fitness professionals in one-to-one PA promotion consultations. The second purpose is to examine the inter-rater reliability of the instrument. Thirdly, I aimed to examine the concurrent validity of the observation instrument by comparing observed scores with

participants' perceptions of the psychological environment created by the health and fitness advisor (HFA). The fourth and final aim was to assess the instrument's ability to distinguish between two arms providing one-to-one interactions, between HFAs and their clients, during exercise referral consultations within an exploratory randomised control trial (Brandon, Taum, Young, & Pottenger, 2008). In one arm, the advisors were trained in principles of SDT and need supportive strategies. The second arm reflected standard provision of the exercise on referral service.

Method

Instrument Development

The Need Satisfaction in Exercise Interaction is a theory-based observational protocol (NSEI-OP) developed to objectively assess the environment afforded by health and fitness professionals with their clients during one-to-one interactions. The development of the SDT-based instrument commenced with a review of the relevant literature on environmental support in a variety of settings (e.g., education, physical education, sport, and exercise). This review generated an initial pool of behaviours that captured the four environmental dimensions relevant for the satisfaction (or thwarting) of the needs for autonomy, competence, and relatedness (i.e., autonomy support, involvement, structure and control). However, due to the variety of settings (e.g., ranging from education to healthcare) from which these behaviour items were generated, descriptions of the behaviours that were specific to the exercise setting needed to be formulated for the present study. For example, the behaviour description for provision of choice was "The client was provided with choice over the types, duration and frequency of the physical activity programme where possible".

A 7-point scale (1= *Not at all true*; 7= *Very true*) was employed to rate the degree to which the different need supportive (or need thwarting, in the case of controlling) behaviours

were exhibited. In addition, where behaviours were absent due to lack of opportunity (i.e., when the HFA did not have the opportunity to acknowledge any negative affective states because the client did not exhibit any), an option for “not applicable” was included.

Data Collection

Data were collected as part of an exploratory cluster randomised controlled trial comparing a standard provision of exercise on referral service with a SDT-based exercise on referral intervention (Jolly et al., 2009; Rouse, Duda, Ntoumanis, & Williams, 2010). Exercise referral programmes are PA interventions frequently employed by local councils and primary care trusts that make initial use of the personal relationship that exists between a general practitioner (GP) and patient. Patients that are deemed to possess at least one major risk factor for cardiovascular disease are referred to a HFA located at a community leisure centre. The HFA in conjunction with the client develops a 12 week exercise programme. Eleven leisure centres were randomised to current standard practice ($n=6$) or to a SDT-based intervention arm ($n=5$); the HFAs working at these centres, randomised to the intervention arm, received training in how to create a need supportive environment. Each leisure centre employed a single HFA, except one centre that employed two advisors.

Although the content of the standard provision and SDT-based consultation differed, both arms began with an initial 1 hour one-to-one interaction between the HFA and client. All data were collected from this initial and more formal consultation and recorded using a Sony Handycam DCR-DVD101E in the HFA’s office. The camera was directed to only include the HFA, although the verbalisations from both the HFA and the client were recorded. Ethical approval was obtained from the university ethics review committee and informed consent was obtained from the HFA and participants to film the consultations.

Procedure

Observation iterations.

Replicating previous research developing observational protocols (Brandon et al., 2008), the present study conducted two iterations of observations. Scale development began with iteration one which entailed the training of two final year undergraduates to test whether inexperienced observers could be trained to effectively use the rating system. At completion of the randomised control trial, two further observers were recruited who rated all filmed consultations. Observers for the second iteration were post-graduates who were paid to complete the observations. Throughout both iterations, the observers remained blind to the experimental condition that the HFAs were assigned. Success of the observer training across the two iterations and the effectiveness of the observers' ability to rate the environment was established when the inter-rater reliability for the overall need support score reached a moderate level (i.e., 0.61 – 0.80; Shrout, 1998).

Observer training.

The observers from both iterations received standardised training totalling 17 hours. To familiarise the raters with the principles of SDT, the first author provided an introductory seminar. Two mock consultations between the last author and two patients were filmed and used for the first training consultations (note: data were not collected from these mock consultations). Further, seven separate consultations (Sum = 335.31 minutes, min 17.51 max 89.48) between HFAs and clients were filmed and used for training. A series of tutorials, led by the first author, then took place to train the observers how to rate the 7 filmed consultations using the observational protocol. The tutorials involved joint observations, interactive discussions and independent observations. Throughout the training, observers provided feedback about the usability of the observational tool to the first author. As a consequence,

unclear definitions were clarified in an effort to resolve any discrepancies in levels of ratings for different behaviours. Once training had been completed, observers from iteration one rated 14 consultations (M length = 51.13 minutes SD = 12.5) and observers from iteration two rated 42 consultations (M length = 47.55 SD = 14.680). Data collected from iteration 2 generated the data analysed. After commencing the rating of live consultation data, training remained a frequent and iterative process with interactive meetings between the raters and the first author to discuss any further issues.

The Observational Instrument

The observational instrument (NSEI-OP) assesses behaviours that represent Autonomy Support (7 items), Involvement (2), Structure (4) and Interpersonal Control (8). The number of items differed per category due to the range of components for each category identified in the literature review (i.e., more differential behaviours were identified for autonomy support and interpersonal control than the other two dimensions). The NSEI-OP is presented in Appendix H.

Concurrent Validity

To examine the concurrent validity of the NSEI-OP, observer ratings were compared with data collected from a self-report measure, completed by clients, of the psychological environment created by the HFA following the conclusion of the initial consultation.

Perceptions of autonomy support provided by the HFAs was assessed through the previously validated Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Ryan & Deci, 1996). Participants rated their experience with their HFA via 10 items using a scale ranging from 1 (*not at all true*) to 7 (*very true*). The 10 items were averaged to form a composite need support score, with an example item being “My health and fitness advisor listens to how I would like to do things regarding my participation in physical activity.”

Previous research in the health domain has employed the HCCQ as a measure of environmental support (Williams, Lynch, & Glasgow, 2007). Evidence for the validity of an assessment tool is also provided if scores on the measure can significantly distinguish between groups that, based on theoretical reasoning, it should be capable of differentiating. Therefore, evidence for the validity of the tool was gathered by examining whether observed scores could distinguish the four environmental dimensions and whether the quality of support differed between a SDT-based intervention arm and the standard provision arm.

Results

Inter-rater Reliability

To estimate inter-rater reliability, I used intra-class correlation coefficients (ICC) of two-way ANOVA random models, which is the most frequently used method when different participants are rated by two or more observers (Li & Lopez, 2005). The ICC measures the degree of agreement between observers (Shrout & Fleiss, 1979). Individual scores for each of the four components were averaged. The mean scores for overall need support and each component were then used to calculate the inter-rater reliability (Shrout & Fleiss, 1979). In line with the revised recommendations of Shrout (1998), the following descriptors have been used to establish levels of reliability: <0.10 is virtually none, 0.11 – 0.40 slight, 0.41 – 0.60 fair, 0.61 – 0.80 moderate and finally, 0.81 – 1.0 substantial. Table 4.1 provides the ICCs for Iteration 1 and Iteration 2.

Table 4.1

Intra Class Correlation Coefficients for the Two Phase Development of the Observational Instrument

Live data	Iteration 1 (2 raters; n=14)	95% CI	Iteration 2 (2 raters; n=42)	95% CI
Autonomy Support	.79	.50 - .92	.74	.51 - .86
Involvement	.49	-.21 - .82	.73	.50 - .86
Structure	.80	.51 - .93	.91	.84 - .95
Control	.68	.23 - .88	.35	-.22 - .65
Overall Need Support	.79	.51 - .93	.80	.64 - .89

Iteration 1.

Results indicate that during Iteration 1, the inter-rater agreement for the overall score reached a moderate level. Inter-rater reliabilities for the Autonomy Support and Structure dimensions also achieved a moderate level whilst the degree of rater agreement for Involvement and Controlling was fair (Shrout, 1998).

Iteration 2

Following the rating of 42 consultations, the inter-rater reliability coefficient for the overall need support score, Autonomy Support and Involvement dimensions were moderate. Structure demonstrated a substantial level of inter-rater agreement however the inter-rater agreement for the Controlling subscale was slight (Shrout, 1998).

Observed Ratings

Table 4.2 reveals the mean observed scores for each subscale (Autonomy Support, Involvement, Structure and Controlling) and the overall need support score [including

autonomy support, involvement structure and control (scores were reversed)], separately for the SDT-based intervention arm and the standard practice arm. The means indicate that both the standard practice and intervention arms had the highest observed scores on the involvement sub-scale with moderate scores for autonomy support and structure. Both arms were also marked by low levels of controlling behaviours. Significant correlations (see Table 4.3) were found between autonomy support, involvement, and structure consonant with previous findings reported by Markland and Tobin (2010). This justifies their collapse into a single measure of the environmental support afforded by the HFAs (overall need support score). Further, significant negative correlations were observed between controlling behaviours and the three need supportive facets of the environment.

Validity of the NSEI-OP

To establish whether the observational instrument demonstrated concurrent validity, I conducted a median split (5.01) on the overall need support score from twelve HFAs and compared participants' perceptions of the environment (HCCQ) based on this split. A one-way ANOVA revealed that participants assigned to HFAs who were observed to have created a low overall need support score, perceived their environments to be significantly lower in autonomy support as measured by the HCCQ ($M= 5.35$ $SD= 1.06$), than participants who were observed to provide a higher level of overall need support ($M= 6.33$ $SD=.20$) $F(1,10) = 5.0$ $p < .05$.

Table 4.2

Mean Perceived and Observed Need Support Scores for the Control (Standard Practice) and Intervention (SDT-based) Arms

	Control				Intervention			
	Perceived		Observed		Perceived		Observed	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
HCCQ T2	6.01	1.32			6.25	1.12		
Overall Need support			4.86*	.52			5.22	.46
Autonomy support			4.24	.81			4.56	.73
Involvement			5.08	.74			5.14	.50
Structure			2.98*	.70			3.71	1.17
Control			1.51*	.43			1.24	.23

* $p < .05$

Table 4.3

Bi-variate Correlations between Scores from the Four First Order Factors

	Autonomy support	Involvement	Structure
Autonomy support			
Involvement	.73**		
Structure	.63**	.49**	
Control	-.31*	-.23	-.35*

To examine whether scores on the NSEI-OP could distinguish between the consultation environments manifested in the SDT-based intervention versus control arms in the exercise on referral trial, data from Iteration 2 were used. A multivariate analysis of variance was conducted and no significant differences between conditions (SDT-based intervention arm vs.

standard practice arm) were revealed in Autonomy Support $F(1, 40) = 1.75 p > .05$, or Involvement $F(1, 40) = .09 p > .05$. However, significant differences emerged for Structure $F(1, 40) = 6.14 p = .018$, Control $F(1, 40) = 6.62 p = .014$ and the overall need support score $F(1, 40) = 5.73 p = .022$. Clients' perceptions of the environment, as assessed with the HCCQ, did not differ by condition $F(1, 150) = 1.05 p > .05$.

Discussion

To my knowledge, the Need Support in Exercise Interactions – Observation Protocol (NSEI-OP) is the first theory based, systematically developed instrument to more objectively examine the environmental support afforded by exercise professionals to their clients. The NSEI-OP is an observational rating protocol that taps the degree of autonomy support, involvement, structure and controlling behaviours exhibited within a one-on-one consultation aimed to foster the adoption and maintenance of PA. Although this initial work is exploratory, once fully validated the NSEI-OP may provide a valuable tool that supports the advancement of theory, measures intervention fidelity and prevents programme drift.

Inter-rater Reliability

Autonomy support.

To establish the inter-rater reliability of the NSEI-OP, ratings from independent observers from two iterations were compared (Shrout, 1998). Intra-class correlation coefficients indicated that observers rated the interactions similarly for the quality of autonomy support afforded by the health professional. These findings suggest that trained observers can reliably examine the autonomy supportive features of an environment created by exercise professionals during one-to-one interactions when using the NSEI-OP. My results are in line with previous research highlighting that trained observers can distinguish between autonomy

supportive environments and other aspects of the environment (e.g., controlling; Reeve, Jang, Carrell, Jeon & Barch, 2004; Williams et al., 2002).

Involvement.

Despite a lower level of reliability during the first iteration, observations of the provision for involvement had good levels of inter-rater reliability during the second iteration. A possible explanation for the low ICC in the first iteration may be initial ambiguities with item content. Progressive and continuous training of and discussions with the observers facilitated the clarification of what constituted the different qualities of involvement. For example, for the item ‘Accepting all Behaviours and Beliefs’, an indicator of involvement, the description was: “The HFA accepted the client unconditionally.” To further clarify this item, the following example was provided: ‘the exercise professional parrots what the client says back to him/her rather than making a judgmental comment’. Improvements in the inter-rater reliability for involvement were achieved from iteration 1 to iteration 2. This enhancement in observed reliability suggests that the cogent training of the observers is a critical aspect to establishing good levels of inter-rater reliability.

Structure.

Observer ratings of behaviours reflecting structure demonstrated the strongest levels of inter-rater reliability across both iterations. This could be because structure consists of more readily observable and tangible behaviours. For example, it is easier to observe the act of goal setting (example of structure) than rate the level of unconditional support (an indicator of involvement) that the exercise professional invested.

Interpersonal control.

