SOCIAL CONTEXTUAL AND ENVIRONMENTAL DETERMINANTS OF PHYSICAL ACTIVITY ADOPTION, ADHERENCE AND WELL-BEING

By

FLORENCE-EMILIE KINNAFICK

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ABSTRACT

Over two thirds of the UK population do not meet physical activity (PA) recommendations set by the Department of Health (2011) to improve or maintain health. It is therefore essential to focus research on effective and efficient methods to promote autonomous reasons to engage and persist in PA. Employing a variety of research designs this thesis explores the social contextual and environmental determinants, predominantly from a Self-Determination Theory perspective, of PA adoption, persistence and psychological well-being (Study 1; qualitatively). Study 2 and 3 examined unique sources of support from within and beyond a PA programme including human and non-human sources (i.e., technology). Study 3 employed an intervention focusing on the effect of autonomy supportive text messages on PA behaviour and well-being. Deriving from findings of Study 1, the final study (4) investigated the effect of the physical environment and PA levels on affective states. Results highlight the importance and relevance of socio-contextual (considering each unique contribution of individual sources of support) and environmental determinants (moderate intensity PA within a natural outdoor environment being key for positive high activation) in the promotion of PA. Findings carry important practical implications for those involved in promotion of long-term PA behaviour.

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I would like to dedicate this thesis to my grandmother Madame Solange Laugier.

Ma Mamie qui, à 93 ans, fait toujours preuve d'une force de caractère exemplaire.

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PAPERS AND CONFERENCES

During the course of my postgraduate study within the School of Sport and Exercise Sciences, University of Birmingham, the following articles and conference abstracts were accepted for publication and/or presentation at conferences. Where listed, the secondary authors also advised on study design, data analysis and paper editing.

Publications

Thøgersen-Ntoumani, C, Loughren EA., Duda J., Fox K., **Kinnafick FE**. (2010) "Step by Step". A feasibility study of a lunchtime walking intervention designed to increase walking, improve mental well-being and work performance in sedentary employees: *BMC Public Health*, 10:578

Pulsford R., Cortina-Borja M., Rich C., **Kinnafick FE.,** Dezateux C., Griffiths, L. (2011). Actigraph Accelerometer-Defined Boundaries for Sedentary Behaviour and Physical Activity Intensities in 7 Year Old Children. *PLoS ONE*. 6.8

Revisions

Kinnafick FE., Taylor, I., Thogersen-Ntoumani, C., Duda, J. Motivational processes in sedentary adults participating in a lunch-time walking intervention: A Self-Determination Perspective. *Psychology of Sport & Exercise*

Kinnafick, FE., Thøgersen-Ntoumani, C., Duda, J. Exploring the motivational processes involved in the transition from physical activity adoption to adherence: A qualitative approach grounded in Self-Determination Theory. *Qualitative Research and Health*

Under Review

Kinnafick, FE., Thøgersen-Ntoumani, C., The Effect of Autonomy Supportive Text Messages on Motivation, Psychological Well-Being and Physical Activity Behaviour. *Psychology and Health*

Kinnafick, FE., Thøgersen-Ntoumani, C., The Effect of the Physical Environment and Levels of Activity on Affective States and the Role of Naturally Occurring Mindfulness. *Journal of Environmental Psychology*

Sánchez-Oliva. D., Sánchez-Miguel, PA., Leo, FM., **Kinnafick, FE.,** García-Calvo, T. Physical Education Lessons and Physical Activity Intentions within Spanish Secondary Schools: A Self-Determination Perspective. *British Journal of Education Psychology*

Conference Presentations

ECSS: European Congress for Sport Science. Barcelona June 2013 (Oral)

F.E. Kinnafick, SO Shepherd, OJ Wilson, CS Shaw, AJM Wagenmakers, C. Thogersen-Ntoumani. High Intensity Interval and Traditional Endurance Training Lead to Comparable Improvements in Motivation and Well-Being Outcomes

YIA winner (equal 5th) ECSS: Barcelona June 2013

EHPS: Conference of the European Health Psychology Society. Prague August 2012

F.E. Kinnafick, C. Thogersen-Ntoumani, J. Duda. Motivational processes in sedentary adults participating in a lunch-time walking intervention: A Self-Determination Perspective.

FEPSAC: European Congress of Sport Psychology. Madeira July 2011 (Oral)

Symposium: Physical Activity Interventions in the Workplace: Implementation, Evaluation and Challenges.

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BPS (DSEP): Divisions of Sport and Exercise Psychology. December London 2010

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PAPAL: Psychological Aspects of Physical Activity throughout the Lifespan: University of Birmingham May 2012 (Oral)

Kinnafick FE., Thogersen-Ntoumani, C., Duda JL., Motivational Processes in Sedentary Adults Participating in a Lunch-Time Walking Intervention: A Self-Determination Perspective.

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CHAPTER 1

GENERAL INTRODUCTION

Introduction

Physical inactivity is one of four risk factors (along with poor nutrition, alcohol and tobacco use) that contribute to nearly three quarters of chronic non-communicable disease (Cooper, Boyko, & Cooper, 2011). Lee (2012) and colleagues quantified the negative effects of physical inactivity, showing that it causes 9% of premature mortality, or, more than 5.3 of the 57 million deaths that occurred worldwide in 2008 (World Health Organisation, 2012). These risk factors can be modified via changes in lifestyle, and should be addressed in order to prevent non-communicable diseases and improve all round health. Physical activity is widely known to protect against such diseases and conditions (Lee et al., 2012) and sustained physical activity is necessary for the maintenance of health (Penn, Moffatt & White et al., 2008). Despite this knowledge, a large proportion of Western populations fail to meet the recommended levels of physical activity to improve or maintain health. Over two thirds of the population in the UK, 60% of adult males and 75% of adult females, do not meet physical activity recommendations set by the Department of Health (2011). According to recommendations, an individual should accumulate 150 minutes (2.5 hours) of moderate intensity physical activity in bouts of 10 minutes or more per week (Department of Health, 2011).

Motivation and Behaviour Change

Motivation plays a central role within all spheres of life irrespective of individual's race, social economic status, political views or upbringing. Deci and Ryan, (2000) describe an individual to be motivated when they are moved to do something. An individual could be moved to do something out of necessity (i.e., eating) or out of choice (i.e., engaging in a pastime). These motivations will differ greatly from one individual to another but will also differ with context. Therefore, there is a need to understand "how" and "why" an individual is

motivated to engage in an activity within specific domains of life (e.g., physical activity). Motivation and processes of behaviour change are best understood within theoretical frameworks which can be employed to explain processes of change in many life contexts. Research grounded in theory has shown that the reasons why an individual participates in a behaviour are important for long-term optimal functioning, human growth and well-being (Ryan & Deci, 2000). It is relevant here to explain the key difference between a theory and a model. The US department of Health and Human Services (2005) explain that a theory serves as an explanation for a phenomenon through an integrated set of propositions (i.e., Theory of Planned Behaviour) whereas a model does not try to explain the processes underlying the behaviour but provides a tool for applying the theories (i.e., Health Belief Model). Although many theories and models have been proposed and tested to understand behaviour change in physical activity settings (e.g.; Transtheoretical Model of Change Prochaska & DiClemente, 1983; Theory of Planned Behaviour; Ajzen, 1985, 1987), Self-Determination Theory (SDT; Deci & Ryan, 1985; 2000), a macro theory of motivation, has gained increasing popularity for its relevance to understand and explain behavioural patterns in the physical activity domain (Ng et al., 2012; Hagger & Chatzisarantis, 2008).

Previous research grounded in SDT has advanced the development of interventions within an applied setting (Fortier, Duda, Guerin, & Teixeira, 2012) because the principles of SDT are concerned with the continuation of health behaviours (i.e., physical activity) and endorse autonomous reasons for engaging in the particular behaviour. In contrast, other proposed theories have focused on intentions to be physically active (Theory of Planned Behaviour; Ajzen, 1985, 1987). Given that intentions of exercise behaviour change have been shown to explain only 22% statistical variance of exercise behaviour (Armitage, 2005), the Theory of Planned Behaviour is limited when critically investigating long-term physical activity behaviour, The Transtheoretical Model of Change (Prochaska & DiClemente, 1983)

has also been proposed within this context. However, research has primarily concentrated on one aspect of the model, namely the Stages of Change. The stages of change explain where an individual is in terms of their behaviour change (i.e., pre-contemplation, contemplation, preparation, action, maintenance); it does not however explain how an individual can move from one stage to another. Endorsing autonomous reasons to persist with exercise is vital because an individual cannot be part of an intervention that promotes a behaviour indefinitely. Therefore, SDT is best placed to inform the promotion of physical activity on how to improve self-regulation of physical activity behaviour.

An Overview of Self-Determination Theory

Self-Determination Theory (SDT; Deci & Ryan, 1985; 2000) distinguishes itself from most other theories by suggesting that feelings of autonomy are critical to both behaviour change, and to the associated experiences of optimal functioning. Specifically, the theory suggests that all individuals possess three key psychological needs (autonomy, competence, relatedness) that must be satisfied to optimise motivation for behavioural adoption and maintenance in any particular domain. SDT theorists stipulate that the satisfaction of such needs is likely to lead to relatively self-determined types of motivation, which in turn will predict more adaptive behavioural and well-being outcomes across a variety of life domains (Ryan & Deci, 2000). Figure 1.1 represents the central tenets of Self-Determination Theory (Deci & Ryan, 2000).

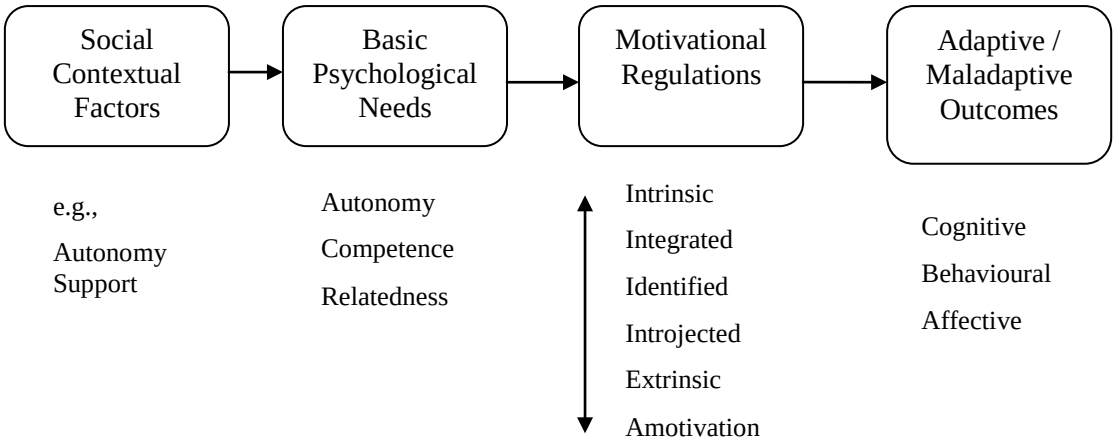


Figure 1.1. The central tenets of Self-Determination Theory (Deci & Ryan, 2000).

Five sub-theories exist within SDT: 1) Cognitive Evaluation Theory, 2) Organismic Integration Theory, 3) Basic Needs Theory, 4) Goal Content, and 5) Causality Orientation Cognitive Evaluation Theory (Deci & Ryan, 1985) hypothesises that an individual performing a behaviour for external rewards, such as for financial gain, will persist with the behaviour providing that the reward is present (Hagger & Chatzisarantis, 2008). If the reward is removed it is thought that the behaviour will cease to exist. Deci and Ryan, (1980) suggest that this will occur because the administration of the external reward reduces levels of intrinsic motivation because the individual receiving the reward experiences a shift in their perception of control over their behaviour. Little research has been carried out using Cognitive Evaluation Theory in the context of exercise for health. Hagger and Chatzisarantis, (2008) propose that this could be because exercise is unlikely to be performed solely for extrinsic rewards. Other forms of extrinsic or controlling motivation are more likely to be involved in the control of behaviour within a health-related exercise context (e.g., direction from a general practitioner).

Central to Self-Determination Theory is the distinction between autonomous forms of self-determined motivation and controlling or non-self-determined forms of motivation.

Autonomous motivation is associated with positive behavioural outcomes (i.e., persistence to exercise behaviour; Rodgers, Hall, Duncan, Pearson, & Milne, 2010; Vansteenkiste, Simons, Soenens, & Lens, 2004), positive cognitive outcomes (i.e., attitudes and intentions to exercise; Hagger & Chatzisarantis, 2008) and psychological well-being (Moustaka, Vlachopoulos, Kabitsis, & Theodorakis, 2012). Organismic Integration Theory (Deci & Ryan, 1985; Ryan & Deci, 1991) extends the aforementioned distinction (Cognitive Evaluation Theory) between intrinsic and extrinsic motivation and explains the processes by which an individual can regulate or internalise a behaviour, along a self determination continuum whereby behaviours initially adopted for non-self-determined reasons can be 'taken in' (i.e., internalised) and become increasingly guided by self-determination.

Organismic Integration Theory details a continuum of motivational regulations. The continuum contains three autonomous forms of motivation (intrinsic motivation, integrated and identified regulation), two controlled forms of motivation (external regulation and introjected regulation) and amotivation (Deci & Ryan, 1985). Amotivation represents the lack of either intrinsic or extrinsic motivation. An individual with amotivation will typically hold the belief that the activity will not result in desired outcomes (Markland & Tobin, 2004). External regulation is evident when an individual engages in a behaviour because of external pressures, for example to please significant others. An individual who has high levels of introjected regulation engages in a behaviour out of feelings of internal pressure; to avoid feelings of guilt or to boost his/her ego. Identified regulation, considered an autonomous form of extrinsic motivation, is evident when the individual recognises the benefits and value of the behaviour and is motivated by the pursuit of personally valued outcomes rather than for the behaviour itself. Integrated regulation is considered the most self-determined external regulation (Markland & Tobin, 2004). An individual who possesses high levels of integrated regulation will engage in a behaviour with a belief that it is part of their identity and the

behaviour is aligned with their own personal values (Deci & Ryan, 2002). The behaviour represents the person that the individual wants to be. Finally, intrinsic motivation is evident when an individual carries out the behaviour because of an experienced sense of enjoyment of and/or inherent interest in the activity. Through an internalisation process, and because of our tendency toward growth and well-being, individuals can move from less internalised non self-determined forms of motivation to more internalised self-determined types of motivation (Pelletier, Fortier, Vallerand, & Bri, 2002). This thesis employs the BREQ-2 (Behavioural Regulations to Exercise Questionnaire-2) to measure the quality of motivation, via the behavioural regulations, to assess the degree to which an individual's motives to exercise are more or less self-determined. Due to the conceptual similarities between integrated and intrinsic regulations, there have been problems regarding the development of psychometrically sound questionnaires to distinguish between the two regulations (Markland & Tobin, 2004). The BREQ-2 does not include the measurement of integrated regulation and therefore integrated exercise regulation will not be considered in this thesis.

Basic Psychological Needs Theory (BPNT; Ryan & Deci, 2000) describes the dynamic relationship between psychological needs, motivational regulations and health and well-being. This thesis will draw specific attention to BPNT (particularly in chapter 3) to further examine the psychological processes underpinning adherence to a physically active lifestyle. According to BPNT, humans possess three basic psychological needs; the innate needs for autonomy (the need for feelings of volition and free will, an experienced sense of personal control and acting with choice), competence (effectiveness in carrying out behaviours and handling situational demands) and relatedness (the need to interact, feel connected to, accepted by and experience caring for others; Deci & Ryan, 2000; Ryan & Deci, 2000). These needs are thought to be fundamental to all humans and it is proposed that satisfaction of these psychological needs support goal-directed behaviour (such as physical

activity) and can also directly enhance physical and psychological well-being (Deci & Ryan, 2000). However, when the three basic psychological needs are thwarted, via influences of the social environment, ill-being and maladaptive outcomes are most likely to follow (Ryan & Deci, 2000). According to Deci and Ryan, the three basic needs are complementary and optimal functioning and integrated behaviour will result only if all three of the psychological needs are supported (Deci & Ryan, 2000; Hagger & Chatzisarantis, 2008; Ng et al., 2012).

Fourth, goal contents have been explored from a SDT perspective (Teixeira, Carraca, Markland, Silva & Ryan, 2012). Goal contents are distinguished by the likelihood that the goal that pursued will satisfy the basic psychological needs. Specifically, this is differentiated by more intrinsic goals (e.g., personal growth, preserving health or seeking affiliation) that are associated with satisfaction of the psychological needs or goals that are more extrinsically orientated (e.g., social recognition, financial reward, improving appearance). Such extrinsic goals are thought to be linked to "substitute needs" (Teixeira et al., 2012) that are not truly essential to personal growth and well-being. Similarly to the motivational regulations being more or less autonomous, different goal or motives to exercise often co-exist within the same person, some are more intrinsic and some are more extrinsic (Teixeira et al., 2012). It is thought that certain types of motives can determine more or less desirable outcomes.

Finally, SDT also proposes that an individual will possess a causality orientation (Deci & Ryan, 1985).This explains the way that an individual will naturally orient towards their environments resulting in patterns in their motivation and behaviour. Specifically, individuals may be naturally more inclined to follow their internal indicators of preference whilst others may seek out external directives and norms. Others may also be generally amotivated and thus are more passive and unresponsive to either internal or external direction (Teixeira et al., 2012).Further to specifying the link between the regulations and behavioural, cognitive and affective outcomes, SDT also proposes the mechanisms by which different regulations can

manifest themselves in a particular context (Deci & Ryan, 1985; Ryan & Deci, 2000). SDT theorists propose that a central construct influencing the development and quality of motivation (intrinsic and identified regulations) is perceived autonomy support (Deci & Ryan, 1985). According to SDT, social and environmental contexts perceived to be autonomy supportive facilitate the development of intrinsic and identified regulations. Conversely, social and environmental contexts that are controlling undermine the development of autonomous regulations, hinder the satisfaction of the basic psychological needs and foster introjected or external regulations. (Deci & Ryan, 1985; Ryan & Deci, 2000).

Autonomy Support

Autonomy support (Deci & Ryan, 1985) refers to a positive environment where those in a position of authority (or significant other) provide choice, a meaningful rationale, unconditional regard, acknowledge the perspective of others and minimise pressure (Deci, Eghrari, Patrick, & Leone, 1994). The significant other or person in the position of authority would take the perspective of the recipient and limit negative feedback (Deci & Ryan, 2000).

It is clear from existing research that environmental antecedents, such as autonomy support are linked with autonomous motivational regulations (Moustaka et al., 2012; Rouse et al., 2011) and are conducive to positive behavioural outcomes (Edmunds, Ntoumanis, & Duda, 2008; Moustaka, et al., 2012; Ng et al., 2012; Rouse et al., 2011). Research within a variety of contexts, including physical activity adoption, has highlighted that when an autonomy supportive environment is created, the reasons for conducting a behaviour become more self-determined or autonomous (Moustaka et al., 2012) and thus facilitate behaviour change (Fortier, Duda, et al., 2012) by satisfying individuals' psychological needs (Edmunds, Ntoumanis, & Duda, 2008; Moustaka et al., 2012).

Thesis outline and aims

This thesis aims to contribute to the current theoretical understanding on the motivational determinants of physical activity adoption and adherence via four separate empirical studies. Particular emphasis has been placed on identifying the social contextual and environmental determinants involved in facilitating successful behaviour change in physical activity settings. A greater understanding would enable health promotion specialists and those who implement interventions to better support their clients/patients.

The specific aims of this thesis are:

1. To identify key motivational processes involved in the transition from a physically inactive to an active lifestyle, and the processes involved in lapse and drop-out behaviour in the context of a walking intervention.
2. To test the associations between unique sources of autonomy support (human and non-human), psychological need satisfaction, well-being and physical activity behaviour.
3. To investigate the effects of perceptions of autonomy supportive from a non-human source on (sustained) physical activity behaviour and psychological well-being.
4. To investigate the effect of the physical environment on affective states as a function on levels of activity (i.e., walking versus sitting) and the moderating role of naturally occurring mindfulness.

For a visual representation of the aims detailed above please refer to Figure 1.2

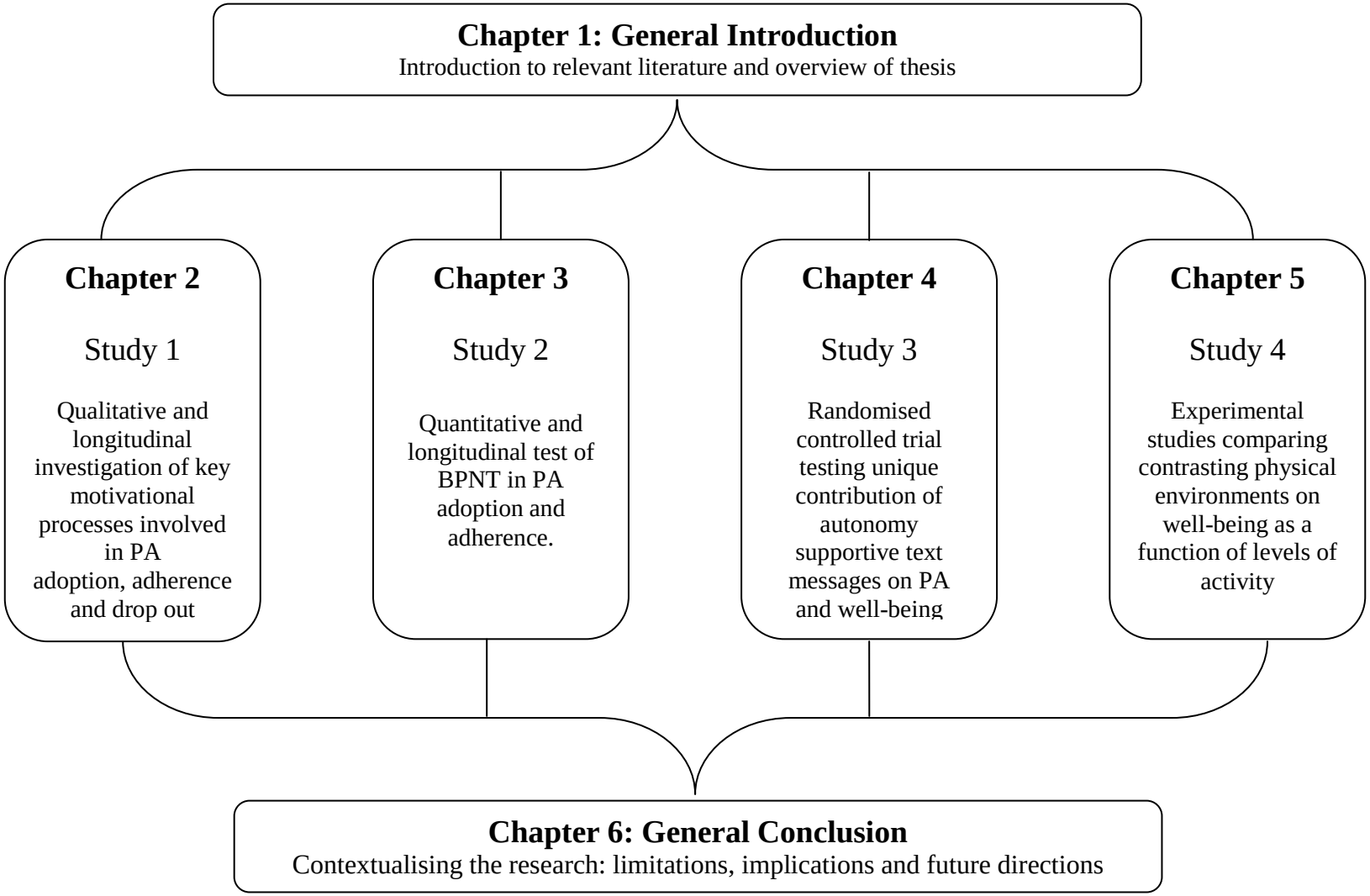


Figure 1.2: A visual representation of the current thesis including aims of each chapter
Note: PA = physical activity

This section will outline each empirical chapter within the current thesis.

Chapter 2: Study 1

Grounded in SDT, the first empirical chapter of this thesis, chapter 2, aimed to outline the content of the current thesis. Therefore, pertinent findings of study 1were investigated further in subsequent study chapters. This was done by qualitatively investigating the experiences of beginner exercisers participating in a lunchtime walking programme. Participants were interviewed on four separate occasions over a 10 month period. Research has primarily focused on participants who have adhered to intervention programmes (Rodgers, et al., 2010). Therefore participants who had lapsed and dropped out of the intervention were also included to identify key processes of motivation.

Moving beyond the cross-sectional designs more commonly found in literature (Edmunds et al., 2006; Hall, Rodgers, Wilson, & Norman, 2010), both chapter 2 and 3 employed a longitudinal design.