It is noteworthy that my two iterations failed to establish an appropriate level of inter-rater reliability for controlling behaviours. As previously discussed, the inclusion of behaviours

that are more tangible may have helped to increase the reliability of the structure construct. With respect to the controlling dimension, it is possible that the lack of more overt, tangible behaviour items and the diversity in content of the interpersonal control items considered (e.g., praise and positive non-verbal language was used when the HFA heard what he/she wanted to hear) may have led to a decrease in reliability. However, another explanation is that some controlling behaviours might be perceived as “expected” of the role of HFAs by some observers and therefore might not be rated as highly controlling. My findings highlight the difficulty of achieving high levels in inter-rater reliability when assessing controlling behaviours. Until recently, controlling behaviour has remained an understudied area in the SDT literature (Bartholomew et al., 2010). Future research investigating the behaviours that are reflective of controlling environments within exercise consultations is needed.

Different Environmental Aspects

Although previous research (Tessier et al., 2008; Williams et al., 2002) has used observational data to measure autonomy supportive aspects of the environment, limited work has examined the relationships between three different aspects of contextual support (autonomy support, structure and involvement), and how these relate to motivational, behavioural and psychological outcomes (see Edmunds et al., 2008, and their work in exercise classes for a notable exception). Data collected in the present study revealed medium to strong positive associations between autonomy support, involvement and structure and small negative relationships between these constructs and controlling behaviours. These relationships between the four dimensions of the NSEI-OP indicate that these facets may represent different aspects of the environment and provide some evidence regarding the discrimination between autonomy support, involvement, structure and controlling behaviours within PA consultations.

Concurrent and Convergent Validity

Initial evidence of concurrent validity was established by comparing observed scores from the NSEI-OP with scores collected with the HCCQ. Results indicated that when the HFAs were split into two groups based on the observed overall need support score, participants' perceptions of the environment were significantly different. Specifically, participants who were assigned to HFAs who were independently observed to have provided a lower level of overall need support perceived the environment to be less need supportive. Therefore, the NSEI-OP was able to identify variability in the overall need support score in a similar fashion to a well-established measure of perceived environmental support. The NSEI-OPs validation would have benefited from establishing correlation coefficients between its four components and participants' perceptions of the same dimensions. However, currently two limitations prevent such validation attempts. Firstly, current SDT-based measures of perceived environmental support are uni-dimensional². Secondly, data collected using measures such as the HCCQ frequently demonstrate ceiling effects. Once, these limitations to the self-reported measures of environmental support are overcome, future research comparing observed data and self-report data of the same environmental dimension would help further establish the NSEI-OPs validity.

² The Health Care Climate Questionnaire (HCCQ) has most frequently been employed as a measure of autonomy support (Adie et al., 2008; Hurkmans et al., 2010) however Williams and colleagues (Williams et al., 1996) developed some of the items to be competence supportive (e.g., my advisor gave me clear and understandable instructions). Therefore, the HCCQ could be considered a measure of overall environmental support with most of the items targeting autonomy support (Markland & Tobin, 2010; Silva et al., 2010b).

With an eye toward creating more effective PA interventions, it is imperative that research studies examine adherence to the protocol originally developed. In order to establish that the NSEI-OP is capable of identifying variability in one-to-one consultations from the standpoint of the environmental dimensions endemic to SDT, data were collected from an exploratory randomised control trial (Jolly et al., 2009; Rouse et al., 2010). Specifically, utilising the NSEI-OP, I determined whether the degree to which the consultations conducted as part of a SDT-based exercise on referral intervention and standard practice (control arm) were seen to be significantly different in the views of independent raters. Data collected from the NSEI-OP during the second iteration revealed significant differences between standard practice and intervention arms for overall need support score and ratings of structure. However, no between arm differences were observed in the quality of autonomy support or involvement provided. Therefore, although the training received by the HFAs (randomly assigned to the intervention arm) was successful in changing their behaviour to satisfy the need for competence, the training may not have been effective in making any meaningful differences in the quality of autonomy support and relatedness need satisfaction, compared to those offered by the HFAs assigned to the control arm. The significant between arm differences in the overall need support score and structure dimension highlights that the NSEI-OP can identify variability in the consultation styles employed by exercise professionals that is otherwise missed by subjective perceptions. Regarding the latter and in contrast to the observed score, between arm differences in the perceptions of the degree to which the consultation was need supportive (as assessed via the HCCQ) were not significant. Therefore, the elements of the SDT-based consultation that were most straight forward to learn and implement, such as goal setting, might be successfully employed. In contrast, the more intricate and subtle interpersonal skills reflecting autonomy support were not

significantly different in the HFAs who received the SDT-based training from standard provision HFAs.

An explanation for the non-significant findings for autonomy support and involvement between the control and intervention arm may have been that the control arm included HFAs who already afforded a high level of autonomy support and involvement. Mean observed scores suggest that both arms afforded a moderate level of autonomy support and a high level of involvement. Yet another explanation might be, HFAs assigned to the intervention arm may not, did not, or were not able to implement the intended intervention regarding particular autonomy supportive (e.g., listened carefully to how the client wanted to do things) or relationship supportive (e.g., accepting the client unconditionally) behaviours with fidelity. For example, the HFAs may have been prevented from providing effective autonomy support due to language barriers (the intervention was conducted in a multi-cultural context), the HFA may have chosen not to implement the training that they had received, or the training provided was inadequate and not effective at teaching the HFAs how to create a comprehensively (from the standpoint of all 3 needs) need supportive environment. It is important to note that, in this study, comparisons between arms were conducted using data collected from Iteration 2 which demonstrated good levels of inter-rater reliability. Therefore, I can be confident that any significant findings are a consequence of real differences in environmental need support and not due to compromised internal consistency of my scales.

Practical Implications

Our findings carry important implications for future SDT-based interventions that entail training individuals, such as HFAs, to create need supportive interactions. Firstly, my data suggest that HFAs can be trained to use specific psychological tools, such as goal setting, to provide structure. Therefore, observational data can help to identify what aspects of an

intervention have and have not been successfully employed. As a consequence, these data can inform future research designs about which specific aspects of an intervention are effective. Research conducted by Su and Reeve (2011) that focussed on identifying particularly effective autonomy support interventions concluded that observational data would be a welcome addition to the literature. In addition, although the NSEI-OP was developed for a RCT and focussed on interactions between HFAs and their clients within an exercise on referral programme, future research may also use this tool to examine other one-to-one interactions between health professionals (such as physicians, fitness instructors etc.) and their clients when attempting to support PA behaviour change.

With further validation, the NSEI-OP can help future studies examine the extent to which SDT-based interventions, that target interactions between exercise professionals and clients, are implemented with fidelity (Brandon et al., 2008; Mowbray, Holter, Teague, & Bybee, 2003). Dusenbury, Brannigan, Hansen, Walsh and Falco (2005) highlighted the importance of future research designs that attempt to understand how to achieve intervention effectiveness under real-world conditions. The substantial resources and finance required to assess intervention fidelity (e.g., protocol development, training of providers and on-going assessments) is worthy of comment. Once the NSEI-OP is fully validated a single individual could be employed to rate the observed environment during one-to-one interactions allowing tighter management of both measurement and associated costs. However, Hardeman and colleagues (2008b) highlight that future intervention funders should consider these costs as part of evaluations so that appropriate conclusions can be drawn on effectiveness.

The NSEI-OP may be implemented by service providers to prevent programme drift over time (that is, to longitudinally examine what aspects of a programme are being successfully or unsuccessfully employed; Paulson et al. 2002). Future SDT-based training

interventions that wish to improve the quality of one-to-one interactions between HFAs and their clients may also benefit from implementing the NSEI-OP as a self-reflective learning tool. Finally, studies that aim to explore the role of environmental support on basic psychological need satisfaction and motivational regulations in an exercise context could employ the NSEI-OP to gather data that provides an alternative perspective to self-report regarding environmental characteristics.

This study has provided initial support that the NSEI-OP can be reliably and validly used to assess the need supportive environments created by exercise professionals in one-to-one consultations. Further research with larger samples of observers and interactions in a wider variety of PA promotion contexts, such as interactions with GPs and patients (Fortier, Sweet, O'Sullivan, & Williams, 2007) is necessary to provide greater evidence regarding this observational instrument's utility. Other types of health care practitioners may not be as need supportive as HFAs regarding PA. In addition, a larger sample of observations would help establish the instruments construct validity by testing the factor structure through confirmatory factor analysis.

Despite the encouraging results stemming from the present work, it is important to acknowledge that the data were collected from filmed rather than live consultations. Therefore, caution must be exercised when drawing conclusions. It is possible that changes in behaviour may have occurred due to the presence of a camera and the desire to impress the person filming and others who might be observing the footage (Reeve, Jang, Carrell, Jeon, & Barch, 2004b). Further, the use of filmed consultations, particularly with the camera centred on the HFA, may have led to a loss of information regarding the interaction between the HFA and client (e.g., acknowledging the non-verbally expressed feelings of the client).

In conclusion, the NSEI-OP provides an alternative assessment method to self-report to examine facets of environmental support offered by an exercise professional to a client in an exercise consultation. Further, the NSEI-OP appears to be a promising assessment tool to use in future research when it is important to examine programme fidelity and effectiveness in SDT-based interventions.

**EFFECTS OF MOTIVATION AND EGO DEPLETION ON
ONE'S ABILITY TO RESIST TEMPTATIONS AWAY FROM
PHYSICAL ACTIVITY**

Abstract

Understanding the psychological processes that underpin the limited self-control resource could have important consequences for health behaviour change interventions. The present study employs a 2x2 (Autonomous x Controlling; Depleted x Not Depleted) experimental design to investigate whether an initial act of self-control influences participants' ability to employ counteractive control strategies that help to resist temptation and stick to a focal physical activity goal and upon feelings of subjective vitality. Experimental instructions manipulated the environments to generate autonomy supportive and controlling conditions. After completing either a depleting or not depleting Stroop task, undergraduate students' ($n=77$) counteractive evaluations towards a temptation (to complete a sedentary trial with no information) and a focal goal (to complete a physically active trial that provided valuable information) were measured. Despite the successful manipulation of the experimental conditions, results indicated no significant effect of the motivational support condition or depletion condition on the value participants placed on a temptation or focal goal. A significant interaction between depletion condition, autonomous motivation and controlled motivation was observed for subjective vitality. Participants high in autonomous motivations and low in controlling motivations maintained levels of subjective vitality whether depleted or not. I discuss the importance of future experimental work on the effects of temptations on self-control resources in the physical activity domain.

Introduction

Whilst Studies 1 and 2 focussed on the impact of autonomy support and reasons why an individual participates in physical activity (PA) on mental well-being and PA intentions across an exercise referral scheme, the final study of this thesis (Study 4) examined whether autonomy support and personal motivation protect individuals from giving in to temptation drawing them away from valued health goals, and from experiencing reductions in subjective vitality. Therefore, Study 4 supports the aims of this thesis by examining the processes that support one's attempt to become physically active through acts of self-control and its impact on mental well-being.

Health behaviour change frequently requires self-control efforts along with proactive and determined action on behalf of the individual, particularly when the target behaviour is not inherently enjoyable (e.g., physical activity for purposes of 'exercise'). A consequence of changing health behaviours, such as increasing PA, is the existence of a persistent temptation (i.e., remaining sedentary) not compatible with the long term goal. When attempts are made to support health behaviour change, it is important to reduce and minimise the strength of such temptations. Therefore, successful PA interventions are reliant upon understanding the processes that increase PA compared to fostering sedentary activities. For example, walking through the front door after a long day at work, many individuals know that it would be beneficial for them to participate in 30 minutes of PA but are often faced by the temptation to collapse in a comfortable arm chair in front of the television. What determines whether these individuals stick to their focal goal or give in to such a temptation? Previous research highlights that self-regulation techniques are one of the most effective methods of supporting PA behaviour change (Michie, Abraham, Whittington, McAteer, & Gupta, 2009). Self-regulation occurs when one achieves a goal by effectively monitoring and managing one's

thoughts, feelings and behaviours (Baumeister & Vohs, 2004). Therefore, understanding the processes and techniques that support participants' attempts to self-regulate their behaviour could provide valuable information for future PA interventions. The present study is designed to examine the impact of ego depletion on one's ability to adhere to a PA related focal goal and reduce the temptation of a sedentary alternative by bolstering the value that one places on that goal. This study also examines whether my motivation towards a cognitive depleting task influences the relationships between depletion and temptation, and between depletion and reported psychological well-being.

Ego Depletion

Self-control efforts are important to help one adhere to health-related behaviours such as dieting, quitting smoking and participating in regular PA. Failure to implement self-control when exposed to temptations (e.g., cookies, cigarettes, and sedentary behaviours) can be counteractive to achieving health-related goals. Previous research supports the proposition that acts of cognitive self-control weaken one's future self-control attempts. This has been called ego depletion (Baumeister et al., 1998).

Baumeister et al., (1998) proposed that the self is a limited resource that is used for all acts of volition, such as controlled processing, active choice, initiating behaviour and overriding responses. Muraven, Tice, and Baumeister (1998) tested the hypothesis that people have a limited self-regulatory capacity in four experimental studies that employed a two-task paradigm. The two-task paradigm tests the fatiguing quality of the self-control by employing an initial cognitive or physical task that does or does not deplete the self-control, followed by a second task that requires self-control. Results from all four experiments revealed that, compared to participants whose self-regulatory strength had not been drained in a preceding self-regulatory task, participants who were ego depleted were less persistent at subsequent

unsolvable tasks, worse at controlling their emotions and demonstrated a decline in physical stamina. Muraven et al. concluded that these studies supported the proposition that after people participate in an act of self-control, they are subsequently less capable of regulating themselves because their cognitive resources become depleted. Research studies have now corroborated the hypothesis that performance on a subsequent self-regulatory task becomes impaired after ego depletion (Muraven & Baumeister, 2000; Vohs, Baumeister, & Ciarocco, 2005; Wallace & Baumeister, 2002). In a recent meta-analytic review of 83 studies that made 183 independent tests of the ego depletion effect, a medium to large effect size was found for the impact of ego depletion on a wide range of self-control dependent outcomes (Hagger et al., 2010).