Chapter 3: Study 2

Chapter 3 quantitatively explored the key psychological processes involved in the transition from a physically inactive to an active lifestyle in beginner exercisers who took part in a 16 week lunchtime walking intervention. Chapters 3 and 4 aimed to extend the findings of Rouse et al. (2011) by highlighting the possibility of facilitating need satisfaction through autonomy support from unique elements within an exercise programme. From a Basic Psychological Needs Theory (Ryan & Deci, 2000) perspective in order to explain the dynamic process of how the socio-environmental context of an individual can facilitate need satisfaction and consequently adaptive outcomes, chapter 3 examined whether autonomy support provided by the walk leader and autonomy support provided via a non-human source (categorised as the

programme as a whole and included motivational texts messages, log books, emails, websites) could independently predict subjective vitality and self-reported physical activity.

Chapter 4: Study 3

Chapter 4 then furthered the investigation in study 2 by exploring whether an individual can indeed perceive autonomy support via a non-human, inanimate object. To investigate these effects a single element involved in the walking programme of Chapter 3: Study 2 (text messages) that had been of particular interest to the participants interviewed in Chapter 2: Study 1, was used as a tool to provide a source of autonomy support. Text messages have been used with some success in behaviour change interventions, often in conjunction with other behaviour change techniques (Cole-Lewis & Kershaw, 2010) and have been found to be a cost-effective, efficient addition to physical activity promotion. It was therefore deemed important to pin-point the effects of the text messages underpinned by SDT, which has not previously been investigated. This study examined the independent effects of autonomy supportive text messages on behaviour and well-being among a physically inactive population beginning a series of exercise classes (controlling for the effects of perceived autonomy support from an exercise class leader). Using a randomised controlled design, the overarching aim of this study was to investigate the effects of the autonomy supportive text messages, compared to neutral text messages in the promotion of physical activity behaviour and psychological well-being.

The long-term effects of social contextual and environmental factors on physical activity behaviour are somewhat unclear. Therefore, empirical chapter 2, 3 and 4 measured physical activity behaviour up to six months following the end of the intervention.

Chapter 5: Study 4

The final empirical chapter 5: Study 4 includes 2 experimental study arms. The physical walking environment emerged as a factor of enjoyment for the participants taking part in study 1. Given that perceived enjoyment and feelings of pleasure is associated with repeated behaviour (Williams et al., 2008), this was an area worthy of further investigation. The aim was to provide evidence on the effects of an urban and natural environment (both indoor and outdoor), when directly comparing a sedentary behaviour with a single bout of walking on affective states. The aim was also to explore the moderating role mindfulness plays in the relationship between the opposing environments, physical activity and affect. The first study investigated these effects in a controlled indoor, laboratory setting where participants watched the opposing environments on a screen. Study 2 replicated the first study to an outdoor setting where participants walked and sat immersed in a natural or urban environment. A within subject design was used for both studies enabling the comparison of differences within each condition in the same individual.

Chapter 6: General Discussion

Following the presentation of the 4 empirical studies (chapter 2, 3, 4, 5), a final chapter (6) will summarise the main research of the thesis, reflect on the limitations of the current work and suggest directions for future research. The findings from the series of studies may aid health professionals to further understand motivation in order to better facilitate successful behaviour change among their recipient/clients.

CHAPTER 2

Study 1:

MOTIVATIONAL PROCESSES INVOLVED IN THE TRANSITION FROM PHYSICAL ACTIVITY ADOPTION TO ADHERENCE OR LAPSE, AND DROP-OUT: A STUDY GROUNDED IN SELF-DETERMINATION THEORY

Abstract

Objective: Grounded in Self-Determination Theory, the aim of this empirical study was to explore and identify key motivational processes involved in the transition from a physically inactive to an active lifestyle, and processes involved in lapse and drop-out behaviour within a walking intervention.

Methods: A predominantly qualitative, longitudinal case study method was implemented, using semi structured interviews and theoretical thematic analyses. This was supported by a quantitative measure of Behavioural Regulations to Exercise Questionnaire. Fifteen women were interviewed over 10 months and three profiles were generated (Profile 1: Non adherence, 2: Lapse/reuptake of physical activity, 3: Adherence).

Findings: Internalisation of walking behaviour was key to adherence. Satisfaction of the needs for competence and relatedness were central for participation during exercise at the adoption stages and autonomy was particularly pertinent in facilitating adherence. Those who lapsed and restarted physical activity experienced feelings of autonomy at the point of reuptake. Sources of support were driving forces in the adoption and adherence phases.

Conclusion: Qualitatively exploring inactive women's experiences of physical activity within a walking programme enables the understanding of the motivational processes involved in lapse, drop-out and persistence to exercise,

Introduction

The benefits of a physically active lifestyle to improve and maintain health are well documented (Department of Health [DoH], 2011). Such benefits include reducing the risk of several lifestyle conditions such as cardiovascular disease, diabetes and cancers (Lee et al., 2012) as well as improving global self-esteem, mood and general psychological well-being (Johansson et al., 2011; Netz et al., 2005). Current recommendations suggest that an individual should engage in at least 150 minutes of moderate intensity physical activity in bouts of 10 minutes or more per week (DoH, 2011). Despite such guidelines, 60% of adult men and 72% of adult women in England do not undertake sufficient levels of physical activity to benefit health (DoH, 2011). Maintaining behaviour change regarding physical activity engagement is critical for health improvements to be realised (Penn et al., 2008). Physically inactive adults have the most to gain in terms of health from physical activity interventions but are generally more resistant to physical activity behaviour adoption and maintenance.

Walking appears to be promising in terms of facilitating adoption of an active lifestyle among physically inactive adults and is the most common type of moderate intensity physical activity (Lee & Buchner, 2008). This behaviour might be particularly suitable in public health interventions because of its widespread acceptability and accessibility (Lee & Buchner, 2008) and positive effects on mood and affect (Ekkekakis et al., 2011). Findings from recent walking interventions have supported the use of walking in facilitating behaviour change in physically inactive adults. Smith-Spangler et al. (2012) conducted a systematic review of 26 studies that successfully aimed to facilitate walking and thus achieved associated outcomes with the behaviour change that included improved and sustained psychological well-being.

Behaviour Change and Physical Activity

There is an increasing focus of research investigating the psychological processes involved in the adoption of physical activity and adherence in beginning to exercisers (exercise initiates) (Rodgers et al., 2010; Vandelanotte, Spathonis, Eakin, & Owen, 2007). This adds to the existing knowledge of the psychological processes involved in regular exercise (Thøgersen-Ntoumani & Ntoumanis, 2006; Vansteenkiste, Simons, Soenens, & Lens, 2004; Wilson, Mack, & Grattan, 2008). Relatively little research has investigated the processes involved in drop-out, and lapse behaviour, and has often focused on those who persist with exercise or those who complete interventions (Rodgers et al., 2010). It is equally important to examine processes related to drop out or lapses to get a true understanding of the behaviour change process (Prochaska & DiClemente, 1983; Rodgers et al., 2010). This importance is highlighted by statistics showing that an average of 50% drop out during physical activity interventions (Buckworth & Dishman, 2002). Here a lapse is defined as one period of time (specifically to this thesis, and participating individuals, the time period was between 1-3 months) when the participants did not exercise during the 10 months of the current study. To capture changing processes involved in adoption, adherence, lapse and drop-out behaviours, research requires the use of a longitudinal approach and the use of a predominantly qualitative methodology. However, there is a relative paucity of studies which have used such an approach (Fortier, Sweet, et al., 2012).

Self-Determination Theory and Physical Activity

Self-Determination Theory (SDT; Deci & Ryan, 1985; 2000), which is a macro theory of motivation, has gained increasing popularity for its relevance to understand behavioural patterns in the physical activity domain (Ng et al., 2012; Hagger & Chatzisarantis, 2008). As detailed in chapter 1 of this thesis (p 7-13) the theory distinguishes itself from most other

theories in suggesting that feelings of autonomy are critical to behaviour change and associated experiences of optimal functioning.

SDT theorists stipulate that the satisfaction of the three psychological needs is likely to lead to relatively self-determined types of motivation, which in turn will predict more adaptive behavioural and well-being outcomes across a variety of life domains (Ryan & Deci, 2000). Through an internalisation process, and because of our tendency toward growth and well-being, individuals can move from less internalised non self-determined forms of motivation to more internalised self-determined types of motivation (Pelletier et al., 2002).

Although needs are all posited to be essential in changing behaviour and facilitating healthy development and well-being, Deci and Ryan (1985, 2000) have argued that the extent to which each of the needs determine motivation might vary depending on the functional significance of the situation. In an exercise rehabilitation setting with overweight and obese middle aged women, using a cross-sectional study design, Markland and Tobin (2010) demonstrated that different combinations of need satisfaction mediated the relation between need support and specific behavioural regulations as identified by SDT. Markland and Tobin (2010) showed that whereas autonomy and social assimilation (a type of relatedness need satisfaction) are related to lower levels of external regulation, the satisfaction of autonomy, competence and personal relatedness was associated with higher levels of identified regulation. Satisfaction of autonomy and competence need satisfaction mediated the relation between need support and intrinsic motivation. Markland and Tobin (2010) also revealed that personal relatedness positively predicted introjected regulation when such feelings of relatedness were not accompanied by feelings of autonomy. A longitudinal perspective would have provided further insight into the changes that occurred throughout the intervention.

Using a longitudinal design with another sample of exercise rehabilitation patients, Rahman, Thøgersen-Ntoumani, Thatcher, and Doust (2011) demonstrated that changes in

relatedness satisfaction positively predicted changes in introjected regulation. Furthermore, Markland and Tobin (2010) found that social assimilation could partly counteract the negative prediction from personal relatedness to introjected regulation. Rahman et al. (2011) found that, whereas autonomy need satisfaction in particular appeared important throughout the behaviour change process, relatedness need satisfaction appeared to be most pertinent in the adoption stage. This finding is in line with Koestner and Losier's (2002) suggestion, and Deci and Ryan's (2000) theorising, that whereas autonomy is essential for full internalisation, relatedness is less relevant in the prediction of intrinsic motivation which in turn is more likely to develop in latter stages of the behaviour change process (Williams et al., 2006).

Changes to Behavioural Regulations to Exercise

Research investigating changes in behavioural regulations (Rodgers et al., 2010), which supported earlier work of Ingledew, Markland, and Sheppard (2004), suggested that a beginning exerciser can increase self-determined motivation over time, but that even over a 6 month period they did not reach similar levels as a regular exerciser. Furthermore, their behavioural regulations were vulnerable to change (Rodgers et al., 2010). Regular exercisers tended to reinforce self-determined regulations more strongly than controlled regulations (Rodgers et al., 2010; Thøgersen-Ntoumani & Ntoumanis, 2006). According to Rodgers et al. (2010) those new to exercise endorsed less self-determined regulations (i.e., extrinsic and introjected) to a higher degree than regular exercisers, and reinforced more self-determined regulations (identified and intrinsic) to a lesser degree than regular exercisers when including any lapses and drop-out phases. Changes to identified regulation and intrinsic motivation appear to occur within the first 8 weeks (Rodgers et al., 2010) but at 6 months there was still an amount or fluctuation and insufficiently developed self-determined motivation indicating that the participant is still at risk of drop out and lapse and relapses. As Markland and

Ingledew (2007) explain, it is possible for an individual to possess controlled forms of motivation as long as they also possess self-determined forms of motivation.

Rodgers et al. (2010) showed that in an exercise programme ranging from six weeks to six months, controlled forms of regulation did not change substantially whereas self-determined forms of regulation tended to increase. In addition, identified regulation appeared to increase at a faster rate than intrinsic motivation. Hall et al. (2010) found that patterns of motivation reported in the groups of regular exercisers, non-exercisers and non-exercisers who intended to exercise were not consistent within each group, suggesting that the forms of regulation might develop independently, and therefore might also be expected to influence behaviour independently among individuals with different behavioural experiences. Rodgers et al.'s (2010) findings supported the notion that regular exercisers have stronger self-determined regulations (Hagger & Chatzisarantis, 2008) and that it is critical for exercise initiates to develop self-determined forms of regulation to facilitate adherence to physical activity programmes. For example, in a chronically ill population, using resistance and aerobic exercises within a structured environment, Fortier, Sweet, et al. (2012) found that those who did progress through the 6 month intervention experienced increased levels of self-determined motivation, which is in support of previous longitudinal research (Pelletier et al., 2002; Rodgers et al., 2010). In contrast, those who did not progress experienced a decrease in self-determined motivation between 3 and 6 months.

To the knowledge of the author, research by Markland and Tobin (2010) and Rahman et al. (2011) are the only studies to date which have been used to examine how needs differentially relate to types of motivation and differential levels of adherence (in the case of Rahman et al., 2011) in physical activity settings. Furthermore, only one of these studies (Rahman et al., 2011) used a longitudinal design which allows for an examination of changes in need satisfaction in relation to physical activity behaviour. Fortier, Sweet, et al. (2012),

Hall et al. (2010), Markland and Ingledew, (2007), Rodgers et al. (2010) have investigated changes to behavioural regulations from a cross-sectional (Hall et al., 2010; Markland & Ingledew, 2007); Rodgers et al., 2010) and longitudinal (Fortier, Sweet, et al., 2012; Rodgers et al., 2010) perspective, considering issues related to adherence. Walking was not investigated in any of these studies, an activity which is particularly suited to exercise initiates (Lee & Buchner, 2008), nor has longitudinal research extended past 6 months when instability of behavioural regulations is still apparent (Rodgers et al., 2010). In addition, Fortier, Sweet, et al., (2012) who, via the BREQ-2; Markland & Tobin, 2004), grouped behavioural regulations into self-determined or non self-determined motivation suggested that future research should consider them separately. To address these limitations, a predominantly qualitative case study approach was used, with longitudinal design spanning 10 months. This was implemented to provide an in depth exploration of factors that contribute to the development of adherence related behaviours. In addition changes in behavioural regulations were measured separately (amotivation, external regulation, introjected regulation, identified regulation, intrinsic regulation).

Qualitative Research and Physical Activity Behaviour Change

It is suggested (Huberty et al., 2008) that qualitative research might lend itself particularly well for exploring change processes. Using a grounded theory approach, Huberty et al. (2008) found that enhanced feelings of self-worth, social support, and exercise enjoyment impacted on motivational processes underpinning exercise adherence in overweight women aged 26 – 66 years who had completed a structured exercise programme.

An article by Sabiston, McDonough, Sedgwick and Crocker (2009), involving sedentary women who had participated in a dragon boat physical activity intervention, offered some insight into changing self-perceptions as a result of engagement in an exercise programme.

Specifically, women who exhibited increased psychological need satisfaction and self-determined motivation revealed greater feelings of empowerment. Those who expressed a lack of psychological need support experienced feelings of self-disappointment and concerns with body weight. Similar to the findings of Huberty et al. (2008), Sabiston and colleagues (2009) indicated that women with high self-worth who realised higher levels of autonomy were more likely to continue with the activity. Whereas both studies contribute to the current literature, neither investigation involved the collection of data from participants during the intervention.

Aims

The study aimed to explore changes in participants' reported motivational processes from pre intervention to 6 months post intervention, including an examination of changes taking place during the course of a walking intervention. As a result, important detail could be gained on the processes relevant to those who lapse but reengage, those who drop out, as well as those who adhere. It should be noted that the sample was recruited prior to the intervention and therefore it was not known how many participants would adhere, drop out or lapse.

In view of the above and using SDT as a guiding framework, our overarching purpose of the present study was to explore physically inactive adults' experiences of participation in a lunchtime walking intervention with the view to informing and improving facilitation of long term physical activity behaviour within and following a walking intervention that lasted 16 weeks. Specifically, the aim was to identify key motivation related processes involved in a) the transition from a physically inactive to a physically active lifestyle, and b) lapse and drop-out behaviour.

Method

A mixed method approach was employed for this study. Predominantly qualitative, longitudinal case studies were developed spanning ten months (16 week walking intervention plus a 6 month follow up period) based on a series of semi-structured interviews with participants. Interviews and theoretical thematic analyses were supplemented with analyses of quantitative data taken from the Behavioural Regulations for Exercise Questionnaire (BREQ-2; Markland & Tobin, 2004), which were administered at baseline and at week 16 of the intervention. A 10 month time frame was selected to extend results of previous exercise trials (Fortier, Sweet, et al., 2012). Specifically, it has been indicated through prior studies that exercise initiates who engage in regular exercise at six months maintain increases in self-determined motivation, but at 6 months non self-determined motivation was still apparent. A period of ten months meant that changes over a longer period of time could be examined.

A multiple case study approach was used to guide the individual's account to identify shared patterns of meaning and explore variability between the different case studies (Yin, 2003). A case study design is appropriate when researchers seek to explore issues of 'how' and 'why'. Yin (2003) defines the case study method as an empirical inquiry that investigates a contemporary phenomenon within its real life context using multiple sources of evidence.

Participants

Following ethical approval, 15 women (BMI; M=27.48 kg/m^2, SD = 4.32)were recruited and interviewed from a workplace lunchtime walking intervention (10 weeks of group led walks followed by 6 weeks of independent walking) for physically inactive employees from a British University (for more information about the design of the walking intervention, see (Thøgersen-Ntoumani, Loughren, Duda, Fox, & Kinnafick, 2010) as part of this study. At the time of recruitment, all participants were considered physically inactive as determined by

current recommended levels of physical activity for 18-64 year olds (DoH, 2011). This was measured as part of the initial screening criteria for the intervention using the validated (against pedometers) International Physical Activity Questionnaire (IPAQ: Craig et al., 2003). This questionnaire is widely used within walking programmes to determine levels of physical activity.

It was felt that after interviewing 15 participants data saturation was reached (this was defined as no new themes emerging). Therefore, conducting more interviews with further participants would not have resulted in new and meaningful information. In a similar vein to Faulkner and Biddle (2004), for the purpose of brevity, and to retain continuity throughout the results section, the experiences of three of the women who were interviewed are illustrated. Illustrating the experiences of three women meant that their stories could be represented in an in depth manner, consistent with the case study approach. These specific participants were chosen as their experiences included the breadth of the themes identified across all the participants within each profile (Profile 1: Non adherence *n*=4, Profile 2: Lapse/re uptake of physical activity, *n*=4, Profile 3: Adherence, *n*=7) and they expressed their experiences with particular clarity. Data from the remaining participants are available from the first author.

All the participants from the walking intervention (*N* =75; *n*= 69 women, *n*= 6 men) were approached in person prior to the intervention, informed them about the qualitative facet of the overall study, gave them an information sheet, and asked them to provide written consent if they wished to participate. All participants were non academic staff, White British women aged between 34 and 60 years (*M* = 49.4, *SD*=7.98).

Procedure

Using a semi-structured format, each participant was interviewed on four separate occasions. The first interview took place prior to the walking intervention, the second at mid intervention

(week 8), and the third immediately post intervention (week 16). The final follow up interview was at six months after completion of the intervention. Interviews took place in a private room and recorded using an Olympus VN-2100pc digital voice recorder. Only the participant and the 1st author were present in each interview.

The interview schedule (please refer to appendix 1) was designed by the 1st author to gather information focusing on the uniqueness of each participant's beliefs, attitudes, perceptions, and general experiences with more specific questions descending from broader research questions. Topics covered included experiences of physical activity, motivations to participate, challenges, coping strategies, benefits gained and perceived support. The questions were broad, open ended, conversational and treated as a template to provide flexibility. The flexible nature of the interviews allowed for investigation of emerging themes and aimed to facilitate each individual's account of the intervention and physical activity in general. Reflexivity was used (Etherington, 2007) as a tool to ensure that the 1st author created an environment that would lessen the gap between the researcher and the participant enhancing awareness of the personal, social and cultural contexts that were involved and how these could affect the conduct, interpretations and representations of each research story (Braun & Clarke, 2006). The author reflected on each interview immediately following its completion and used these reflections to inform the subsequent interview.

The BREQ-2 (Markland & Tobin, 2004), is a 19 item self report measure developed to assess exercise regulations consistent with SDT, and has been shown to have acceptable internal reliability with Cronbach alpha coefficient scoring above 0.75 for all five subscales (amotivation, external regulation, introjected regulation, identified regulation, intrinsic regulation) (Wilson & Rodgers, 2004). Participants rated statements on a five point scale ranging from 0 (Not true for me) to 4 (Very true for me). The BREQ-2 was administered at week 1 and at the conclusion (week 16) of the intervention.

Data Analysis

Thematic analysis was chosen for this study as a method because of its flexibility to facilitate an exploration of how unique personal experiences are understood (Braun & Clarke, 2006). Using this analysis allowed the researcher to play an active, reflective role in the interpretation of the participants' accounts and has been widely used (Boyatzis, 1998), particularly in case studies (Brocki & Wearden, 2006; Craig et al., 2002). The aim of thematic analyses is to provide a method for identifying, analyzing and reporting patterns within data (Boyatzis, 1998). A realist approach was used to theorize motivations, experience and meaning of the topic researched (Braun & Clarke, 2006). Both semantic and latent were identified themes. Semantic themes are common in a realist approach however latent themes were also identified, more common to a constructionist paradigm (Burr, 1995), to explain and understand the motivational processes underpinning exercise adherence.

All interviews were transcribed verbatim promptly following each interview and examined transcripts in detail. Line by line coding was applied with a focus on the transitions experienced by each participant and interpretations made were based on the experiences discussed in the interviews by the participants, and the researcher's reflections. Higher and lower order themes, both latent and semantic, that emerged were given a relevant label and the concept identification was guided by SDT. A theme represented a prevalent subject discussed by all participants who expressed similar experiences with regard to motivational processes (Boyatzis, 1998). In line with thematic analysis, a table was created to categorize the themes based on the analysis which was expanded to incorporate new ideas as they emerged. At this stage peer review procedures were adopted as a means of verification and to challenge our interpretations of the data. The co-authors validated the themes and discussed an interim descriptive account with an exercise psychology research interest group. To increase trustworthiness of the findings, themes and quotations were discussed with the group

and revised them if deemed necessary according to the research interest group's interpretation. A similar process has previously been used to establish reliability in qualitative research (Jones & Ogilvie, 2012; Sparkes, 1988). Themes were continually compared with the original transcripts to ensure that interpretations were accurate.

To further increase the trustworthiness of the research, participants were contacted and presented them with a summary of their responses, and the context in which their quotes were being used for this article, for them to confirm that the findings accurately reflected their stories. Participants all responded in agreement that the interpretation reflected their experiences.

Mean scores for the BREQ-2 were calculated for each of the behavioural regulations.

Results

Based on the data, three major profiles of participants were identified: 1) non adherers, 2) lapsers who restarted walking and 3) adherers who maintained their physical activity engagement. All participants interviewed fitted one of the three profiles and themes were iteratively generated for each of these profiles. Table 2.1 represents the BREQ-2 scores at week 1 and week 16 of the intervention for the cases presented below. The names used are pseudonyms to protect the identity of the participants. Table 2.2 outlines the key themes for each profile.

Table 2.1 Mean BREQ-2 scores at baseline (week 1) and post intervention (week 16).

Regulations	Amotivation	External	Introjected	Identified	Intrinsic
Hannah (non-adherence)					
Week 1	1.75	1.5	1.0	1.5	2.0
Week16	1.25	1.0	1.33	2.0	2.0
Kathryn (lapse and re-uptake)					
Week1	0	0.75	1.0	3.25	2.75
Week 16	0	0.75	1.0	3.25	2.75
Sophie (adherence)					
Week 1	0.25	0.5	3.3	3.3	2.25
Week16	0.75	2.25	0.75	3.5	2.5

Table 2.2: Participant profile and themes from thematic analysis of interview

Profile	Higher Order Themes	Lower Order Themes
Non-Adherence (*n*=4)	Lack of internalisation throughout the programme	Lack of interest Guilt Lack of motivation
	Basic Psychological Needs were not satisfied	Lack of perceived ability Feelings of being alone Obligation to attend
	Not embracing the support available	Lack of perceived importance of support Only perceive a personal responsibility
	Inconvenience of the programme to individual lifestyle	Time Work commitments Social Commitments
Lapse and Re-uptake (*n*=4)	Satisfaction of psychological needs (relatedness and competence) throughout the programme	Achieving goals Perceived acceptance to the group Connection with walk leaders
	Satisfaction of psychological needs (autonomy) at the re-uptake of physical activity	Organising schedule to include walking Choosing a physical activity suitable for their lifestyle
	Guilt and obligation	To walk peers and walk leaders Non-attendance Failing to achieve goals
	Reliance on support	Daily reminder emails Group walks
	Internalising motivations at the re-uptake of physical activity	Enjoyment Value the benefits of physical activity
Adherence (*n*=7)	Satisfaction of the three Basic Psychological Needs	Achieving goals Perceived acceptance to physically active peers Autonomous decision making in everyday life
	Perceived support external to the programme	Professional Family Peers
	Perceived support within the programme	Approachability of researchers Text messages Tools for self-monitoring
	Enjoyment	Physical environment Exceeding Expectations Increased perception of competence

Profile 1: Non adherence

"The walking in the lunchtime ended up being a chore" (Hannah)

Profile 1 included four women. Hannah's experiences are described below. Hannah failed to adhere to the walking intervention, dropping out following the 10 weeks of led walks. She has sporadically attempted to be physically active in the past although she has never found physical activity enjoyable, often losing interest quickly. Four key themes (see Table 2.2) were identified.