Although the effects of ego depletion have been studied across a wide variety of tasks, only a very limited amount of research has been conducted in health behaviour settings and in particular the domain of PA/exercise. Muraven and colleagues (1998) have revealed that acts of self-control depleted participants' ability to perform a subsequent physical task. Specifically, participants who had to suppress emotions while watching a movie performed poorer on a follow-up hand grip task compared to participants who could express freely their emotions during the movie. In a recent study, Martin Ginis and Bray (2010) examined the effects of ego depletion on aerobic exercise and found that depletion led to declines in a subsequent exercise work output during a 10-minute bicycle trial. In addition, participants who were ego depleted planned to participate in less exercise in the future than those who were not ego depleted. Further, ratings of perceived exertion (as measured by Borg's scale; Borg, 1970) were significantly related to frequency of exercise but not duration. Martin Ginis and Bray argue that the difference in relationships between perceived exertion and exercise frequency and perceived exertion and exercise duration suggests that ego depletion may be

important for the decision to exercise but has a smaller influence on the physical performance of an exercise bout.

Although previous research appears to underline the impact acts of self-control have on subsequent performance, no evidence exists as to whether ego depletion impairs the ability to resist temptations. Baumeister et al., (1998) utilised temptations as a preceding method of inducing ego depletion but no research has examined whether giving in to temptations increases as an outcome of ego depletion.

Counteractive Self-control Theory

Counteractive self-control theory (CSCT; Trope and Fishbach, 2000) proposes that individuals have two options when confronted by a threat to a personally meaningful long-term goal. Firstly, they can give in to temptation because the short-term costs of sticking to the goal are perceived to be too high. For example, the thought of participating in a tiring exercise session after a long day at work could be considered 'too much'. The second option individuals have, when faced with temptation, is to elicit self-control that supports their efforts to stick to their long-term goal. CSCT identifies two types of self-control strategies that can be employed to counteract or resist temptations: choice alternatives and counteractive evaluations. *Choice alternatives* place contingent based penalties or rewards on behaviours to support acts that are in line with a long-term goal (e.g., rewarding attendance to an exercise class with a trip to the cinema). *Counteractive evaluations* bolster the perceived value that is placed upon the long-term goal (for example, individuals may say to themselves "despite the effort required, it is really important that I go to this exercise class because I want to lose weight"). Myrseth, Fishbach, and Trope (2009) demonstrated that undergraduate students devalued a temptation (leisure time activities) when pursuing an educational goal. Fishbach, Zhang, and Trope (2010) showed that dieters devalued fattening food and enhanced the value

of healthy eating when presented with images of fattening foods. Therefore, participants appear to bolster the value of important goals and decrease the value of short-term benefits posed by temptations. According to Fishbach and Trope (2008) what remains unclear, however, is the impact of ego depletion on individuals' capacity to implement these strategies and resist short-term temptations. The purpose of the present study is to combine these two distinct research areas (i.e., ego depletion and counteractive self-control theory) and investigate the effect that ego depletion has on the ability to resist short-term temptations.

The Role of Motivation

Previous research has indicated that an individual's motivation for participating in a cognitively depleting task can reduce the effects of ego depletion. Muraven, Gagne, and Rosman (2008) created two conditions that supported two different qualities of motivation (autonomous and controlled). Autonomous motivations are initiated by the self, are personally meaningful and valued. In contrast, controlled motivations are conducted to avoid feelings of guilt, gain ego enhancements or are externally driven. Social contextual environments can be manipulated to support these two qualities of motivation (Deci et al., 1994). For example, an autonomy supportive environment elicits and acknowledges perspective, offers choice, provides relevant information and minimises pressure and control. In contrast, controlling environments highlight normative comparisons, use controlling language and exert pressure. Results from two studies by Muraven et al., (2008) indicated that, when exerting self-control, supporting autonomous motivation as well as one's personal autonomous motivation resulted in less depletion of self-control strength manifested through better performance on a subsequent self-control task. Further, Muraven (2008) demonstrated that when participants refrained from eating cookies for more controlled reasons, performance on a handgrip task was worse than those with more autonomous reasons. Muraven (2008) further showed that

more autonomous forms of motivation negatively predicted depletion. Therefore, it appears that an individual's reason for exerting self-control can moderate the impact of depletion on subsequent acts of self-control. However, it is not clear whether autonomous motivation has the same moderating role when examining the impact of ego depletion on employing counteractive control strategies. The second purpose of this study, and in response to Hagger et al.'s (2009) call for more research that integrates the self-control model with existing health-related models of behaviour change, is to examine the role of motivation on the ability to resist temptation following depletion. Explicitly, it is thought that those in an autonomy supportive condition and those with more autonomous motivations will be more likely to resist temptation by moderating the effect of depletion on self-control.

Feelings of Vitality

In addition to the potential moderating effect of motivation, SDT (Deci & Ryan, 2000) proposes that when reasons for participating in an activity are more autonomous, rather than controlled, psychological well-being will be observed (Ryan & Deci, 2000b). In the SDT literature, a key indicator of well-being is subjective vitality (Edmunds et al., 2008; Ryan & Deci, 2000c). Ryan and Deci (2008) state that vitality 'represents energy that one can harness or regulate for purposive actions' (p. 703). Further, when one feels vital, he or she can cope better with stress and challenge (Ryan & Frederick, 1997). Muraven and colleagues (2008) showed that failing to support autonomous motivation can lead to lower feelings of vitality particularly after exerting self-control. Such propositions may have important implications for the effects of ego depletion on participants' feelings of subjective vitality. Specifically, participants high in autonomous motivation should experience feelings of subjective vitality regardless of the challenges or depleting effects of an activity.

Present Study

To summarise, the purpose of the present study is to examine the impact of ego depletion and motivation on one's ability to resist temptations. Based on the existent literature, it is hypothesised that acts of self-control will impair an individual's ability to resist temptations by reducing his/her ability to employ counteractive control strategies (i.e., bolstering the value of a long term goal and reducing the value of short term benefits of a temptation). Secondly, it is expected that autonomy supportive conditions and autonomous motivation will moderate the effect of ego depletion on one's ability to resist temptations. Finally, I hypothesise that autonomy support and personal autonomous motivation will help maintain feelings of psychological health (i.e., feelings of subjective vitality) regardless of whether one is ego depleted or not.

Method

Participants

Participants ($n=77$) were undergraduate students who required course credit for participation in research that contributed to their degree (M age = 19.78 SD = 1.69; Male = 35 Female = 42).

Procedure

Ethical consent for the study was obtained from a UK's University's Ethical Advisory Board. Participants signed up for a study that was advertised to investigate the beneficial effects of PA on cognitive performance. This advertisement was necessary to divert participants' attention from the actual study purpose that was to investigate the effect of ego depletion on individuals' ability to resist temptations, not the effect of PA on cognitive functioning. This faux description was implemented in order to prevent participant bias. The experimental protocol occurred during a single session in a sport and exercise psychology lab and lasted

approximately 30-45 minutes. Each participant was randomly assigned to one of four conditions: autonomous depleted ($n=20$), autonomous not depleted ($n=18$), controlled depleted ($n=19$) and controlled not depleted ($n=20$). Trial instructions informed participants that they will be required to complete either a physically active trial or a resting trial and that they could choose which they would prefer to complete. Participants were informed that they did not need to indicate their choice now but would be asked to specify which session at the end of a questionnaire. The physical task was described as reliable and effective at providing information about individual optimal levels for cognitive functioning and generates presumably valuable information about how to improve cognitive functioning that the resting trial would not provide. The purpose of this description was to emphasise the value of participating in the physically active trial. Before and after the cognitive task, participants were asked to rate the value of the physically active trial, the resting trial and the usefulness of the knowledge about their optimal levels of PA for good cognitive functioning.

Participants completed a cognitive task that required self-control to induce ego-depletion and generated two depletion conditions (Depleted and Not Depleted). Written instructions and manipulations of the environment created two different motivational support conditions (Autonomy supportive and Controlling). As an objective marker of ego depletion (Gailliot et al., 2007), three blood samples were taken with a single-use blood sampling lancet and blood glucose levels were measured (mg/dL) using an Accu-Check Aviva blood glucose monitor. At the end of the study the participants were informed that they will not complete the remainder of the session on that day. The purpose of the present study was to investigate the impact of ego depletion on the ability to resist temptations and employ counteractive control strategies, not the impact of PA per se. Therefore, participants were only required to believe that they were going to complete either the resting or physically active trial. Participants were informed

that the experimenter would be in contact to re-schedule and de-brief the participant. At the end of the data collection, all participants were fully debriefed.

Manipulations

Cognitive task.

Previous research has shown that a modified version of the Stroop task is an effective method of depleting the self-control reserve (Martin Ginis & Bray, 2010; Muraven, Rosman, & Gagne, 2007; Vohs et al., 2005). The computer generated task requires participants to press a key that represents the ink colour of each word in two lists of 70 words as quickly and accurately as possible (Wallace & Baumeister, 2002). In line with previous research, the colours used in the present study were red, blue, green, and purple.

Depleted condition.

In the depletion condition, participants were asked to name the colour of ink that words of different colours were written (e.g., the word “blue” written in red ink). In addition, participants were instructed to ignore this rule when the ink colour was blue and read the written word. Therefore, participants had to implement self-control in terms of two different behaviours.

Not depleted condition.

Participants in the not depleted condition viewed words and colour print that matched (e.g., the word “red” written in red print). Therefore, there was no requirement to override the dominant response and the participants could state the colour of the print without an interfering stimulus (i.e., a different colour written word).

Motivational support.

Pre-cognitive task, two motivation conditions were manipulated through instruction slides and the environment afforded by the experimenter.

Autonomy supportive condition.

For the autonomy supportive condition the task instructions highlighted the benefits and emphasised the personal challenge of completing the task and acknowledged the participants' positive and negative feelings towards the experiment. In addition, the experimenter remained in a non-obstructive position out of view of the participant. Participants were informed that they could start when they were ready. The instructions stated "Please state as quickly and accurately as you can, the colour of the ink that the words are printed; if you make an error please try and correct it". For the depletion condition the following instructions were added; "unless the ink colour is blue, in which case please ignore the colour of the ink and simply read the text". These autonomy supportive characteristics are similar to an environment that is task involving (i.e., makes the participant feel more connected and valued; Ames, 1992).

Controlling condition.

Participants randomly assigned to the controlling condition received instructions that used controlling language (e.g., "you must"), highlighted normative comparisons (i.e., "success will be a good indication of your cognitive functioning compared to that of other participants") and placed pressure on the participants to not make mistakes. In addition, the experimenter stood next to the participant with a stopwatch to time how long the participant took to complete the task. The experimenter decided when to start the task by stating "Three, Two, One, Go!". Participants were instructed "You need to read as fast and accurately as you possibly can the colour of the ink that the words are printed, and you must ensure that no errors are left uncorrected. Most participants only make one or two errors". For the depletion condition, the following instructions were added, "unless the ink colour is blue, if the colour font is blue you must read the written text". These controlling characteristic are similar to an environment that is ego-involving (i.e., social comparisons and pressure to not make mistakes; Ames, 1992).

Measures

Pre-task questionnaire.

Prior to commencing the Stroop task, participants completed a questionnaire pack that contained the following measures:

Brief mood introspection scale.

Mood was measured to examine whether it mediated the effects of ego depletion (Muraven, Gagne, & Rosman, 2008). The brief mood introspection scale (Mayer & Gaschke, 1988) was used as it has been frequently employed in previous ego depletion research (Muraven et al., 2008; Moller et al., 2006). Participants rated 16 adjectives that represented two independent factors (pleasant versus unpleasant affect, and high versus low arousal) on a scale ranging from 1 (*Definitely do not feel*) to 4 (*Definitely feel*). Previous ego depletion studies have failed to report levels of internal consistency. Mayer and Gaschke (1988) reported alphas of .63 and .86 for the two factors, respectively.

Counteractive-self control strategies.

Self-control efforts were measured through counteractive control evaluations. The perceived value that participants placed on the two trials (physically active and resting trial) and the usefulness of the knowledge about their optimal levels of physical activity for good cognitive functioning was assessed. On 7-point scales ranging from 1 (*Not at all*) to 7 (*Very much*), participants rated 6 items measuring the usefulness and importance of participating in each trial (e.g., “How useful will the results of the physical activity test be to you?”), the importance of the study, the importance of participating in scientific research and the extent to which the study was interesting, as an assessment of a counteractive self-control strategy (Trope & Fishbach, 2000). Similar to Trope and Fishbach (2000), these ratings were designed to assess the bolstering of the subjective value of the two trials.

Post-task questionnaire.

After completing the Stroop task, participants completed all measures from the pre-task questionnaire as well as the following measures:

Manipulation checks.

Cognitive depletion.

Participants completed two brief manipulation checks to assess their perceptions of ego depletion. For the first item, participants responded to the item “How much effort was required to comply with the cognitive task instructions?” on a scale anchored by 1 (*No effort was required*) and 7 (*Maximum effort was required*). Similarly the question “How tiring did you find complying with the cognitive task instructions?” was rated using a 7-point scale anchored by 1 (*Not very tiring*) and 7 (*Very tiring*).

Motivational support.

Six items developed for this study measured the participants’ perceptions of the situational motivational climate. Three items measured perceptions of autonomy support (e.g., “My feelings about the cognitive task were considered”) and three items measured controlling aspects of the environment (e.g., “I felt pressured to compete the task within a certain time”). All items were rated on a 7-point scale anchored by 1 (*Strongly disagree*) and 7 (*Strongly agree*).

Situational motivation scale.