At the pre intervention interview Hannah stated, "I think I lose motivation pretty quickly, any excuse not to do it." Her initial motivation to attend was guided by her friends' involvement. At mid intervention just before Hannah stopped walking she stated, "Sometimes it is just easier not to do it . . . you have to shout at yourself to go but sometimes it doesn't work." Even by trying to persuade herself to go, she expressed no autonomous motivation to attend the walks.

Hannah articulated limited competence in/for the activity, feeling that she was not very good at walking, "I'm the one who is always at the back, trying to keep up. I'm not very good it isn't much fun really." At the 6 month follow up interview, she indicated her lack of autonomy by explaining that she felt obliged to attend the walks and did not have a choice or control over the decision, "I could have attended for a few weeks, then gone off and done my own walks. I felt like I had to walk at lunchtime." Hannah felt that her participation in physical activity was down to her, she did not look for, or perceive, any support from others involved in the programme (i.e., walk leaders/walk peers), "I don't think anybody supports me to do it, it is just down to me." The programme was seen as interference to other commitments (i.e., work) which often took priority. This conflict seemed to cause some negative feelings for Hannah whereby she felt irritated by the programme, "I think it just got irritating towards the end because I didn't have the time. The walking in lunchtime ended up

being a chore". Hannah's qualitative account highlights her controlled forms of motivation and the lack of motivation to exercise altogether. According to Hannah's BREQ-2 score (Table 2.1), she began and ended the programme with similar scores on motivational regulations. The lack of change regarding reasons for engaging in physical activity is aligned with her qualitative account.

Profile 2: Lapse and re uptake

"If I drop out I would feel like I've let people down" (Kathryn)

The second profile included four women. All women adhered fully to the programme, lapsed on completing it (for approximately 1-3 months), then experienced a re-uptake of physical activity before the six month follow up interview. Kathryn had not participated in any form of physical activity for many years. She wanted to improve her health although was aware that she has always found exercising difficult to maintain. Five key themes (see Table 2.2) emerged for this profile.

It was apparent that throughout the walking programme, all women in this profile experienced increased satisfaction of their needs for competence and relatedness. Kathryn's feelings of competence augmented as the intervention progressed. At first, she was concerned that she would not be able to complete the programme because of lack of motivation and fitness, "laziness, that I won't, after a mornings work, feel like it. I hope I'm successful but what I don't want to happen is to go belting around and then feel jaded in the afternoon." Immediately following the programme, Kathryn felt more competent in her abilities:

> I think it has improved my outlook; I was worried about doing an activity in the lunch hour and being fagged out [exhausted] later. That happened on one of the first walks, I thought I'd never be able to continue but it never happened again. I was pleased because it was a concern.

She also expressed a sense of relatedness with the walk leaders and embraced the autonomy supportive environment that she perceived they created. An illustrative example was offering the walkers a choice of pace, “The walk leaders always ask what pace you want to go and they are always really interested: a nice bunch of people.” Following the sustained lapse in physical activity, Kathryn experienced a re-uptake of physical activity. It was at this point that the satisfaction of the need for autonomy became prominent. She made decisions to take control of her walking by recognizing and proactively aiming to satisfy her need for relatedness which was important to her. Although she encouraged friends and colleagues to accompany her on her lunchtime walks, she was no longer reliant on others to walk:

> Next year I will see if anyone from the whole of the school office wants to come. I would feel nice that I had started something . . . Once or twice I haven’t been able to go with them so I have gone out on my own on a different day.

Feelings of guilt and obligation to the programme were prominent for all participants in this profile indicating introjected forms of motivation. Kathryn was concerned about letting people down, “If I drop out, I would feel like I’ve let people down.” As the programme progressed, she saw this obligation as a facilitator which helped her stick with the programme, “The fact that you got emails, then the reminder. Even if you didn’t feel like it you got the reminder and knew you had to be there.” Sources of support, which is defined here as the support from different sources associated with the programme (i.e., organisers, walk peers, walk leaders and text messages), was perceived to be essential contributors to Kathryn completing the programme and her sense of relatedness:

> Without that support initially I don’t think I would’ve done it. You know, choosing your walk and meeting the team. I think that imprinted it into your mind . . . I’m not

> very good on the weekend, having the groups help. I love the text messages and the support. It kept you focused on it.

Initially Kathryn felt that she should be exercising, a reflection of the fact that her motivation was characterised as mainly introjected in orientation, "You read that you need to be exercising 3 times a week, I'm looking for the pressure or support to kick start me."

At the follow up interview, Kathryn reported experiencing large benefits predominantly with regard to her psychological well-being. This suggested that her motivation to engage in physical activity shifted to become more identified:

> The main thing is I want to do it. I've never enjoyed November and December, I wait for Christmas to be over but I haven't this time. I think it's because of the walking. I've noticed that I haven't felt low this time and we've bought a Christmas tree. I feel more positive about the whole thing. If the walking can help that negativity, I am going to keep it up.

The qualitative account indicates a move from highly introjected forms of motivation to identified regulation however this did not happen quickly. After 6 months of regular exercise Kathryn had lapsed and this continued for approximately 8 weeks. It was at the follow up interview (10 months) that more autonomous regulations become apparent. Although she was still experiencing some controlled forms of motivation, identified regulation had increased, "I think the main thing is I want to do it. Maybe I feel bad if I don't do it, I feel guilty if I don't walk. Maybe that can creep in." This account indicates an improvement in her quality of motivation.

Kathryn's BREQ-2 scores for week 1 and week 16 remain unchanged showing higher identified and intrinsic motivation than external or introjected regulations throughout. Given

that the measure was only taken at two time points (pre and post intervention), changes to motivational regulations could have occurred during the intervention that cannot be accounted for using the BREQ-2 at these time points as no measures were taken.

Profile 3: Adherence

"It was the stepping stone I needed" (Sophie)

Profile three included seven women. All women adhered to the programme including the follow up (10 months of exercise) and showed signs of internalising their motivation regulations for exercise. Sophie is overweight and was keen to dramatically change her lifestyle. She had low self-esteem, which had prevented her from being physically active in the past. Five key themes (see Table 2.2) were consistent for all women in this profile. The satisfaction of the three basic psychological needs played an important role in the adoption and adherence to the programme for participants in this profile. Sophie experienced satisfaction of her needs for competence, autonomy and relatedness and explains how these were key to her adherence, particularly during the independent walking phase and in maintaining physical activity behaviour change at follow up. Sophie initially did not think that she would be able to complete the programme, "If you do it on your own, you are more likely to fail and I will fail because I don't want to do it." As the programme progressed, Sophie felt a sense of competence when she realised that she could complete the walks:

> One week when I was sick on a couple of days, I still went on the walks which I wouldn't normally do. It's that sense of achievement that I completed something. I'm more confident in my ability to walk and realise that I have got fitter.

Sophie also thrived when she experienced relatedness, initially feeling self conscious, "I always think people are looking at me, I'm conscious about that. That's how I feel." In the

adherence phase, she became more socially confident, joined a gym and embraced its culture; she stated during the follow up interview:

> I'm quite happy in myself now and I don't have to put a smile on anymore if I don't want. Once you see people regularly they start to talk to you, it's really weird because people talk to me all the time; I'm not used to it. It's nice that people have a conversation with me.

Mid way through the programme, Sophie felt she was slowing the group down. To avoid this, Sophie made the choice to keep a map of the route with her thus increasing her confidence:

> Taking the map with me and saying if I get left behind just leave me, I'll catch up at the end. I can't walk at that pace so they can't expect me to. I'm faster now and I try and stick to the front for half at least, then I might slow down.

At the post intervention interview, Sophie experienced increased satisfaction with her need for autonomy by consciously making decisions about and felt a sense of control over the management of her health:

> The walking helped me to control my asthma. I wasn't the best person to know about my health. I did let things get so bad that I end up on antibiotics but now I can feel when things are starting to go wrong; whether I'm having a bad day or actually ill, I can go to the doctors quicker.

Sophie's motivation to join the walking programme came from external encouragement from her General Practitioner who recommended she increase her physical activity to improve her health. She stated "I am under a dietician and counselor through my doctor who help me." Initially Sophie relied on her walk peers attending the same walks as

her, “My friend from the office, if she is in then I’ll definitely go on the walk. She won’t let me stop anyway.” Support from within the programme was critical at mid intervention when Sophie felt like she could not keep up:

> I was really down on myself because I couldn’t keep up, then I got that email from you [the author], we had that chat when I wasn’t feeling very motivated. After the chat I decided to buck up my ideas and get more involved.

She then stated the significance of this contact on her completing the programme, “If it hadn’t been for you I wouldn’t have done it.” During the walking programme, she embraced support from her mother and work colleagues feeling she needed it to continue with the walks, “My mum and at work everyone is really supportive. I’ve got quite a few people onto the programme because I don’t like it on my own. I need support.” At follow up, Sophie continued to embrace the support around her however felt that she no longer relied on it, “I used to need the push but I don’t need it now. It’s always nice to have support and people say that you are doing well but I don’t worry about that now.”

Similarly to Profile 2, feelings of guilt were initially prominent for the women in this profile indicating high levels of introjected regulation. Sophie expressed a sense of obligation to the programme at its start and the desire to avoid letting people down. This feeling was perceived as beneficial to encourage the participants to initially attend the walks. At the point when Sophie found walking difficult, her reasons for attending walks were to avoid these feelings of guilt, “I push myself to go because it’s scheduled and I’m letting people down if I don’t go.” At the post intervention stage, Sophie experienced a change in her feelings of guilt:

> I do get days when I feel that I can’t be bothered and that’s ok as long as I don’t stop. I don’t beat myself up now if I don’t walk. I’ll walk longer on the weekend with the dog.

Although still apparent, the more controlled forms of motivation had decreased for Sophie at follow up and she expressed a sense of autonomy regarding when, where and for how long she would walk.

Participants in this profile expressed elements of enjoyment at different time points, for example in regard to the social context, the physical environment they were exposed to during the walks or the physical activity itself. Sophie strongly disliked any physical activity prior to the programme having only signed up because her GP encouraged her to; "I am trying to convince myself that I want to do it, I am not an active person. I hate doing anything physical." This motivation for engagement changed as Sophie noticed the benefits and understood the importance of her enjoying the activity to facilitate her adherence and thus indicating a shift from external regulation to more autonomous motivation:

> I have lost weight and see the difference in my breathing, I can see the benefits of the last year. Now I enjoy the walking whereas I never used to. I am trying to find exercises that I enjoy rather than pushing myself into ones I don't. Suddenly you think, "this isn't too bad after all".

Although Sophie did not enjoy the exercise for its own sake, she is aware of the importance for her to find exercises that she would enjoy more than others.

By the 6 month follow up interview, walking became more habitual for Sophie, "I get home and without thinking about it I get the lead, the dog and go for a walk. It does us both good. I don't even think twice about it." The data obtained from the interviews indicated that Sophie began the intervention with high levels of introjected motivation but that her motivation at follow up showed signs of becoming internalised. Following 10 months of exercise signs of internalisation were apparent for Sophie, however, as is seen in the final

quote from Sophie controlled forms of motivation are still apparent, albeit they coexist with more autonomous motivation. Sophie's BREQ-2 scores are supportive of her account. They indicate high introjected motivation at the beginning and low introjected motivation at follow up. In this closing quote Sophie described her changing perceptions:

> I am pushing myself to do it [exercise]. I am not so worried about what other people think. I know I am capable of doing it myself now. Before I needed that support because I thought "I can't do this" whereas now my mind set has changed.

Discussion

Qualitatively exploring inactive women's experiences of physical activity within a walking intervention has enabled for understanding and to identify the underlying (changing) motivational processes related to physical activity adoption, adherence, lapse and drop-out. The information adds to extant research exploring the processes involved in behaviour change in physical activity settings (Fortier, Duda, et al., 2012; Huberty et al., 2008; Rodgers et al., 2010; Sabiston et al., 2009; Vandelanotte et al., 2007) and changes in need satisfaction among participants in a physical activity promotion programme (Rahman et al., 2011). Exploring these changes in the context of a physical activity intervention has allowed for a predominantly qualitative, longitudinal case study design, which in turn facilitated an exploration of the dynamics undergirding behavioural change. Participants in this study were followed for a longer time period (10 months) than previous longitudinal studies (6 months; Fortier, Sweet, et al., 2012, Rodgers et al., 2010).

Results are in line with SDT propositions (Deci & Ryan, 1985, 2000), indicating it is possible to internalize motivation in physically inactive adults through a walking programme, as previously documented in an intervention with inactive overweight women involving dragon boat racing (Sabiston et al., 2009). Our findings support/extend the qualitative work of

Sabiston and colleagues (2009) who discussed how increased need satisfaction was linked to improvements in quality of motivation, which positively impacted intentions and attitudes toward exercise. Drawing from this literature and the present study, it appears that need satisfaction is imperative because it increases the likelihood that the behaviour will be sustained longer term (Ng et al., 2012; Edmunds et al., 2007).

Furthermore the present case studies showed that the satisfaction of the needs for competence and relatedness are critical to the exercise adoption stages, whereas satisfaction with autonomy can become more important in the adherence phase. Findings provide qualitative elaboration on the work of Rahman et al. (2011) who found that relatedness need satisfaction was particularly important early in the behaviour change process. In support of SDT and previous research (McDonough & Crocker, 2007; Wilson & Rodgers, 2004), all adherers in this study displayed autonomously regulated behaviour throughout latter stages of the programme. In those who lapsed and restarted their physical activity, increased feelings of autonomy were mainly evident at the point of re uptake of physical activity. As Koestner and Losier (2002) suggested, and Deci and Ryan (2000) theorised, satisfaction of the need for autonomy is essential for internalisation and more likely to develop in the latter stages of the behaviour change process.

It has been argued that environmental support is particularly important during the uptake of a behaviour (Kahn et al., 2010). In our findings, sources of support (different sources of support perceived by the individual to help them in their efforts to become more physically active) were key driving forces in the adoption phases of the walking behaviour, and in terms of adherence to this form of physical activity. Those who did not adhere did not positively perceive the available support. In contrast, participants who adhered to the programme embraced support from within and beyond the program, calling on it when they felt necessary. For example, Sophie felt particularly amotivated at a point during the

programme and contacted the researchers for advice. Beyond the programme she consulted her GP and walked with her mother. Participants who lapsed following the end of the intervention showed a reliance on support from within the programme, only experiencing perceived support from outside at the re uptake of physical activity following the lapse. That is, programme support was pertinent at the initial uptake and support from beyond the programme was important for continuation of physical activity. In their quantitative study with women undergoing exercise rehabilitation, Markland and Tobin (2010) showed that a reliance on social support (social assimilation) in the absence of feelings of autonomy was related to introjected regulation. Our findings extend those results by suggesting that a reliance on people within an intervention in the absence of autonomy might also lead to physical activity lapses (as apparent for participants in profile 2).

Feelings of guilt when absent and perceiving a sense of obligation to the programme were shown to facilitate the adoption of physical activity in the present study. As suggested by previous research, such introjected forms of regulation are unlikely to be conducive to long term behaviour change (Pelletier et al., 2002). This qualitative analysis adds and extends cross sectional research regarding the processes of behaviour change. As Thøgersen-Ntoumani and Ntoumanis (2006) showed, introjected regulation can be related to both adaptive and maladaptive outcomes. Although Sophie (until follow up) and Kathryn (while she adhered to the intervention) still experienced feelings of guilt, although reduced, toward failing to exercise they continued to adhere. Therefore, as Markland and Ingledew (2007) argue, an individual can possess levels of controlled forms of motivation and persist with physical activity as long as they also experience autonomous forms of motivation.

Participants saw obligation as a positive motivator to help them attend initially. The qualitative accounts revealed that those who were exercising at the 6 month follow up experienced a decrease in introjected regulation over the period of the intervention. However,

it was only at the re uptake of physical activity (between 6-10 months) that participants in profile 2 showed decreases in introjected regulation and increases in identified regulation. These findings support Markland and Ingledew's (2007) point that identified regulation can offer similar benefits to intrinsic motivation and also result in persistence to exercise. Therefore, within this exercise context, full internalization might not be necessary for adherence. This was particularly apparent in Kathryn's case, when at the re uptake of exercise, she exhibited high levels of identified regulation and persisted with exercise to improve her psychological well-being.

Internalising motivation and enjoying the activity for its own sake is an important contributor to behavioural adherence (Pelletier et al., 2002). Participants in profile 3 showed signs of autonomous reasons for physical activity engagement. Along with high levels of identified regulation (i.e., personal importance of the health benefits of physical activity) Sophie stated that she enjoyed the walking itself. The enjoyment of walking can be explained by the work of Ekkekakis and colleagues (2011) who showed that, in comparison to higher intensity exercise, walking provided more pleasure in terms of mood and affect. This further supports walking as an effective activity to promote enjoyment of physical activity in exercise initiates.

Rodgers et al. (2010) indicated that at 6 months of regular exercise, exercise initiates did not reach the same levels of self-determined motivation as regular exercisers and did not experience full internalization of motivation. At 10 months of regular exercise both adherers and those who lapsed for a period of 1-3 months showed signs of internalising behaviour. The signs of internalisation occurred between the interview immediately following the intervention (4 months) and the follow up interview in the lapsers. At 4 months and at 10 months, levels of controlled motivation were evident (although progressively less) alongside more self-determined motivation. This highlights that motivational regulations can still be

unstable after 10 months of exercise and therefore individuals are potentially still susceptible to inconsistencies in behaviour (i.e., lapses or drop out).

Limitations

Although the findings of this study contributes to existing research (Fortier, Sweet, et al., 2012; Huberty et al., 2008; Rodgers et al., 2010; Sabiston et al., 2009), there were limitations that should be considered in future work. Although the BREQ-2 has shown evidence of being sensitive to changes in physical activity behaviour (Wilson, Sabiston, Mack, & Blanchard, 2012), this has been at a cohort level. An implication of using the BREQ-2 is that it might not be a sensitive idiographic (specific to individuals) measure and therefore might not be accurately reflective of each individual's story (as revealed via a more in depth qualitative analysis). Furthermore, the BREQ-2 was administered at week 1 and week 16 within the intervention, separately to the interviews. Collecting this information at the beginning or end of each interview (baseline, week 10, week 16 and at 6 month follow up) would have given a more accurate view of the changes to the behavioural regulations. Finally, in the current study the BREQ-2 was employed to measure behavioural regulations of a lifestyle physical activity (walking), whereas it is most commonly used within a more formally defined exercise context (e.g., gym classes). This could be a limitation of this measure in the current context.

In addition, all participants were white British women. A more varied sample could reveal more diverse experiences in response to physical activity interventions and increase understanding of the processes of behaviour change within different population groups (Darker, Larkin, & French, 2007). Despite efforts of the researcher to create a trusting and non-judgmental environment and encouraging participants to be honest within their accounts, it is possible that the participants responded with social desirability during interviews because of our involvement in the intervention. This involvement, however, enabled the researcher to

provide a more comfortable interview environment and helped to better understand the experiences and perspective of the participants (Sabiston et al., 2009).

The strengths of this study lie in its longitudinal nature and the use of multiple interviews to explore participants' experiences during and following the intervention. More specifically, the results of the present study allowed the researcher to explore the transition from a physically inactive to a physically active lifestyle and investigate factors relating to lapse and drop-out behaviour. Although the qualitative approach to exploring processes related to behavioural change within the intervention was an asset of the study, our interpretations grounded within SDT (Deci & Ryan, 1985) provide only one set of perspectives to the findings (Brocki & Wearden, 2006).

Implications for Applied Practice and Future Direction

It is evident that SDT (Deci & Ryan, 1985) can be used to understand processes of behavioural change within a walking programme. In future interventions it is suggested that concepts of SDT can be used to increase adherence through internalisation of behaviour and by satisfying participants' psychological needs. Specifically, it seems particularly pertinent to increase a sense of competence and relatedness during the adoption phases. Results point to the importance of ensuring increasingly more attention to satisfying the need for autonomy throughout the intervention. This can be achieved through provision of autonomy support provided by both exercise leaders and significant others which can take the form of giving a rationale, providing choice, and acknowledging negative feelings. Kathryn found support through emails and text messages which were part of the programme. Future research should consider the effects of such tools as a source of support. Providing need supportive training for walking leaders before the programme begins (Williams et al., 2006) can be used to help them create an environment aimed to facilitate participants' satisfaction of autonomy,

competence and relatedness. Facilitating realistic and flexible goal setting as part of the intervention can ensure that participants feel competent in achieving these goals and avoiding feelings of disappointment. To increase feelings of relatedness, an intervention could provide an avenue for participants to be in contact with one another for example by creating an online forum where participants can exchange walk information, arrange venues and times for walks and coordinating walking 'buddies'.

Walking interventions that facilitate enjoyment further are an important future direction. An example could include considering the physical environment a person walks in and areas which could increase the enjoyment. Along with satisfying the psychological needs of the participants from within the programme, findings also highlighted the importance of need support (and in particular social assimilation, as described by Markland and Tobin, (2010)) to help participants continue the activity post intervention. The provision of information on how family members/friends could adopt an autonomy supportive approach, information on external groups (e.g., walking groups) and teaching participants planning strategies and self-regulation skills which could be used following the end of the intervention to enhance perceptions of autonomy, could be incorporated as part of future interventions.

Conclusion

Given our findings and in consideration of this study's limitations, two key points should be considered in further research. First, it is important to examine whether motivational processes identified in this study are equally applicable in mainly sedentary men engaged in walking programmes. Second, future work should aim to identify which specific intervention strategies grounded in SDT principles designed to increase physical activity adherence are most effective.

CHAPTER 3

Study 2:

SOURCE OF AUTONOMY SUPPORT, SUBJECTIVE VITALITY AND PHYSICAL ACTIVITY BEHAVIOUR ASSOCIATED WITH PARTICIPATION IN A LUNCHTIME WALKING INTERVENTION FOR PHYSIALLY INACTIVE ADULTS

Abstract

Objectives: Based on Basic Psychological Needs Theory (BPNT: Deci & Ryan, 1985), this study examined longitudinal relationships between autonomy support (AS), psychological need satisfaction (PNS), subjective vitality (SV) and self-reported physical activity (PA: METs). The proposed aim was to explore the unique contributions of sources of AS (provided via a walk leader versus the programme as a whole) to PNS, SV and PA from baseline to week 16 (post-intervention) and at a 4 month follow-up. It was proposed that the relationship between perceived AS and the outcomes are mediated by PNS (autonomy, relatedness, competence).

Methods: Physically inactive participants (N =69; n= 63 females, n= 6 males) from a 16 week lunchtime walking programme, designed around SDT principles, completed a multi-section questionnaire at three time points including a 4 month follow-up investigating all aforementioned variables.

Findings: The hypotheses were partly supported. AS from the walk leader predicted change in SV from baseline to week 16. AS from the walk leader positively predicted change in PA from baseline to follow up. AS from the programme positively predicted change in SV from baseline to week 16. Perceived AS from the walk leader predicted autonomy and relatedness need satisfaction from the walk leader. Autonomy need satisfaction from the walk leader mediated the relationship between AS and SV (b = .26, p = .01), and between perceived AS and PA (b = 445.87, p = .01). Perceived AS from the programme predicted autonomy and relatedness need satisfaction from the programme.

Conclusion: Findings indicate that perceived AS can be achieved from both a walk leader and the programme as a whole with positive effects on PNS, subjective vitality and PA. Researchers implementing future walking interventions could increase PA behaviour and SV by facilitating PNS through the provision of AS from both these of sources.

Introduction

Physical activity is widely known to protect against chronic non-communicable diseases and conditions (Lee et al., 2012) and the maintenance of physical activity is necessary for physiological and psychological health improvements (Penn et al., 2008). Despite this, over two thirds of the population in the UK, 60% of adult males and 75% of adult females do not meet physical activity recommendations to achieve or maintain health as set by the Department of Health (2011). According to recommendations, an individual that accumulates 150 minutes (2.5 hours) of moderate intensity activity in bouts of 10 minutes or more per week (Department of Health, 2011) would be expected to achieve or maintain greater health and well-being.

Autonomy Support and Basic Psychological Needs Theory

According to Basic Psychological Needs Theory (BPNT; Ryan & Deci, 2000), detailed in chapter 1 (pages 10-11), humans possess three basic psychological needs; the innate needs for autonomy (the need for personal control of our own life, acting with choice), competence (effectiveness in dealing with the environment) and relatedness (the need to interact, feel connected to and experience caring for others) (Deci & Ryan, 2000; Ryan & Deci, 2000).