Motivation for engaging in the cognitive task was measured using the 16-item situational motivation scale (SIMS; Guay, Vallerand & Blanchard, 2000). Participants responded to the SIMS in terms of their reasons why they engaged in the cognitive task (i.e., the Stroop task). The SIMS measures three different regulations (i.e., Intrinsic, Identified, External), as well as amotivation. Intrinsic motivation stems from an inherent interest or enjoyment for an activity,

whilst identified motivation occurs when one values the benefits associated with participating in a behaviour. These two motivations represent more autonomous forms of motivation. External motivation, the most controlling motivation, occurs when one participates in an activity to obtain a separable outcome (e.g., rewards) or as an outcome of external pressure. Finally, amotivation represents a lack of intention or desire to conduct the behaviour in question. All sub-scales have demonstrated adequate internal consistency ($\alpha = .64-.95$; Guay, et al., 2000). Each sub-scale was measured with four items and rated on a scale anchored by 1 (*Corresponds not at all*) and 7 (*Corresponds exactly*).

Subjective vitality.

The subjective vitality scale (SVS; Ryan & Frederick, 1997; Bostic, Rubio, & Hood, 2000) was employed as an indicator of psychological well-being. Participants responded to how, over the last two weeks they felt, using a scale anchored by 1 (*Not at all true*) to 7 (*Very true*), and an example item is “I feel alive and full of vitality”. The SVS has been shown to have good internal consistency in past work in the exercise context with Cronbach alphas ranging from 0.84 - 0.86 (Bostic, Rubio, & Hood, 2000).

Behavioural intentions.

Finally, a behavioural intention for the subsequent trial was measured with a dichotomous choice item. Participants were asked to indicate which task they would prefer to participate in today by circling either the Physically Active Trial or Resting Trial. Participants were then asked to indicate their preference for the session on a 6-point rating scale ranging from -3 (“I much preferred to complete the Physically Active trial today”) to +3 (“I much preferred to complete the Resting Trial today”) thus reflecting their behaviour intentions and resistance to temptation.

Results

Manipulation Checks

Ego depletion.

Consistent with previous research using the Stroop task as a method of depletion, participants in the Depleted condition perceived the task to be more tiring and requiring more effort to comply with the instructions ($M = 4.33$ $SD = 1.07$) compared to the Not depleted condition ($M = 3.14$ $SD = 1.25$) $F(1,73) = 22.56$ $p < .001$. Alternative methods of confirming participants' level of ego depletion was their reaction times (i.e., mean time it took participants to respond to each item) and blood glucose levels. Results revealed that the reaction time of participants in the Depleted condition ($M = 1.70$ $SD = .92$) was significantly longer than those in the Not depleted condition ($M = 1.10$ $SD = .78$) $F(1,74) = 10.03$ $p < .01$.

However, for blood glucose levels, a repeated measures ANOVA revealed no significant interaction between Time* Depletion $F(2,73) = .995$ $p > .05$, Time*Motivation $F(2,73) = .208$ $p > .05$ or Time*Motivation*Depletion $F(2,73) = .266$ $p > .05$.

Motivational support.

A One-way MANOVA revealed a significant effect of Motivational support condition $F(2,74) = 20.86$ $p < .001$. Participants in the Autonomy supportive condition scored significantly higher on the autonomy supportive items ($M = 5.54$ $SD = .91$) compared to participants in the Controlling condition ($M = 4.22$ $SD = 1.07$) $F(1,75) = 34.00$ $p < .001$. In contrast, participants in the Controlling condition scored significantly higher on the controlling items ($M = 3.44$ $SD = 1.01$) than those in the Autonomy supportive condition ($M = 2.27$ $SD = .92$) $F(1,75) = 27.94$ $p < .001$.

Counteractive Control Strategies

Experimental conditions.

A multivariate ANOVA was conducted with Depletion condition and Motivational support conditions as the independent variables and the counteractive control strategies towards the resting trial (*Value of Rest*) and the physically active trial (*Value of Physical Activity*) as the two dependent variables (see Table 5.1). With regard to the value of the resting trial, results from the MANOVA indicated no significant effect of Motivational support $F(1,73) = 1.76$ $p > .05$ or Depletion $F(1,73) = .64$ $p > .05$. Further, no significant interaction was observed between Motivation support and Depletion $F(1,73) = .27$ $p > .05$. Similarly, with respect to the value placed on the physically active trial, results revealed no significant main effects of Motivational support $F(1,73) = 1.72$ $p > .05$ or Depletion $F(1,73) = .17$ $p > .05$ nor a significant interaction $F(1,73) = .48$ $p > .05$. These non-significant results fail to provide support for the hypothesis that ego-depletion impairs an individual's ability to resist temptations by inhibiting the use of counteractive control strategies. Further, no evidence is found for the hypothesis that supporting autonomous motivation moderates the effect of ego depletion on one's ability to resist temptation.

Table 5.1

Means (Standard Deviations) Counteractive Control Scores Towards the Resting Trial and Physically Active Trial

	Depleted				Non-depleted			
	Autonomous		Controlled		Autonomous		Controlled	
	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>
Value of Resting Trial	4.32	(1.10)	3.72	(1.29)	3.81	(.87)	3.68	(.99)
Value of PA Trial	4.40	(1.1)	4.07	(1.17)	4.35	(.88)	4.22	(1.39)

Personal Motivation

In order to examine the effect of autonomous motivation for task engagement, the same analyses were conducted using the participants' scores from the SIMS. Scores from the SIMS were used to generate autonomous (intrinsic and identified) and controlled (extrinsic and amotivation) motivation composite scores which were then split at the median (4.00 for autonomous motivation and 3.25 for controlled motivation) to produce four groups (high and low Autonomous and high and low Controlled). A 2x2x2 (Autonomous high and low x Controlled high and low x Depleted and Not depleted) MANOVA was conducted with the value scores for the two trials as the dependent variables. With regards to the value of the resting trial, results showed no significant effect of Depletion $F(1,69) = 1.88 p > .05$ and Controlled motivation $F(1,69) = .06 p > .05$. However, a significant effect of Autonomous motivation $F(1,69) = 12.08 p = .001$ was revealed. Contradicting my second hypothesis, this significant result indicates participants high in autonomous motivation placed greater value on the resting trial than those low in autonomous motivation. A significant interaction between Depletion and Autonomous motivation $F(1,69) = 6.39 p = .014$ also emerged indicating that participants high in autonomous motivation valued the resting trial differently when depleted and not depleted to participants low in autonomous motivation. Specifically, participants high in autonomous motivation placed a lower value on the resting trial when not depleted. In contrast, participants low in autonomous motivation valued the resting trial similarly regardless of depletion condition (see Figure 5.1).

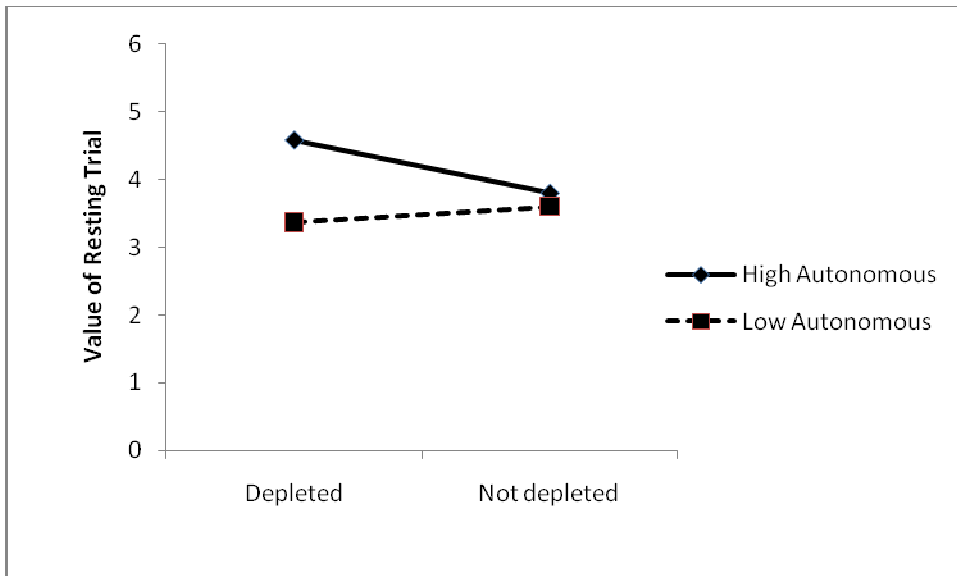


Figure 5.1. The Value Participants High and Low in Autonomous Motivation (SIMS) Placed on the Resting Trial when Depleted and Not Depleted.

No significant interaction was observed between Depletion and Controlled motivation $F(1,69) = 1.59 p > .05$, nor between Depletion, Autonomous motivation and Controlled motivation $F(1,69) = 1.42 p > .05$. For counteractive control strategies towards the physical activity trial a significant main effect for Autonomous motivation was observed $F(1,69) = 14.82 p < .001$. This finding indicates that participants high in autonomous motivation valued the physically active trial significantly more than participants low in autonomous motivation. No significant effect was observed for Depletion $F(1,69) = .003 p > .05$, Controlled motivation $F(1,69) = 3.36 p > .05$, Depletion*Autonomous $F(1,69) = 1.48 p > .05$, Depletion*Controlled $F(1,69) = .81 p > .05$, or Depletion*Autonomous*Controlled $F(1,69) = .95 p > .05$.

Feelings of Vitality

Experimental condition.

In contrast to my third hypothesis that supporting autonomous motivation would help sustain perceptions of vitality across depletion conditions a factorial ANOVA revealed no significant effect of Depletion $F(1,73) = 2.05 p < .05$ and Motivational support $F(1,73) = 1.56 p < .05$ nor

between Depletion and Motivational support $F(1,73)= 3.53$ $p=.06$ on feelings of subjective vitality.

Motivational scores.

To examine the moderating role of personal motivation on feelings of subjective vitality analyses were conducted using participants' SIMS scores. A factorial ANOVA revealed no significant effect of Depletion $F(1,73)= 2.36$ $p<.05$ and Controlled motivation $F(1,73)= .15$ $p<.05$ but a significant difference in vitality scores between high and low Autonomous participants $F(1,73)= 9.09$ $p=.004$. No significant interaction was observed between Depletion and Autonomous motivation $F(1,73)= 2.22$ $p<.05$, and between Depletion and Controlled motivation $F(1,73)= .31$ $p<.05$. However, a significant three way interaction was observed between Depletion, Autonomous motivation and Controlled motivation $F(1,73)= 4.33$ $p=.041$ indicating that participants high in controlled motivation demonstrated similar levels of subjective vitality regardless of their autonomous motivation and across depletion conditions. In contrast, participants low in controlled motivation revealed different levels of vitality when high and low in autonomous motivation across depletion condition. Specifically, and supporting my third hypothesis, participants high in autonomous motivation demonstrated higher and consistent levels of subjective vitality across depletion conditions when low in controlling motivation where as participants low in autonomous motivation and low in controlling motivation had less vitality when depleted (see Figure 5.2).

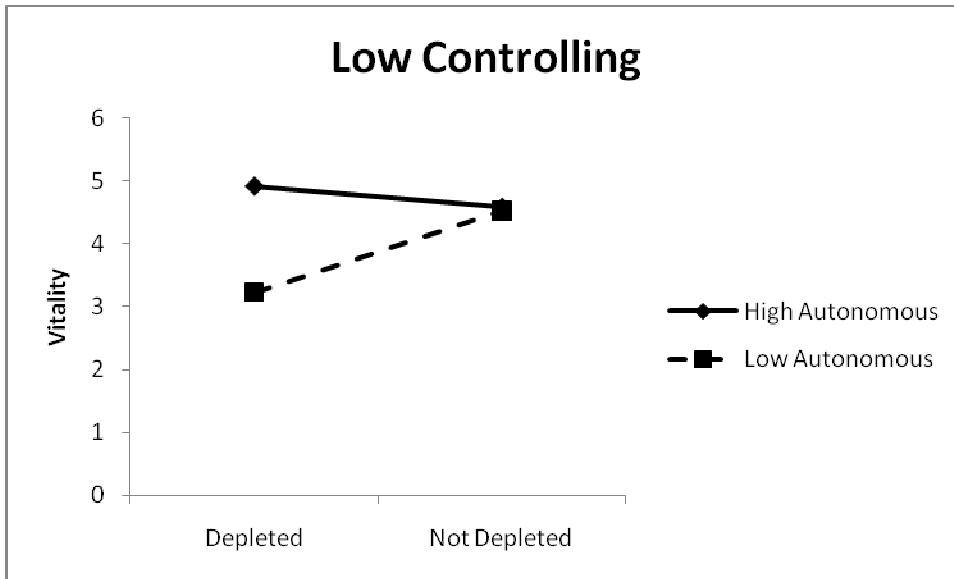


Figure 5.2a. Three-way interaction for subjective vitality scores for participants low in controlled motivation, autonomous motivation and depletion conditions.

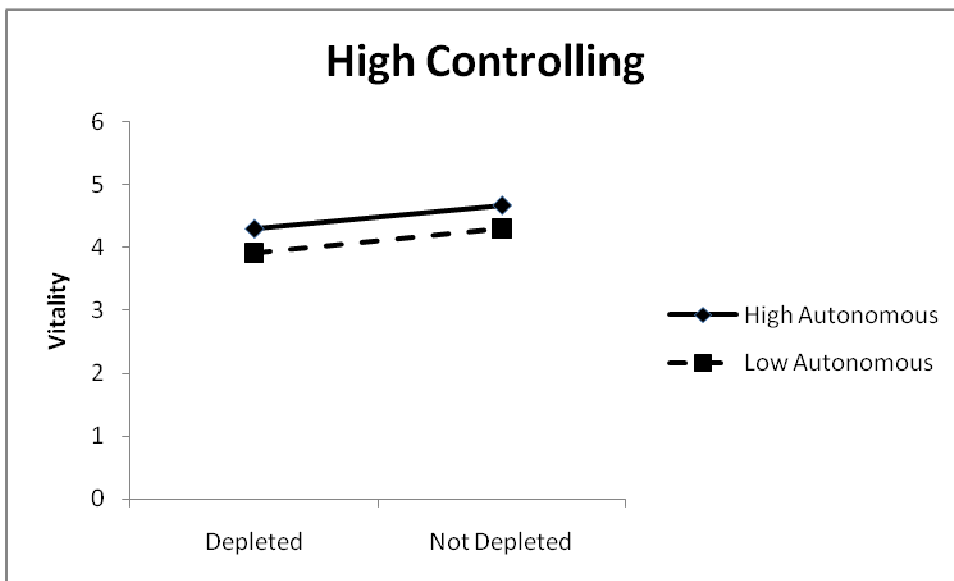


Figure 5.2b. Three-way interaction for subjective vitality scores for participants high in controlled motivation, autonomous motivation and depletion conditions.

Behavioural Choice

Twenty-three participants selected the physically active trial whereas fifty-four selected the resting trial. Two Chi-square (χ^2) tests revealed that the percentage of participants that selected the physically active trial did not differ by Motivational support condition $\chi^2 = (1, n=77) 2.79 p > .05$, or by Depletion condition $\chi^2 = (1, n=77) .68 p > .05$. Two separate χ^2 tests

were conducted due to less than 5 participants selecting the physically active trial in the autonomous depleted condition (Field, 2005). Two further Chi-square tests with personal motivation scores revealed similar results. The percentages of participants that selected the physically active trial did not differ by Autonomous motivation $\chi^2 = (1, n=77) 2.79 p > .05$ or by Controlled motivation $\chi^2 = (1, n=77) .68 p > .05$.

Discussion

Understanding the processes responsible for adhering to long-term health behaviour goals, such as increasing physical activity, and resisting temptations that draw one away from these goals (i.e., engagement in sedentary activities) could be important for the development of effective interventions. The present study represents a novel experimental study that examined whether ego depletion and motivation influenced participants' ability to employ counteractive control strategies and adhere to a focal PA goal rather than give in to temptation. This study, and future experimental research, could provide valuable practical guidance for how interventions can support behaviour change along with techniques that support the development of health behaviour habits (i.e., health behaviours that are customary ways of behaving; Ouellette & Wood, 1998).

Experimental Manipulations

Results from my manipulation checks indicated that my study successfully manipulated ego depletion and motivational support. Participants in the depleted condition perceived the Stroop task to be more tiring, required more effort and had longer reaction times compared to those in the not depleted condition. It is noteworthy however, that my objective measure of ego depletion, blood glucose levels, did not reveal any significant differences between conditions. However, Clarkson, Hirt, Jia, and Alexander (2010) highlighted that individual perceptions are sufficient to evoke ego depletion. The successful implementation of the

Stroop task as a means of inducing ego depletion corroborates previous research employing the same task (Martin Ginis & Bray, 2010; Muraven et al., 2007). Manipulation checks further confirmed that the pre-task instructions successfully manipulated participants' motivation for completing the cognitive task. Participants in the autonomy support condition scored significantly higher on the autonomy supportive items and significantly lower on the controlling items compared to participants in the controlling condition.

Counteractive Control Strategies

Counteractive self-control theory (Trope & Fishbach, 2000) hypothesises that one possible way of adhering to a focal goal is to increase the value placed on that goal and decrease the value of temptations. As a measure of counteractive control strategies, participants in my study were requested to answer questions that indicated the perceived value that they placed on both a physically active trial and a resting trial. The design manipulated the physically active trial to represent a focal goal and the resting trial to represent a temptation and examined the previously untested hypothesis that acts of self-control may diminish the capability of participants to employ counteractive control strategies. However, results did not support this hypothesis. No significant effect of cognitive depletion on the value that participants placed on the resting trial or the physically active trial was observed. Similar unexpected results were found for the motivational support condition. No significant differences were observed in perceived value of the physically active trial or the resting trial between the autonomy support and controlling condition. This non-significant effect of motivational support is not surprising given the non-significant effect of cognitive depletion. According to previous research (Muraven et al., 2008), motivational support moderates the impact of ego depletion caused by an initial act of self-control on a second subsequent self-control act. However, in this study motivational support during the first ego depleting act

could not reduce the impact of depletion on a subsequent act of self control because no such effect existed.

We also examined the role of motivation in my study by analysing participants' personal motivation scores. Previous research (Moller et al., 2006) has highlighted that the reasons why one conducts an activity influences the strength of ego depletion. The present results showed that how participants, high and low in autonomous motivation valued the resting trial was contrary to my hypothesis when depleted and not depleted. Specifically, participants high in autonomous motivation who were depleted placed more value on the resting trial (temptation) than when not depleted. In contrast, participants low in autonomous motivation valued the resting trial similarly whether cognitively depleted or not.

With regards to the value that participants placed on the physically active trial, only a significant effect of autonomous motivation was observed. Participants high in autonomous motivation placed greater value on the physically active trial in both the depleted and not depleted condition compared to those low in autonomous motivation. These results suggest that even though there was no significant effect of cognitive depletion, when participants were highly autonomous they were more likely to value a trial that carries pre-identified benefits (i.e., knowledge of their optimal levels of physical activity for cognitive functioning). However, caution must be expressed because the same participants also placed a high value on the resting trial that carried no pre-identified benefits and represented a temptation away from the focal goal.

Potential explanations for why the present results do not support my hypotheses may be found in the propositions of Counteractive Control Theory (CCT; Trope & Fishbach, 2000). Specifically, CCT proposes that short-term costs or temptations will not elicit counteractive control when they do not threaten a valued goal. It is plausible that some of my participants

did not place any true value on the pre-prescribed goal. When no value is placed on the long-term goal, Trope and Fishbach (2005a) found that participants would choose according to simple economic considerations. Mean scores for the value participants placed on the valued goal suggests that a medium value was placed on the physically active trial, a similar level to that of the resting trial. In an attempt to manipulate personally valued goals previous counteractive control research have used dieters and participants leaving gyms (Fishbach, Zhang, & Trope, 2010; Myrseth, Fishbach, & Trope, 2009). Therefore, future studies should attempt to implement a goal that is already personally valued by the research participants. Using already meaningful goals would help clarify whether my non-significant findings were due to an undervalued goal or because an initial act of self-control does not impact one's ability to employ counteractive control strategies.

Trope and Fishbach (2005a) highlight that the balance between the long-term goal and the strength of the temptations is also a critical factor for counteractive control strategies to be employed. Therefore it is possible that the present study failed to achieve an appropriate balance between these factors and may have been the cause of the non-significant findings regarding the use of counteractive control strategies (Trope & Fishbach, 2005a). Participants from this study were undergraduate students from a Sport and Exercise Science bachelor's degree course. Participants may have had already completed significant levels of physical activity on the day they visited my lab making the short term temptation of the resting trial very strong. Alternatively, because participants planned to be physically active in the near future, they could have given in to temptation without identifying a conflict in the balance between the temptation and the goal. Fishbach and Converse (2010) highlight that self-control failure, or self-regulation failure (Baumeister & Vohs, 2004), is frequently caused by the failure to identify that a conflict between an important goal and a temptation exists. Therefore,

the scenario generated for my study may have failed to have achieved a sufficient level of perceived long-term cost from the temptation (resting trial) for the participants to identify a conflict. If conflict identification, or lack of, is a cause for the present results this may provide an important insight into a potential barrier to participating in physical activity or exercise in the general public. If one has a perception that deciding not to be physically active is of little threat to important longer term goals, such as reducing cholesterol or increasing cardiovascular fitness, it is less likely that one will identify a potential self-control conflict. The challenge for future laboratory studies in this area is to establish an appropriate level of temptation that necessitates conflict identification and the use of counteractive self-control strategies.

Future research is necessary to corroborate this speculation. If remaining sedentary carries a low perception of cost towards important long term goals, this could have important practical implications for future health initiatives. For example, physical activity interventions may need to support, and link, the relationship between the consequences of sedentary lifestyles and the attainment of personally meaningful long-term goals. This would initiate awareness that a conflict existed and increase the likelihood of counteractive self-control strategies being employed. Such potential implications highlight the importance of employing experimental research methods in the development of future effective health interventions.

Behavioural Choice

As a second measure of their ability to resist temptation, participants indicated whether they would prefer to complete a 'physically active trial' or a 'resting trial' following the Stroop task. Results revealed that the percentage of participants that selected the trials did not differ by depletion condition or motivational support condition. In fact, too high a percentage of participants (70%) selected the resting trial to complete the desired analyses. These findings

provide further support to my suspicion that the balance between the strength of the temptation and the strength of the long-term goal was not optimal. Future research designs would benefit from developing an experimental protocol that would facilitate a greater balance in the strength between the two behavioural choices.

Feelings of Vitality

Results revealed that reported subjective vitality did not differ between the two depletion conditions or the two autonomy supportive conditions. However, a close to statistically significant interaction between motivation and depletion conditions was observed that was contrary to what was expected. Specifically, perceptions of vitality were similar in the depleted condition regardless of whether participants were assigned to the controlling or autonomous condition.

Personal motivation.

In order to explore the relationships between motivation, self-control and feelings of vitality further, participant's motivation scores (median split) were used as independent variables instead of the two autonomy supportive conditions. Multivariate analyses indicated that participants scoring high in autonomous forms of motivation had higher perceptions of subjective vitality regardless of depleting condition. A significant three way interaction between depletion, autonomous motivation and controlling motivation was also observed. This finding indicates that perceptions of subjective vitality for those high and low in autonomous motivation across the depleted and non-depleted conditions differed depending on the level of controlling motivation. Participants who possessed low controlled motivation and high autonomous motivation demonstrated a similar level of vitality regardless of depletion condition. Participants low in controlled motivation and low in autonomous motivation demonstrated lower levels of subjective vitality when ego-depleted. In contrast,

participants high in controlled motivation demonstrated similar levels of subjective vitality regardless of whether they were high or low in autonomous motivation whether depleted or not depleted. These results provide partial support for SDT and previous research by indicating that being high in autonomous motivation and low in controlled motivations for conducting a behaviour is associated with maintained vitality (Ryan & Deci, 2008). For example, Nix and colleagues (1999) demonstrated in a variety of studies that undergraduate students who engaged in activities for autonomous reasons exhibited enhanced or maintained feelings of subjective vitality relative to students with more controlled reasons. Kasser and Ryan (1999) showed that when older participants possessed more autonomous regulations towards their daily activities they demonstrated higher levels of subjective vitality.

The conflicting results for subjective vitality observed between the motivational support conditions and the personal motivation scores suggest that there may have been an aspect of my manipulation that did not fully support autonomous motivation. A potential confounding factor may have been that the majority of participants were first and second year undergraduates participating in research to accrue credit towards their degree. It is possible that the external reward for participating may have created some external regulations for participating in the study not measured by the manipulation checks.

Limitations and Future Directions

The present study represents a novel experimental design that attempted to understand the processes responsible for how one adheres to a focal goal and resist temptation in the face of cognitive depletion. Results stemming from experimental research, such as that employed in the present study, adds further understanding of the barriers to and solutions for participating in regularly PA as well as feelings of mental well-being. Specifically, the present research highlights that when participants are high in autonomous motivation and low in controlling

motivations for conducting a cognitively depleting task, they maintain perceptions of vitality. Therefore, employers, teachers and coaches that attempt to create autonomy supportive environments could help support their employee's mental well-being. Edmunds (2005) highlighted that a major limitation of the exercise focussed literature is the lack of studies that examine the theoretical tenets of SDT using experimental designs. In addition, it is important that research in the exercise and public health domain continue to test and examine the role of complementary and alternative theories through experimental research designs to assess whether they add further understanding to the processes responsible for behaviour change and associated mental health outcomes. However, despite the innovative nature of this research, limitations must be acknowledged. The design of this study meant that even before a participant had received information about the up-coming cognitive self-control task, each participant may have already made the decision to complete the resting trial. That is, previous research indicates that counteractive evaluations only take place before a decision is made. For example, Myrseth et al., (2009) showed that gym participants only bolstered the value of a health bar compared to a chocolate bar *before* deciding which to eat. Once the decision had been made, participants rated the two bars equally. Therefore, although my design did not require participants to make a choice between the two trials until they rated the utility of the physically active and resting trials, participants knew that this decision was approaching and may have had already consciously made their decision. Future research designs could examine whether knowledge of an approaching choice between giving in to temptation or sticking to a focal goal reduces the ability to employ counteractive evaluations. Therefore, such designs should not indicate to the participant that they will have to make a choice until after the depletion task. Further, in determining the effects of ego depletion on counteractive self-control this study only examined one counteractive control strategy. Counteractive self-

control theory (Trope & Fishbach, 2000) also proposes that one can employ choice alternatives as a method of resisting temptations. Therefore, future research designs could incorporate choice alternatives as a measure of counteractive control. For example, participants could be requested to assign a proportion of their research credit to a temptation and valued goal. The proportion of credit assigned could indicate efforts to support adherence to the focal goal or give in to temptation.

Summary

To conclude, this study successfully manipulated ego depletion and supported autonomous motivation towards an ego depleting task. However, these experimental conditions did not have any significant influence on the ability to enhance the value of an imposed goal or to actually choose that goal over a tempting alternative. Despite these non-significant results, my study provided partial support for SDT's (Deci & Ryan, 2000) proposition that high personal autonomous motivation combined with low controlling motivation is associated with vitality in the face of both depleting and not depleting tasks. Future research should continue to develop study designs that explore the role of ego depletion on people's ability to employ counteractive control strategies. Knowledge of the processes that underpin the capacity to adhere to a long-term goal and resist temptations could have important implications for developing more effective health interventions.