Given that satisfying one's psychological needs can lead to effective human development, self-determination researchers have examined the impact of the interpersonal environment on individuals' psychological needs. BPNT theorists propose that a central construct influencing the quality of motivation and its development is perceived autonomy support (Deci & Ryan, 1985). For example, in the context of a group walking intervention, a walk leader who is behaving in an autonomy supportive manner would see and understand the given situation from the view point of the walker and encourage them to make decisions of their own. They would not try to change the views of the walkers or impose their own

perspective or opinions on them (Williams, Gagné, Ryan, & Deci, 2002). It is proposed that when an individual experiences perceptions of autonomy support, the regulation of behaviour will be perceived (i.e., by the walker), as their own and the most autonomous forms of extrinsic motivation will guide behaviour.

It is clear from previous physical activity research that the provision of autonomy support is conducive to improved quality of motivation and positive behavioural outcomes (Edmunds, Ntoumanis, & Duda, 2008; Moustaka et al., 2012; Rouse et al. , 2011). In a longitudinal investigation of long term weight loss in overweight women of Silva et al., (2011) demonstrated that both autonomy support and autonomous regulations were important predictors of sustained (3 year) weight loss.

Sources of Autonomy Support

Previous research has focused on creating an autonomy supportive environment via a figure of authority (i.e., exercise class instructor) (Edmunds et al., 2008; Moustaka et al., 2012). Very few studies (Rouse et al. 2011; Kennedy, Goggin, & Nollen, 2004) have differentiated between different sources of autonomy support and to the knowledge of the author, only one has done so within a physical activity context.

In the context of smoking cessation Williams et al., (2006) demonstrated that abstinence to tobacco was predicted by different sources of autonomy support (health care professional and important others). However, no distinction was made between each source to fully understand the unique or similar contribution that each source made towards behavioural and affective outcomes. Kennedy, Goggin, and Nollen, (2004) also investigated autonomy support from health care providers and family with regard to adherence to HIV medication. Autonomy support from health care providers resulted in the most autonomous motivation in comparison to family members however a number of participants had not disclosed their

condition to family members limiting the validity of the data. HIV medication adherence also represents a different behavioural domain to behaviours such as smoking cessation or indeed physical activity engagement. For example, as Kennedy et al. (2004) acknowledge the importance for antiretroviral therapy may remove or override the role of patient autonomy in adherence to treatment.

Using Williams, Lynch, et al. (2006)'s validated Important Other Climate Questionnaire (IOCQ), Rouse et al. (2011) showed that effects of autonomy support, of a specified significant other, on mental health and physical activity intentions differed as a function of who provided the support (offspring, partner or physician), with a partner or physician having the strongest effects. The results of Rouse et al. (2011)'s study added important findings to research regarding the provision of autonomy support, highlighting the possibility of increasing need satisfaction from those beyond an exercise programme. Furthering existing research can inform future health initiatives attempting to increase physical activity and well-being through social environmental interventions. More research should be conducted to examine the significance of who or, indeed, what, provides the autonomy support and the extent of each unique contribution to need satisfaction and adaptive outcomes. The current study intends to extend the work of Rouse et al. (2011) by examining whether autonomy support can be provided by both a walk leader and via other aspects of a walking programme as a whole, that were used as part of the programme to increase long-term persistence to exercise (i.e., motivational texts messages, log books, emails, websites) and whether these two main sources exert independent effects on psychological need satisfaction, psychological well-being and physical activity-related outcomes. The present study also differs to the work by Rouse et al. 2011 in that it measured physical activity behaviour rather than intention to exercise because of evidence regarding intention-behaviour discrepancy (Prestwich, Perugini, & Hurling, 2010).

Moustaka and colleagues (2012) and Edmunds et al. (2008) investigated the effectiveness of an autonomy supportive exercise instructor style versus a neutral exercise-instructing style. Moustaka et al. (2012) showed that the perception of competence was particularly pertinent throughout this intervention while perceptions of competence decreased for those in the control group. Relatedness did not show any change between groups which differed to the findings of Edmunds et al. (2008), who demonstrated a significant increase in competence and relatedness, rather than autonomy. Deci and Ryan (2000) theorised that while autonomy is essential for full internalisation and is more likely to develop in latter stages of the behaviour change process (Williams et al., 2006), relatedness may be less relevant in the prediction of intrinsic motivation. An explanation for the lack of relatedness need satisfaction suggested by Moustaka et al. (2012) is that there are situations where relatedness plays a less central role to intrinsic motivation compared to autonomy and competence. An example is when individuals engage in behaviours alone or do not engage in the behaviour because they wish to develop social relationships (i.e., to improve physical fitness and improve physique). Using a longitudinal design with patients from an exercise referral scheme, Rahman, Thøgersen-Ntoumani, Thatcher, and Doust (2011) demonstrated that, while autonomy need satisfaction appeared particularly important *throughout* the behaviour change process, relatedness need satisfaction appeared to be most pertinent in the adoption stage. Adding to the research of Rahman et al. (2011) a measure was included to investigate perceived autonomy support of both the programme as a whole and the walk leader separately on need satisfaction.

Subjective Vitality

Central within SDT is the concept of subjective vitality (Ryan & Frederick, 1997) which is considered an important indicator of health and motivation (Ryan & Deci, 2008). Subjective

vitality is described as a feeling of energy and aliveness that develops from a sense of freedom of choice, autonomy support and intrinsic motivation (Ryan & Frederick, 1997). Little information exists on the extent to which effects of an autonomy supportive environment on subjective vitality are maintained once a programme has finished (Moustaka et al., 2012). By measuring subjective vitality alongside physical activity behaviour over an 8 month period (including a 4 month follow up), which is longer than in previous research (Edmunds et al., 2008; Fortier, Sweet, et al., 2012), the findings of this study can provide an insight into whether an autonomy supportive environment and the satisfaction of the three psychological needs can predict this outcome over an extended period of time.

Research within a Physically Inactive Population

For a physical activity intervention to be successful, intervention benefits must be sustainable in the long term. Thus researchers should consider the impact of SDT constructs once the programme has finished, when reverting back to an inactive life is most likely. Much research has been focused on habitual exercisers (Vansteenkiste et al., 2004; Wilson et al., 2008) and recent focus has investigated the behaviour change process of participants within an exercise referral scheme (Edmunds, Ntoumanis, & Duda, 2007; Rahman et al., 2011; Rouse et al., 2011). This study uses a physically inactive population. Given the (growing) national levels of physical inactivity and the consequences of a physically inactive lifestyle, this is a population group in need of investigation.

Furthermore, individual change were investigated as opposed to group changes (Moustaka et al., 2012) and within the context of a lifestyle physical activity (i.e., brisk walking) adding to existing relevant research within an exercise referral context (Rahman et al., 2011) and resistance based exercises (Fortier, Sweet, et al., 2012). Brisk walking has clear benefits for cardiovascular health and mental well-being (Murphy et al., 2007; Baker et al.,

2008) and appears to be promising in terms of facilitating the adoption of an active lifestyle among physically inactive and obese population groups (Darker, Larkin, & French, 2007). This is partly because, as Ekkekakis and colleagues (Ekkekakis, Parfitt, & Petruzzello, 2011; Ekkekakis, 2010) have found, low to moderate intensity physical activity provides the most 'pleasure' in terms of mood and affect during and for a short time following the activity. In turn, individuals who experience pleasure associated with physical activity behaviours are more likely to repeat them (Williams et al., 2008).

This study also adds to the literature in other ways. The design of the study allows for examination of predictors of intra-individual change in the outcomes. Investigating intra-individual change rather than individual differences represents an important contribution to the literature because the two levels of analysis are conceptually and statistically divergent (Curran & Bauer, 2011). The aforementioned emphasis on cross-sectional designs in previous literature limits the ability to study change over time and, therefore, it is not clear whether attempts to manipulate a walk leader's style or the influence of the programme as a whole, via the intervention may have any positive effect. For example, perceived autonomy support from the programme as a whole may only be associated with benefits in the later stages of the intervention, whereas perceived autonomy support from the walk leader may be paramount in the early stages. This suggestion is in accordance with Rahman et al.'s (2011) findings which revealed that relatedness was key in the early stages of the intervention whereas autonomy need satisfaction was important for persistence to physical activity following the end of the programme. This not only reiterates the importance of using a longitudinal design but also to differentiate between perceived sources of autonomy support. Exploring when a provider of autonomy support is the most influential can aid intervention design.

Aims and Hypotheses

In view of the above, it is proposed that autonomy support provided by the leader (autonomy support-walk leader) and autonomy support provided via the programme as a whole (autonomy support-programme) would independently predict change in subjective vitality and self-reported physical activity from baseline to week 16 (post-intervention) and at a 4 month follow-up (H1). Secondly, it is proposed that significant direct relationships among types of autonomy support and the outcomes would be mediated by psychological needs (autonomy, relatedness) (H2).

Methods

Participants

Following ethical approval and an extensive recruitment campaign, sixty nine (N =69; n= 63 females, n= 6 males; age M = 46.59, SD = 10.51) physically inactive participants volunteered for a 16 week lunchtime walking programme. All participants were non-academic staff from a large British University who did not reach the recommended levels of physical activity of at least 150 minutes of moderate intensity activity in bouts of 10 minutes or more per week (Department of Health, 2011).

The Walking Programme

The intervention (for more detailed information of the intervention please see Thøgersen-Ntoumani, Loughren, Duda, Fox, & Kinnafick, 2010) 'Step by Step', a lunchtime walking programme consisted of 10 weeks of led group walks followed by a 6-week independent phase. Prior to the 10 weeks of group walking the walk leaders were trained (via a one two-hour long workshop) in the basic provision of autonomy-supportive leadership by a member of the research team (Thøgersen-Ntoumani et al., 2010). During the workshop, walk leaders

were introduced to the basic principles and tenets of SDT and the well-being effects associated with an active lifestyle. The walk leaders were also introduced to the concept of the three basic psychological needs as a means to encourage more autonomous participation. The needs for competence, relatedness and autonomy were explored using examples from other intervention work (i.e., Edmunds et al., 2008). The group discussed practical ways of how the walk leaders could implement these examples and promote participants' feelings of competence when walking, feelings of being connected with the other group members as well as with the leader and feeling more autonomous in their participation.

A motivational booklet that included specific educational information regarding the uptake and continuation of physical activity (e.g., identifying/countering exercise barriers and goal setting principles) and a section for the participants to record their reasons for walking and identify their favourite walks was given to each participant prior to the intervention.

During the group phase (week 1-10), participants were asked to attend three weekly, lunchtime walks (30 minute) and accumulate sixty minutes of walking at the weekend. In these first 10 weeks each participant received two autonomy-supportive text messages based on SDT principles (e.g., minimising pressure and control, supporting individual volition, offering choice, acknowledging participants perspective and feelings, and providing a meaningful rationale for engaging in the walks) which were randomly allocated. During the following six weeks of independent walking, the official led groups ended and the participants were asked to accumulate 150 minutes of walking per week (the recommended levels of physical activity) independently. They were encouraged to contact the research team if they wished. During this period each participant received three autonomy-supportive text messages per week according to their specific motivations for joining the programme. Participants specific motivations were measured at baseline using the Exercise Motivation Inventory -2 (EMI-2; Markland & Hardy, 1993) and grouped according to the participants' scores. The

inventory groups motivation into 14 categories (i.e., stress management, enjoyment, social recognition) and each participant received text messages relating to their 5 highest scoring motives. Examples text messages can be seen in Table 3.1 along with the relevant category of motivation. In this context the EMI-2 was employed to aid the development of the text messages and include personalised information.

Table 3.1: Examples of text messages

EMI-2 category	Text messages
Stress Management	Summer is approaching! Flowers are blooming and the leaves are back on the trees. Why not use your surroundings to help you relax– is there a particular area which relaxes you more than others? Why not walk there to de-stress?!
Affiliation	You have indicated that the social aspect of your regular walking is important to you. Walking with friends is thought to increase the positive outcomes of physical activity further! Who said gossiping was a bad thing?!
Ill-Health Avoidance	Osteoporosis, a common disease as you age can be offset by regular walking and physical activity: no matter your age! After 10 weeks of walking you can accrue these benefits.

Procedures

Following ethical approval, all participants received information about the study and provided informed consent. Outcome measures of total physical activity and subjective vitality were administered along with measures of perceived autonomy support and need satisfaction. Multi-section questionnaire packs including a pre-paid return envelope were sent, including the measures below, via the internal mail at the University (please refer to appendix 2 for the questionnaires).