GENERAL DISCUSSION

Overview

This thesis examined the predictive utility of Self-Determination Theory (SDT; Deci & Ryan, 2000), in the health domain of physical activity (PA), with respect to the relationships with cognitive and mental well-being outcomes such as intentions and subjective vitality.

Implementing a variety of methodologies (i.e., cross sectional, longitudinal and experimental), broad support has been shown for the application of SDT to the health context of PA behaviour change. Specifically, this thesis highlights that socio-environmental support and the reasons why an individual participates in PA have important consequences for behavioural intentions and the mental health of participants, not just during and after, but also before one begins their journey to PA behaviour change. Further, an observational tool was developed, the Need Support in Exercise Interactions-Observational Protocol (NSEI-OP), that can support and supplement self-reported measures of one-to-one interactions between exercise professionals and his or her client. Initial evidence was provided for the instrument's inter-rater reliability and concurrent validity. Finally, this thesis raises awareness of autonomous motivation's potential to moderate the effect of ego depletion on self-control strength and highlights the role that motivation may play in protecting an individual's feelings of subjective vitality.

This final chapter draws together the main results presented by Studies 1-4 (Chapters 2-5) and highlights the questions that remain unanswered. This chapter also identifies the key practical implications for future PA interventions which stem from the empirical research within this thesis. Consideration is given to the most effective methods of achieving mental well-being before, during and after participants attempt to change this crucial modifiable risk factor for so many life threatening diseases.

Summary of Research Findings

Study 1 (Chapter 2) investigated the role of socio-environmental support for those about to begin the road to PA behaviour change. I tested the differential predictive utility of different important others' autonomy support on positive and negative indicators of well-being (i.e., subjective vitality and depressive symptoms), as well as PA intentions in participants about to commence an exercise referral programme. Implementing a cross-sectional design, the results from Study 1 support previous research (Williams et al., 2006a) that reveal the important contribution towards well-being and PA intentions made by important others surrounding individuals' attempting to change their level of PA. Specifically, exploration of the significant interactions from hierarchical regression analyses showed that partners' and physicians/nurses' autonomy support were significantly associated with PA intention, whereas, offspring autonomy support was not associated with these intentions. In addition, autonomy support provided by partners was negatively related to depressive symptoms but no relationship was observed for offspring and physician/nurse autonomy support. Although only preliminary, and non-causal, these results extend previous research by revealing that autonomy support from a variety of important others (i.e., partners, offspring and physician/nurse) make different and potentially unique contributions towards participants' PA intentions and depressive symptoms even before commencing an exercise referral programme.

A second purpose of Study 1 was to test a SDT-based structural path model examining the hypothesised relationships between autonomy support, motivational regulations and indicators of mental well-being and PA intentions in participants about to commence a PA promotion programme. Corroborating previous research (Wilson & Rodgers, 2004), results showed that perceived environmental support from important others and motivational reasons

for participating in PA were positively associated with indicators of well-being and intentions to be physically active. Specifically, more autonomous reasons for participating in physically active behaviours were associated with participants' perceptions of their important others affording a more autonomy supportive environment. In addition, a direct positive relationship emerged between important other autonomy support and PA intentions that had not been hypothesised. When participants perceived that the environment surrounding them at the beginning of the exercise referral scheme was autonomy supportive they were more likely to possess greater intentions to be physically active. Motivational regulations were found to be significant predictors of indices of mental well-being. The re-specified structural model revealed a positive association between autonomous regulations and subjective vitality, whereas controlled regulations were linked with depressive symptoms. Although no direction or causal relationship can be inferred from these cross sectional data, Study 1 suggests that participants arrive at PA interventions with variety in their motivations and that these motivation regulations are differentially linked to variability in their well-being and PA intentions.

In contrast to the cross-sectional design employed in Study 1, Study 2 (Chapter 3) implemented a 6 month longitudinal design investigating the consequences of a motivational sequence on indicators of mental health in participants of an exercise referral programme. Study 2 further extended Study 1 by investigating the determinants and implications of the three basic psychological needs and included two different measures of autonomy support (provided by 'important others' and health fitness advisor) as a continued exploration of the relationships between the different individuals providing autonomy support, satisfaction of the basic psychological needs and motivational regulations. Although it would have been preferable to break 'important others' down further (i.e., different important others), to test the

hypothesis that different important other make unique contributions to cognitive and mental well-being outcomes, sample size restricted this possibility.

Supporting previous research (Edmunds et al., 2008), results from Study 2 revealed that positive perceptions of health and fitness advisors' (HFA) autonomy support were associated with the satisfaction of the basic psychological needs for autonomy, competence and relatedness. Therefore, it appears that HFAs are capable of creating an environment during one-to-one interactions with their clients that supports the basic psychological needs. In contrast, autonomy support provided by 'important others' was only associated with satisfaction of the need for relatedness. This significant relationship could hold implications for the initiation of PA behaviour change because the PA behaviours in question may be prompted, modelled and valued by an important other to whom the participant feels attached and related. Discussion on the differential relationships with need satisfaction according to who provided the autonomy support focussed on the comparative quality of autonomy support provided by HFAs than that provided by important others. Path analysis also revealed that autonomy need satisfaction (i.e., participants' feelings of ownership, choice and volition towards participating in physical activity), along with a feeling of connectedness with others (relatedness need satisfaction) were positively associated with more autonomous reasons for participating in PA. However, feelings of competence were not significantly related with the participants' reasons for participating in PA. It is plausible that the skill levels required for PA behaviour change, especially for "beginners", are greater and/or more diverse than for other health behaviours (e.g., dieting). Thus, an individual commencing PA behaviour change turns to value other aspects of the experience such as feelings of relatedness and ownership over the activities that they participate in. Advancing previous research (Wilson & Rodgers, 2004; Edmunds et al., 2006) and the cross-sectional relationships observed in Study 1, Study 2

found that the reasons for participating in PA at the end of the exercise on referral scheme were positively related to feelings of subjective vitality and negatively related to depressive symptoms three months later. This finding highlights that the reasons why one decides to participate in PA may have important and long-term consequences for one's mental well-being. Therefore, Study 2 corroborates previous research and provides further indication of processes responsible for both positive and negative indicators of psychological health in participants attending an exercise on referral physical activity promotion scheme.

Exercise referral programmes rely on one-to-one interactions between HFAs and their clients to implement changes in PA behaviour and promote greater well-being. Therefore, it is important to collect reliable and valid data from these interactions to understand the processes responsible for any outcomes achieved. Observational data provide an alternative and supplementary method of measuring environmental support during these interactions other than client self-reports on the nature and quality of interactions with their 'exercise counsellor'. No previous research that I am aware of has systematically developed an observational protocol to rate the motivational environment afforded by exercise professionals during one-to-one interactions. Study 3 (Chapter 4) introduced the NSEI-OP, a SDT-based observational instrument that examines four aspects of environmental support (autonomy support, involvement, structure and control). Results from Study 3 provide initial support for the inter-rater reliability of the Autonomy Supportive, Involvement and Structure components of the NSEI-OP. However, it appeared rather difficult to reliably rate Controlling behaviours during one-to-one interactions. Data collected using the NSEI-OP from an exploratory randomised control trial provided data that when compared with self-reported data (e.g., Health Care Climate Questionnaire; Williams et al., 2006b) revealed greater insight into variability in consultation delivery. For example, observational data showed significant

differences between a standard practice arm and a SDT-based intervention arm for overall need support (autonomy support, involvement, structure and control) and the Structure dimension individually. These between arm differences, revealed through observed ratings, demonstrate that the NSEI-OP can detect variability in consultation styles that is otherwise missed in participants' perceptions. Initial evidence for the concurrent validity of the NSEI-OP was also demonstrated when participants who were assigned to HFAs rated as providing lower levels of overall need support, perceived the environment to be less autonomy supportive. Thus, the NSEI-OP identified variability in a similar fashion to a well-established measure of environmental support.

Edmunds (2005) highlighted that a major limitation of the exercise focussed literature is the lack of studies that examine the theoretical tenets of SDT using experimental designs. In addition, it is important that research in the exercise domain continue to test and examine the role of complementary and alternative theories to assess whether they add further understanding to the processes responsible for behaviour change and associated mental health outcomes. Whilst Studies 1 and 2 focussed on the impact of autonomy support and reasons why an individual participates in PA on mental well-being and PA intentions across an exercise referral scheme, the final study of this thesis (Study 4) examined whether autonomy support and personal motivation protect individuals from giving in to temptation drawing them away from valued health goals, and from experiencing reductions in subjective vitality. When developing health interventions, it is important to reduce the strength of barriers, such as temptations, that prevent one from achieving the desired goal. Despite confirmation of the successful manipulation of the experimental conditions (depletion x motivation), Study 4 (Chapter 5) found no significant differences in counteractive control strategies employed by the participants. Specifically, and in contrast to previous research (Trope & Fishbach, 2000),

participants who were ego depleted, valued a physically active task and a sedentary task (temptation), similarly to participants who were not cognitively depleted. In addition, participants assigned to controlling or autonomy supportive conditions also valued the temptation and long term goal similarly, regardless of whether they were cognitively depleted or not. The balance between the value of the focal goal and the temptation was discussed as a potential explanation for these non-significant results (Trope & Fishbach, 2005b). For example, study participants were from a sport and exercise science department and may have already planned to be physically active in the near future. As a result, perhaps they did not identify a conflict between the valued goal and temptation.

Findings in Study 4 did indicate that, even within an experimental study entailing a successful manipulation of the environment, one's personal motivation has consequences for psychological health. Results revealed a significant interaction between participant's personal motivation, depletion condition and controlling condition on feelings of subjective vitality. This finding indicates that perceptions of subjective vitality for those high and low in autonomous motivation across the depleted and non-depleted conditions differed depending on the level of controlling motivation. Participants high in autonomous motivation maintained levels of subjective vitality whether depleted or not and regardless of their controlling motivations. In contrast, when participants were low in autonomous motivation and low in controlled motivation, levels of subjective vitality were lower when depleted compared to not depleted. This result suggests that when participants possess high levels of autonomous motivation and are cognitively depleted, participants' levels of subjective vitality may be protected irrespective of the levels of controlled motivation. Therefore, autonomous motivation is associated with maintained subjective vitality in the face of both depleting and not depleting tasks. This provides further evidence that the possession of high autonomous

motivation carries a buffering effect towards cognitive depletion and maintains feelings of personal energy.

Practical Implications

This thesis has corroborated previous similar findings from SDT-based research centred on PA behaviour, and has also provided further insight into the determinants and consequences of motivation. Studies 1 and 2 carry important practical implications for future SDT-based interventions that aim to support PA behaviour change. Study 1 suggests that socio-environmental support provided by important others and the reasons underpinning behaviour change are associated with behavioural intentions and mental well-being even before commencing an exercise referral programme. Therefore, knowledge of participant's incoming perceptions of environmental support and his or her motivation to engage in PA may offer important information for exercise professionals to help them more effectively support, or consider barriers to, PA adoption. An initial questionnaire completed by the referred patient before attending the first meeting with the exercise instructor could provide a method of obtaining this important information.

Study 1 also indicates that different important others make unique contributions to the prediction of participants' well-being and PA intentions. This finding suggests that when designing autonomy support interventions that target facets of the environment surrounding an individual who is attempting to change a behaviour, it is important to determine who the participant believes to be important in his/her attempt to change behaviour. Further, Study 2 revealed that important other autonomy support was only associated with relatedness need satisfaction and not competence or autonomy need satisfaction. This implies that, the quality of support provided by different important others could be improved by educating the selected individuals in how to provide effective autonomy support. It is plausible as well that

important others could be taught to convey confidence in the participants' ability to make changes regarding their PA and health, to support feelings of competence, and to show understanding with regards to how one feels about their health-related PA, to support relatedness need satisfaction. Education techniques such as information pamphlets or DVDs may lead to a better quality of autonomy support provided by important others. Studies 2 and 3 reiterate that an important component of any health intervention that aims to support and/or enhance mental health, in addition to behaviour change, is the inclusion of attempts to internalise participant's reasons for changing this important health behaviour by exposing participants to more need supportive environments (Deci et al., 1994). Creating need supportive environments for individuals participating in PA (e.g., at a gym) appears important but to also have important others afford need support at home, at the time when an individual decides whether to complete their PA, could aid intentions to be physically active and further enhance psychological well-being.

Findings from Study 3 also carry important implications for future SDT-based interventions that entail training individuals, such as HFAs, to create need supportive interactions. Data collected using the NSEI-OP indicate that HFAs can be trained to use specific psychological tools, such as goal setting, to provide structure during one-to-one consultations. The NSEI-OP was designed as a monitoring tool, however, the instrument could be used to examine how effective training (e.g., for exercise professionals in how to afford need supportive interactions with their clients) has been. Further, from the standpoint of intervention fidelity, observational data can help to identify what aspects of an intervention have and have not been successfully employed. Moreover, the NSEI-OP provides a systematic method for service providers to prevent programme drift over time by examining

what aspects of a specified programme are being successfully implemented (Paulson et al., 2002).

Limitations and Future Directions

This thesis provides further supportive evidence for the application and relevance of SDT to the health domain. Although some non-expected relationships emerged, all four studies provide additional evidence for SDT's propositions in the relationships with psychological well-being and behavioural intentions. However, it is important to acknowledge the boundaries and limitations of this thesis when drawing conclusions. As a consequence of the work presented in this thesis and its limitations, a variety of further research avenues may be explored with valuable consequences.

Studies 1, 2 and 4 utilised self-reported measures of motivational constructs and well-being. Although self-report assessments are the most frequently employed method of collecting data and provide important insight into psychological constructs and their concomitants, this method remains fallible due to memory distortion, misinterpretation of questions and/or alterations in answers due to social desirability, and could be supported with more objective measures of PA environments and well-being (e.g., markers of immune functioning and stress processes, such as cortisol). Study 3 has begun the process of addressing this limitation through the establishment of an alternative and more objective measure of environmental support. Future research could employ the NSEI-OP to allow greater theoretical understanding of the interplay between need satisfaction and motivational regulations. In addition, although this thesis is targeted at the understanding of the psychological processes responsible for mental health and intentions to be physically active, a limitation of this thesis is the lack of a measure of objective PA behaviour. Future research

would benefit from examining the relationships between self-determination theory grounded constructs and objective measures of PA (Fortier, Kowal, Lemyre, & Orpana, 2009).

Study 2 revealed that important other autonomy support was only positively associated with relatedness need satisfaction, whereas HFA autonomy support was associated with autonomy, competence and relatedness need satisfaction. The cause of this differential pattern is not known. However, it is plausible that the training received by the HFAs has taught them to provide a broader and better quality of support. In contrast, it is highly likely that the important others referred to in Study 2 have not received any training in how to support an individual attempting to change their PA behaviour. Therefore, future research could attempt to provide training for important others to become more autonomy supportive and compare the relationships between autonomy support and need satisfaction with important others who do not receive training.

The sample sizes that were evident in Studies 1 and 2 were smaller than desired and constrained the available statistical options. A larger sample size for Study 1 would have supported multi-group testing to help establish any differential effects on motivational regulations as a function of who provides autonomy support. Further, if a greater number of participants had completed the measures at all three time points in Study 2, this would have permitted the inclusion of more parameters in my model. These additional parameters would have allowed a more detailed examination of the effects of basic needs on individual regulations rather than on the relative autonomy index. In addition, Studies 1 and 2 recruited participants who attended the exercise referral programme but did not recruit individuals who received a referral but subsequently failed to attend. Gathering data from individuals who do not attend their exercise prescriptions remains an important challenge to the researchers and

practitioners in the health psychology domain. Further, the samples reflected in this thesis are not a full representation of the general public which limits the generalisability of any conclusions drawn. For example, although Studies 1 and 2 involved participants that were representative of those who typically enter exercise referral schemes (i.e., white middle aged overweight women), this particular cohort is not representative of the general public. Therefore, further research that includes larger samples of males, different age groups and ethnic groups is necessary before my conclusions stemming from this thesis can be generalised to the general public.

Study 2 moved away from the dominant cross-sectional design and employed a longitudinal design, yet the limited sample size prevented an examination of change in the targeted variables. In order to test whether social-environmental factors, such as autonomy support, facilitate the internalisation process of participants attempting to change his/her PA behaviour (Deci et al., 1994), further research should examine the relationship between change in these motivational constructs. Is need satisfaction related to change in motivational regulations, and subsequently, does change in motivational regulations predict changes in indicators of mental well-being over time?

Although Studies 1 and 2 provide a unique insight into the different relationships between autonomy support provided by different important others and motivational regulations, this research was preliminary and cross-sectional. Therefore, further research is necessary to corroborate whether the individual providing autonomy support (i.e., partner or GP) differentially influences the relationships between mental health outcomes and motivational processes. For example, future research could ask participants to select two individuals who are important in their attempt to change their PA behaviour and to rate their

perceptions of autonomy support over the course of a PA promotion programme and at follow-up to allow normative comparisons. Such research attempts could also clarify when and which important other's autonomy support has the greatest positive relationship with mental well-being and PA intentions.

Research presented in this thesis has predominantly focussed on the consequences of positive socio-environmental factors for motivation and psychological well-being. However, a recent body of research has highlighted the potential negative relationship that controlling aspects of the environment have with motivational processes and associated outcomes (Bartholomew et al., 2011). Therefore, although I have examined the role of autonomy supportive factors surrounding an individual when attempting to change his/her PA behaviour, I have not fully examined the consequences when such environments are marked by characteristics that thwart the basic psychological needs (Ryan & Deci, 2000b). Future research that measures controlling aspects of the environment would provide a more complete examination and give further detail pertaining to the consequences of this social-environmental factor for need satisfaction/need thwarting, motivational regulations and psychological well-being and ill-being.

Further support for research into controlling behaviours within exercise consultations was highlighted in Study 3. Study 3 revealed that need supportive interactions between HFAs and their clients can be operationalised and measured. Observational data can supplement self-reported measures of the environment and allows fidelity data to be collected. Although, good levels of inter-rater reliability were established for autonomy support, involvement and structure, low levels of inter-rater reliability were observed for the dimension of controlling behaviours. Further research into what constitutes controlling behaviours in one-to-one PA

consultations is needed. Such research attempts may be supported by asking participants to consider describing more controlling behaviours of influential individuals that may undermine participant's efforts to be physically active.

Although overall this thesis provides support for SDT and its propositions in an exercise context, some non-expected findings were revealed. For example, in Study 2, I found that feelings of competence need satisfaction at the end of an exercise referral programme were not related to one's motivational regulations. A variety of explanations were explored to explain this non-significant relationship, however, further research is necessary to corroborate these speculations. Currently, the literature provides a confused picture regarding the implications of competence need satisfaction for behavioural regulations in different health contexts. For example, Williams and colleagues (2006b) and Markland and Tobin (2010) demonstrated a significant positive relationship between perceived competence and motivational regulations towards quitting smoking and participating in exercise respectively. In contrast, the present thesis replicated research conducted by Cox et al., (2008) and Fortier and colleagues (2007) who showed no significant relationships between competence need satisfaction and motivational regulations. Therefore, this conflicting evidence warrants further investigations that examine the relationship between competence and motivational regulations in participants of different ages, with different levels of initial PA participation, and across different health behaviours. For example, future research could investigate whether the relationship between competence need satisfaction and motivational regulations varies as a function of PA participation levels. Do individuals with no PA experience, experience the same levels of competence need satisfaction as those with significant PA experience to support the internalisation of motivational regulations? SDT (Deci & Ryan, 2000) clearly states that for vitality, integration and health, the environment should satisfy all three needs,

‘psychological health requires satisfaction of all three needs; one or two are not enough’ (p.229). However, it is plausible, and Vallerand (1997) argues, that the salience of each need may vary according to the nature of the task, the conditions surrounding the activity and the individuals’ needs.

Research that employs observational instruments, such as the measure developed in Study 3, could help clarify the current ambiguities within the SDT literature. Study 3 developed and established initial support for the inter-rater reliability and concurrent validity of an observational instrument that provides an alternative and supplementary method of examining social-environmental support afforded by exercise professionals. Data collected with the NSEI-OP could facilitate more rigorous assessments of SDT propositions. For example, future research employing the NSEI-OP may shed further light on the relationship between need supportive environments, competence need satisfaction and motivational regulations.

It appears that the consequences of manipulating the social environment as proposed by SDT are manifold. Future PA interventions may benefit from implementing designs that attempt to support the internalisation process when one sets out on their quest to PA behaviour change. This may be achieved by training PA advisors in how to increase autonomy support, involvement and structure (e.g., acknowledge negative affective states that the client has experienced/may experience regarding physical activity by summarising and/or parroting any affective states expressed by the client). Indeed Fortier et al., (2007) call for further research that investigate both the amount and quality of autonomy support, to come to a better understanding of the underpinnings of the changes in key self-determination variables and their relationships with PA. Therefore, it would appear that future SDT-based PA

interventions would benefit from a more detailed and objective examination of the environment afforded by exercise professionals. Specifically, a measure that provides an understanding of how the environment supports autonomy but also supports the needs for relatedness and competence would help elucidate and clarify the relationships that exist between SDT based constructs and PA.

Data collected from Study 3 (Chapter 4) also indicates that specific behaviours that are need supportive may be more easily employed in interventions than others. For example, Study 3 indicated that teaching HFAs how to provide structure (e.g., the setting, with clients, of realistic and optimally challenging goals) is more easily achieved than teaching HFAs how to be autonomy supportive (e.g., understanding the clients' perspective). In addition, at no point has the cost-effectiveness of PA interventions been more important, and as a consequence, duration and/or amount of time that an intervention takes have become critical factors. Therefore, once validated future research that employs the NSEI-OP could provide data that focuses on whether specific need supportive behaviours are more effective at supporting the internalisation process than others. Identifying especially effective need supportive behaviours for the internalisation process would help establish an optimal intervention that balances cost-effectiveness with the achievement of selected outcomes. Previous research conducted by Michie, Abraham, Whittington, McAteer, and Gupta (2009) highlighted that it is not necessarily the number of techniques that determine intervention effectiveness. In a systematic review of behaviour change techniques that promote PA and healthy eating, Michie and colleagues noted that a large number of techniques can lead to a loss in intervention quality and fidelity, in contrast, the quality of intervention content was associated with effectiveness. Specifically, Michie et al., indicate that their review strongly suggests that self-regulation techniques (i.e., intention formations, feedback on performance,

specific goal setting with reviews and self-monitoring) enhance the effectiveness of PA interventions. A recent meta-analysis of autonomy support interventions revealed that the use of non-controlling language maybe a particularly effective at supporting autonomy (Su & Reeve, 2011). However, Su and Reeve (2011) concluded that future research is necessary to establish the optimal elements of autonomy supportive interventions and, that the use of objective raters to assess interventions is warranted. Therefore, data gathered from the NSEI-OP could help establish which need supportive behaviours or techniques are particularly effective at facilitating the internationalisation process and support feelings of well-being. However, before such research can be systematically conducted further research is necessary to fully establish the NSEI-OP as a reliable and valid tool. Future research that attempts to further validate the NSEI-OP could employ a larger number of observations using new and multiple raters in different PA contexts (e.g., private health centres, hospital rehabilitation gyms).

Future research that examines the role of multiple acts of self-control on the ability to stick to focal goals, such as changing PA behaviour and resisting temptations (see Study 4), would benefit from recruiting participants who already place value on the manipulated goal. For example, recruiting participants from a weight loss programme and using weight loss as the long term goal and unhealthy food as a temptation could provide a more suitable research scenario. Study 4 (Chapter 5) employed a novel experimental design that examined the relationship between acts of self-control on the ability to employ counteractive control strategies, stick to a focal goal and avoid temptations. In addition, this study examined whether motivation towards a cognitively depleting task has consequences for, first, one's ability to employ counteractive control strategies in the face of ego depletion, and second, feelings of subjective vitality. Although results demonstrated that personal motivation did

have consequences for participant's perceptions of vitality, I did not reveal, as predicted, that an act of self-control reduces one's ability to employ counteractive control strategies. A variety of possible explanations were discussed in Study 4 to explain this later finding but in order to qualify this speculation, further research is necessary. For example, although I believed that information pertaining to optimal levels of PA for cognitive functioning would be valuable to my student sample, future research could employ scenarios that adopt participants that already possess a particular long term goal (e.g. participants entering a gym or attending a weight management programme) to ensure an optimal balance between the focal goal and temptation is achieved. Such research would help establish whether the present non-significant findings were a consequence of an imbalance, in terms of perceived attraction, between the goal and temptation or is in fact a true null finding.

Conclusions

Previous research has clearly established the positive outcomes that can be accrued from regular participation in PA. However, grounded in SDT, the work embedded in this thesis highlights that the reasons why one participates in PA has significant consequences for psychological health. Employing a variety of research designs this thesis has shown that social-contextual environments play a prominent role in developing more autonomous reasons towards changing PA behaviour whilst also supporting participants' mental well-being. Therefore, service providers like local councils that develop and employ PA interventions such as exercise referral programmes, would benefit from including psychological techniques during one-to-one interactions that support the internalisation of motivational regulations.

APPENDICES

Appendix A. Important other care climate questionnaire (IOCQ; Williams, Lynch, McGregor, Sharp, Deci, and Ryan, 2006)

Your important other and your effort to be more active.

Who (partner, best friend, GP etc.) is the most important person (most important people) in your effort to becoming healthier through regular physically activity?

My important other(s) is/are.....

	Strongly disagree							Strongly agree
	1	2	3	4	5	6	7	
I feel that my important other(s) has/ have provided me with choices and options about my physical activity and health.	1	2	3	4	5	6	7	
I feel my important other(s) understand(s) how I see things with respect to my physical activity and health.	1	2	3	4	5	6	7	
My important other(s) convey(s) confidence in my ability to make changes regarding my physical activity and health.	1	2	3	4	5	6	7	
My important other(s) listens to how I would like to do things regarding my physical activity and health.	1	2	3	4	5	6	7	
My important other(s) encourage me to ask questions about my physical activity to improve my health.	1	2	3	4	5	6	7	
My important other(s) try to understand how I see my health-related physical activity before suggesting changes.	1	2	3	4	5	6	7	

Appendix B. Behavioural regulations in exercise questionnaire-2 (BREQ-2; Markland & Tobin, 2004)

Your reasons for engaging in physical activity

We are interested in the reasons underlying people’s decisions to engage or not engage in current physical activity/exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Circle only one (1) number for each item.

		Not at all true		Somewhat true		Very true
1	I engage in physical activity because other people say I should	0	1	2	3	4
2	I feel guilty when I don’t exercise	0	1	2	3	4
3	I value the benefits of physical activity	0	1	2	3	4
4	I engage in physical activity because it’s fun	0	1	2	3	4
5	I don’t see why I should have to be physically active	0	1	2	3	4
6	I take part in physical activity because my friends/family/partner say I should	0	1	2	3	4
7	I feel ashamed when I miss an exercise session/chance to be physically active	0	1	2	3	4
8	It’s important for me to regularly participate in physical activity	0	1	2	3	4
9	I can’t see why I should bother being physically active	0	1	2	3	4
10	I enjoy my exercise sessions/participation in physical activity	0	1	2	3	4

		Not at all true		Somewhat true		Very true
12	I don't see the point in being physically active	0	1	2	3	4
13	I feel like a failure when I haven't been physically active in a while	0	1	2	3	4
14	I think it is important to make the effort to regularly participate in physical activity	0	1	2	3	4
15	I find physical activity pleasurable	0	1	2	3	4
16	I feel under pressure from my friends/family to participate in physical activity	0	1	2	3	4
17	I get restless if I don't regularly participate in physical activity	0	1	2	3	4
18	I get pleasure and satisfaction from participating in physical activity	0	1	2	3	4
19	I think engaging in physical activity is a waste of time	0	1	2	3	4

Appendix C. Subjective vitality scale (SVS; Ryan & Frederick, 1997).

Your feelings of energy?

Directions: Please respond to each of the following statements by indicating the degree to which the statement is true for you in general **over the last week.**

In general, over the last week...	Not at all True		Somewhat True			Very True	
1. I feel alive and full of vitality.	1	2	3	4	5	6	7
3. I have energy and spirit.	1	2	3	4	5	6	7
4. I look forward to each day.	1	2	3	4	5	6	7
5. I nearly always feel alert and awake	1	2	3	4	5	6	7
6. I feel I have a lot of energy.	1	2	3	4	5	6	7

Appendix D. Hospital anxiety and depression scale (HADS; Zigmond & Snaith, 1983).



Appendix E. Physical activity intentions (adapted from Hagger, Chatzisarantis, & Biddle, 2001).

Your physical activity intentions

Please read the statement below and circle any number between 1 and 7 to show how much it describes your feelings about your intended engagement in regular physical activity.

Regarding my engagement in physical activities...	Strongly disagree Strongly agree						
I intend to regularly engage in physical activity (i.e., at least 5 days per week for a total of 30 minutes each day) during the next 3 months	1	2	3	4	5	6	7
I expect to regularly engage in physical activity (i.e., at least 5 days per week for a total of 30 minutes each day) during the next 3 months	1	2	3	4	5	6	7
I plan to regularly engage in physical activity (i.e., at least 5 days per week for a total of 30 minutes each day) during the next 3 months	1	2	3	4	5	6	7

Appendix F. Health care climate questionnaire (HCCQ; Williams, Grow, Freedman, Deci, & Ryan, 1996).

Your views regarding your health and fitness advisor Health care professionals have different styles in dealing with clients. We would like to know about your experience with your health and fitness advisor so far. Your responses will be kept confidential, so your health and fitness advisor will not know about your responses. Please respond to each of the following items with respect to your advisor.

	Not at all true							Somewhat true							Very true						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
I feel that my health and fitness advisor has provided me with choices and options about how I can regularly engage in physical activity	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
I feel my health and fitness advisor understands how I see things with respect to my participation in physical activity	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My health and fitness advisor conveys confidence in my ability to make changes regarding my participation in physical activity	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My health and fitness advisor listens to how I would like to do things regarding my participation in physical activity.	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My health and fitness advisor encourages me to ask questions about my participation in physical activity.	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My health and fitness advisor tries to understand how I see my participation in physical activity before suggesting any changes.	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My advisor gave me good advice	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My advisor gave me clear and understandable instructions	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My advisor made clear what to expect	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
My advisor helped me feel confident	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Appendix G. Psychological need satisfaction in exercise (PNSE; Wilson, Rodgers, Rodgers, & Wild, 2006)

The following statements represent different experiences people have when they exercise or engage in physical activity. Please answer the following questions by considering how YOU TYPICALLY feel while you are exercising/engaging in physical activity.

	False	Mostly False	More false than true	More true than false	Mostly True	True
1. I feel that I am able to participate in physical activities that are personally challenging	1	2	3	4	5	6
2. I feel attached to those who participate in physical activities with me because they accept me for who I am	1	2	3	4	5	6
3. I feel like I share a common bond with people who are important to me when we participate in physical activities	1	2	3	4	5	6
4. I feel confident I can do even the most challenging exercises/ physical activities	1	2	3	4	5	6
5. I feel a sense of camaraderie with those people I am active with because we engage in physical activity for the same reasons	1	2	3	4	5	6
6. I feel confident in my ability to perform exercises/physical activities that personally challenge me	1	2	3	4	5	6
7. I feel close to those I am physically active with as they appreciate how difficult regular engagement in physical activity can be	1	2	3	4	5	6
8. I feel free to be physically active in my own way	1	2	3	4	5	6
9. I feel free to make my own decisions regarding my participation in physical activity	1	2	3	4	5	6
10. I feel capable of doing physical activities that are challenging to me	1	2	3	4	5	6
11. I feel like I am in charge of my exercise program decisions	1	2	3	4	5	6
12. I feel like I am capable of doing even the most challenging physical activities	1	2	3	4	5	6
13. I feel like I have a say in choosing the exercises/physical activities that I do	1	2	3	4	5	6
14. I feel connected to the people who I interact with while we participate in physical activity together	1	2	3	4	5	6
15. I feel good about the way I am able to complete challenging exercises/physical activities	1	2	3	4	5	6
16. I feel like I get along well with other people who I interact with while we are physically active together	1	2	3	4	5	6

Continued...	False	Mostly False	More false than true	More true than false	Mostly True	True
17. I feel free to choose which exercises/physical activities I participate in	1	2	3	4	5	6
18. I feel like I am the one who decides what exercises I do	1	2	3	4	5	6

Appendix H. The need support in exercise interactions-observation protocol

Subject	Description	Notes/Evidence	Rating							
Autonomy Support			N/A	Not at all True			Very True			
Acknowledging Feelings	The HFA acknowledged negative affective states that the client has experienced/may experience regarding physical activity.			1	2	3	4	5	6	7
Acknowledging Feelings (2)	The HFA acknowledged any positive affect that the client has experienced/may experience regarding physical activity.			1	2	3	4	5	6	7
Providing Rationale	A meaningful rationale was provided for setting goals in a physical activity program.			1	2	3	4	5	6	7
Encouraging Self-initiative	The HFA encouraged the client to put forward solutions to barriers.			1	2	3	4	5	6	7

Effective Non-verbal Skills	The HFA listened carefully to how the client wanted to do things.			1	2	3	4	5	6	7
Providing Choice	The client was provided with choice over the types, pace and frequency of the physical activity program where possible.			1	2	3	4	5	6	7
Taking Perspective	The HFA really understood how the client felt before making any suggestions (e.g. appreciated his /her personal barriers and his /her past experiences with physical activity).			1	2	3	4	5	6	7
Enhancing Self-worth	The HFA enhanced the client's sense of importance.			1	2	3	4	5	6	7

Subject	Description	Notes/Mark/Evidence	Rating						
Involvement		N/A	Not at all True			Very True			
Demonstrating Affection	The HFA demonstrated dedication to and care for the client.		1	2	3	4	5	6	7
Accepting all Behaviours and Beliefs			1	2	3	4	5	6	7
Structure									
Non-controlling Reinforcement	The HFA gave positive informational feedback to the client for effort, improvement and task mastery.		1	2	3	4	5	6	7
Encouraging Questions	The HFA encouraged the client to ask questions and answered any posed, fully and carefully.		1	2	3	4	5	6	7

Appropriate Goal Setting	The HFA helped the client to identify and formulate realistically achievable goals.			1	2	3	4	5	6	7
Informative	The HFA made sure the client understood the risks of an inactive lifestyle.			1	2	3	4	5	6	7
Informative (2)	The HFA clarified the benefits of an active lifestyle.			1	2	3	4	5	6	7

Subject	Description	Notes/Mark/Evidence	Rating							
Controlling			N/A	Not at all True			Very True			
Over Authoritative	The HFA sought to dominate the consultation talking and monopolizing the interaction.			1	2	3	4	5	6	7
Enforcing Compliance	The HFA pressured the client to adhere to the physical activity program.			1	2	3	4	5	6	7
Forcing Change	The HFA sought to change the client's attitudes, values and perceptions without rationale or discussion.			1	2	3	4	5	6	7
Controlling Language	The HFA used controlling language with the client (e.g. "should, have to, must and ought to").			1	2	3	4	5	6	7

Using Deadlines	The HFA established deadlines without consulting the client.			1	2	3	4	5	6	7
Highlighting External Benefits	Rewards (e.g. passes) and/or extrinsic benefits were offered to initiate exercise behaviour.			1	2	3	4	5	6	7
Using Conditional Acceptance	Praise and positive non-verbal language was used when the HFA heard what he/she wanted to hear.			1	2	3	4	5	6	7
Encouraging Specific Beliefs and Behaviours	The client was told how they should think, feel and act.			1	2	3	4	5	6	7

Appendix I. Brief mood introspection scale (Mayer & Gaschke, 1988).

INSTRUCTIONS: Circle the response on the scale below that indicates how well each adjective or phrase describes your present mood.

(Definitely do not feel) (Do not feel) (Slightly feel) (Definitely feel)

	1	2	3	4
Lively	1	2	3	4
Happy	1	2	3	4
Sad	1	2	3	4
Tired	1	2	3	4
Caring	1	2	3	4
Content	1	2	3	4
Gloomy	1	2	3	4
Jittery	1	2	3	4
Drowsy	1	2	3	4
Grouchy	1	2	3	4
Peppy	1	2	3	4
Nervous	1	2	3	4
Calm	1	2	3	4
Loving	1	2	3	4
Fed up	1	2	3	4
Active	1	2	3	4

Appendix J. A measure of counteractive evaluations (adapted from Trope & Fishbach, 2000)

Please indicate on the scale below (1-7) your response to each of the seven items.

	Not at all Very much						
How useful will the results of the physical activity test be to you?	1	2	3	4	5	6	7
How useful will the results of the resting trial be to you?	1	2	3	4	5	6	7
How important is taking the physical activity trial to you?	1	2	3	4	5	6	7
How important is taking the resting trial to you?	1	2	3	4	5	6	7
How important is it for you to know how your cognitive functioning is affected by increasing levels of physical activity?	1	2	3	4	5	6	7
How important is it for you to know how your cognitive functioning is affected resting?	1	2	3	4	5	6	7
How important is participating in scientific research?	1	2	3	4	5	6	7

Appendix K. A measure of participants' perception of ego depletion (adapted from Muraven, Rosman, & Gagne, 2007).

How much effort was required to comply with the cognitive task instructions?

No effort was required	1	2	3	4	5	6	7	Maximum effort was required
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How tiring did you find complying with the cognitive task instructions?

Not Very Tiring	1	2	3	4	5	6	7	Very Tiring
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Appendix L. A measure of participants' perceptions of the situational motivational climate.

Please respond to the items below about how you were made to feel by the information you have received regarding the cognitive task.

	Strongly Disagree					Strongly Agree	
	1	2	3	4	5	6	7
My feelings about the cognitive task were considered.	1	2	3	4	5	6	7
My feelings about the cognitive task were ignored.	1	2	3	4	5	6	7
I felt like I could complete the cognitive task at my own pace.	1	2	3	4	5	6	7
I felt pressured to complete the task within a certain time.	1	2	3	4	5	6	7
The benefits of participating in the stroop task were clearly explained.	1	2	3	4	5	6	7
No rationale was provided for participating in the stroop task.	1	2	3	4	5	6	7

Appendix M. The situational motivation scale (SMS; Guay, Vallerand, & Blanchard, 2000)

Directions: Read each item carefully. Using the scale below, please circle the number that best describes the reason why you have just engaged in the cognitive activity. Answer each item according to the following scale:

1: *corresponds not at all*; 2: *corresponds a very little*; 3: *corresponds a little*;
 4: *corresponds moderately*; 5: *corresponds enough*; 6: *corresponds a lot*;
 7: *corresponds exactly*.

Why have you just engaged in the cognitive activity?	Corresponds						
	Not at all						
							Corresponds Exactly
1. Because I think that this activity was interesting	1	2	3	4	5	6	7
2. Because I was doing it for my own good	1	2	3	4	5	6	7
3. Because I was supposed to do it	1	2	3	4	5	6	7
4. There may have been good reasons to do this activity, but personally I couldn't see any	1	2	3	4	5	6	7
5. Because I think that this activity was pleasant	1	2	3	4	5	6	7
6. Because I think that this activity was good for me	1	2	3	4	5	6	7
7. Because it was something that I had to do	1	2	3	4	5	6	7
8. I did this activity but I am not sure if it was worth it	1	2	3	4	5	6	7
9. Because this activity was fun	1	2	3	4	5	6	7
10. By personal decision	1	2	3	4	5	6	7
11. Because I didn't have any choice	1	2	3	4	5	6	7
12. I don't know; I don't see what this activity brought me	1	2	3	4	5	6	7
13. Because I felt good when doing this activity	1	2	3	4	5	6	7
14. Because I believed that this activity was important for me	1	2	3	4	5	6	7
15. Because I felt that I had to do it	1	2	3	4	5	6	7

16. I did this activity, but I am not sure it was a good thing to pursue it	1	2	3	4	5	6	7
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Appendix N. A measure of participants' behavioural intentions to participate in the physically active or resting trial.

Please circle whether you would like to participate in the trial that indicates optimal levels of physical activity for cognitive functioning (at a moderate intensity i.e. a brisk walk) or the control trial today:

Physically Active Trial

Control Trial

Please indicate on the scale below how strong your preference was for completing this specific trial today.

I much preferred to complete the <u>Physically Active</u> trial today	-3 -2 -1 0 1 2 3	I much preferred to complete the <u>Control Trial</u> today
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Please indicate below the reason for why you chose to conduct this trial today?

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