Measures

Health-Care Climate Questionnaire (HCCQ)

Perceptions of the degree of autonomy support provided by the walk leader (e.g., *I feel the walk leaders have provided me with choices and options)* and the programme overall (e.g., *Through the walking programme I have felt understood)* were measured separately using adaptations of the 15 item Health-Care Climate Questionnaire (Williams, Grow, Freedman, Ryan, & Deci, 1996). Participants responded to the autonomy support items on a 7-point Likert scale using '1' (Strongly disagree) to '7' (Strongly agree). Previous studies using the original HCCQ (Williams et al., 1996) have reported an alpha value of .95.

Psychological Need Satisfaction Scale (PNSS)

Participant's perception of psychological need satisfaction (Baard, Deci, & Ryan, 2004) derived from the walk leaders (e.g., Autonomy: *'The walk leaders take my feelings into consideration*', Competence: *'The walk leaders help me feel a sense of accomplishment from walking'*, Relatedness: '*The walk leaders are friendly towards me')* and from the programme (e.g., Autonomy: '*I am free to express my ideas and opinions within the walking programme'* Competence: '*I have been able to learn interesting new skills on the walking programme'*, Relatedness: '*People on the walking programme care about me'*) separately using adaptations of the 21-item Basic Need Satisfaction at Work Scale (Deci et al., 2001). Participants responded to the items on a 7-point Likert scale using anchors of '1' (Strongly disagree) to '7' (Strongly agree). In a sample of U.S. workers Deci and colleagues (2001) reported alpha scores of .73 for competence, .84 for relatedness and .79 for autonomy. A smaller version of 9 items, namely 3 items per sub-scale was used for need satisfaction derived from the walk leaders because some items in the longer scale were not relevant. For example, to measure relatedness *"There are not many people on the walking programme that I am close to"* would not be relevant to translate to feelings of relatedness from a walk leader because there was a

single leader per walk. The item '*The walk leaders are friendly towards me'* is more relevant in this context. A 9 item scale has previously been used in the context of Interpersonal Need Satisfaction and showed a cronbach alpha score of .90 (La Guardia, Ryan, Couchman, & Deci, 2000).

Subjective vitality

Subjective vitality that participants were generally experiencing in their lives was measured using the Ryan and Frederick's, (1997) seven-item scale. Participants responded to the items on a 7-point Likert scale '1' (Not at all true) to '7' (Very true). Bostic and Hood, (2000) more recently showed an internal reliability with a Cronbach alpha value greater than .80.

Physical activity behaviour

Additionally, total physical activity in METs (units of metabolic equivalence) per week was measured. This was obtained through the reliable and extensively used International Physical Activity Questionnaire (Craig et al., 2003). The participants reported the amount of time spent engaging in moderate and vigorous physical activity over the previous 7 days. Moderate and vigorous activities were defined using the standard IPAQ descriptions. Moderate activity included activities that required moderate physical effort and made the participant breathe harder than normal. Vigorous physical activity included activities that required hard physical effort and made the participant breathe much harder than normal. Total physical activity on the IPAQ represents all physical activity related to work, transportation, leisure, and domestic or garden activities.

Data Analysis

Descriptive statistics were calculated using SPSS (19.0) including mean scores per variable, Cronbach alpha scores to test internal reliability. Correlations analysis was carried out

between need satisfaction of the walk leader and need satisfaction from the programme to test whether they were distinct and warranted being measured separately (manipulation check).

First, it was explored whether autonomy support-walk leader and autonomy support-programme predicted change in subjective vitality/physical activity from baseline to post-intervention and four month follow-up. This involved constructing single-level regression models with autonomy support predicting the post-intervention outcome variable (i.e., subjective vitality or physical activity), whilst controlling for baseline levels. This was then repeated for the two outcome variables at the four month follow up. This analytical process was carried out separately for autonomy support-walk leader and autonomy support programme due to some high correlations between the same variables across the two contexts (i.e., relatedness need satisfaction $r = 0.72$).

For the remainder of the analysis, multilevel regression equations were constructed, with time points nested within individuals, using MLwiN software (version 2.25; Rasbash, Browne, Steele, Cameron & Charlton, 2012). Adopting this approach allowed for the inclusion of all participants who have provided data for at least one time point and is, therefore, particularly suitable to investigate intervention contexts where some participants may have missing data.

For informational purposes, first intercept-only models were created to calculate the intraclass correlation coefficients (ICCs) of all study variables and identify the degree of variance at the intra-individual level of analysis (with the exception of autonomy support, which was only measured once). Next, the direct effects of autonomy support on subjective vitality and physical activity were investigated. Autonomy support was grand mean centered and entered as a fixed Level 2 predictor into the equations[1]. Potential mediation effects of psychological need satisfaction on the associations among autonomy support and the outcome variables (subjective vitality and total physical activity) were explored using the guidelines

outlined by Krull and MacKinnon (2001) for testing multilevel mediation. In accordance with these procedures, the first step was to investigate the relationships between the independent variable (i.e., perceived autonomy support) and the mediators (i.e., satisfaction of autonomy and relatedness). The second step was to explore the relationships among the mediator variables and the outcome variables (subjective vitality and total physical activity) after controlling for the effects of the independent variables in two distinct equations. Again, separate models for psychological need satisfaction from the walk leader and the wider walking programme were constructed due to high correlations across the two contexts. In order to create an unbiased estimation of intra-individual effects satisfaction of autonomy and relatedness were centred on each participant's unique mean (i.e., group mean centered) and entered as fixed effects into the Level 1 equations (Raudenbush & Bryk, 2002)[1]. The statistical significance of any mediation effects were computed and explored using Sobel *Z* scores (Sobel, 1982).

Footnote: [1] Random effects were tested in all models to establish if the relationships varied across participants, however, none were significant.

Results

Descriptive Data

Table 3.2 details descriptive statistics (means, standard deviations, Cronbach's alpha coefficients and ICC's) for each variable. The mean scores show that, in general, participants reported levels of all variables above the midpoint of each scale. One item from autonomy need satisfaction from the walk leader was removed to ensure that median internal consistency coefficients were all greater than .70 and therefore showing appropriate reliability according to DeVellis, (2003). Competence need satisfaction from the programme revealed poor Cronbach alpha coefficients (α = .62, .43, and .39, respectively). A decision was

therefore made to remove competence need satisfaction from the analyses (for both the walk leader and programme). The ICC's indicate that between 50 and 71 percent of the variance in the study variables was attributed to the intra-individual level. Correlation analysis of the relationship between need satisfaction derived from the walk leader and need satisfaction derived from the programme at all three time points revealed coefficients ranging from small (autonomy need satisfaction, $r = 0.28$) to high (relatedness need satisfaction, $r = 0.72$) in size, with 4 out of the 6 variables scoring below $r = 0.5$). This indicates that need satisfaction derived from both sources may be distinct and confirms the initial decision to measure them separately (manipulation check).

Table 3.2 Range of scales, Cronbach's alphas, means, standard deviations and intra-individual correlation coefficients of all study variables.

		Time 1			Time 2			Time 3			
Variable	Range of Scales	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α	*ICC*
Subjective Vitality	0-7	3.63	1.04	.88	4.59	1.15	.91	4.15	1.44	.74	0.45
Physical Activity	-	1168	1684	-	2074	1744	-	1554	1557	-	0.29
Autonomy Support (leader)	0-7	4.9	0.87	.94	4.9	0.87	.94	4.9	0.87	.94	-
Autonomy Support (programme)	0-7	4.4	0.94	.87	4.4	0.94	.87	4.4	0.94	.87	-
Autonomy (leader)	0-7	4.63	1.12	.79	4.95	0.97	.73	5.0	0.90	.72	0.48
Relatedness (leader)	0-7	5.45	0.91	.76	5.48	0.92	.68	5.45	0.91	.73	0.43
Autonomy (programme)	0-7	4.73	0.74	.76	4.86	0.81	.61	4.95	0.82	.61	0.42
Relatedness (programme)	0-7	5.12	0.77	.84	5.06	0.84	.79	5.09	0.82	.77	0.50

***Note*: Time 1, 2 and 3 is baseline, post intervention (week 16) and at 4 month follow up respectively**

Testing Hypothesis 1: Autonomy Support as a Predictor of Change in Subjective Vitality and Physical Activity.

Table 3.3 shows that autonomy support-walk leader positively predicted change in subjective vitality from baseline to post-intervention, but not at the four month follow up. Conversely, autonomy support-walk leader positively predicted change in physical activity from baseline to four month follow up, but not post-intervention. Autonomy support-programme positively predicted change in subjective vitality from baseline to post-intervention, but not at the four month follow up. Change in physical activity was not predicted by autonomy support-programme.

Table 3.3: Unstandardised Coefficients and Standard Errors Exploring Autonomy Support (AS) as a Predictor of Change in Subjective Vitality (SV) and Physical Activity (PA)

	Predictor Variables			
Outcome Variables	AS-Walk leader *b*(*SD*)	AS-Programme *b*(*SD*)	Baseline levels of outcome variable *b*(*SD*)	Adjusted R^2
PA post-intervention		-315.63(264.27)	.27(.22)	.03
	-312.54(282.81)		.28(.22)	.03
PA follow up		116.16(170.68)	.94(.13)***	.61
	397.70(174.91)*		.96(.12)***	.66
SV post-intervention		.30(.14)*	.56(.12)***	.34
	.38(.15)*		.55(.11)***	.36
SV follow-up		.16(.23)	.65(.17)***	.27
	.13(.23)		.65(.17)***	.26

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Testing Hypothesis 2: Mediation Effects of Psychological Need Satisfaction on Perceived Autonomy Support and Outcome (Subjective Vitality and Physical Activity) Relationships.

Tables 3.4 and 3.5 show that no direct associations were found between either source of autonomy support and the two outcome variables. Nonetheless, mediation effects can be established without direct effects being observed (MacKinnon & Fairchild, 2009), hence, tests for mediation were continued.

As shown in Table 3.4, conducting the first step in Krull and MacKinnon's (2001) guidelines revealed that perceived autonomy support-walk leader significantly predicted autonomy and relatedness need satisfaction derived from the walk leader. Results of the second step showed that changes in autonomy need satisfaction derived from perceived autonomy support from the leader positively predicted total physical activity and subjective vitality after controlling for autonomy support-walk leader. Sobel tests confirmed that autonomy need satisfaction mediated the relationship between autonomy support-leader and subjective vitality (b = .26, p = .01), as well as autonomy support-leader and physical activity (b = 445.87, p = .01). Changes in relatedness need satisfaction were not associated with greater levels of physical activity or subjective vitality, after controlling for autonomy support, therefore mediation effects were not substantiated.

Table 3.4 Regression coefficients, standard errors for the 66 hypothesised mediation models for perceived autonomy support (AS) from the walk leader (Predictor); basic psychological needs from the leader (Mediator); subjective vitality and physical activity (Outcomes)

Step	Predictor	Outcome	*b (SE)*
Perceived Autonomy Support		Autonomy	Subjective Vitality
Direct effect	Perceived AS	Subjective Vitality	.24(.15)
1	Perceived AS	Autonomy	.75(.10) ***
2	Autonomy	Subjective Vitality	.35(.13) *
Perceived Autonomy Support		Relatedness	Subjective Vitality
Direct effect	Perceived AS	Subjective Vitality	.24(.15)
1	Perceived AS	Relatedness	.59(.08) ***
2	Relatedness	Subjective Vitality	.05(.15)
Perceived Autonomy Support		Autonomy	Physical Activity
Direct effect	Perceived AS	Physical Activity	-.147.31(163.11)
1	Perceived AS	Autonomy	.75(.10) ***
2	Autonomy	Physical Activity	594.49(224.47) **
Perceived Autonomy Support		Relatedness	Physical Activity
Direct effect	Perceived AS	Subjective Vitality	-.147.31(163.11)
1	Perceived AS	Relatedness	.59(.08) ***
2	Relatedness	Physical Activity	-251.98(237.69)

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Regarding the wider walking programme context, results shown in Table 3.5 revealed that autonomy support significantly predicted autonomy and relatedness need satisfaction derived from the walking programme. However, results of the second step revealed that neither relatedness nor autonomy need satisfaction predicted subjective vitality or physical activity. As a result, no mediation effects of autonomy and relatedness need satisfaction were substantiated.

Table 3.5: Regression coefficients, standard errors, for the 68 hypothesised mediation models for perceived autonomy support from the programme (Predictor); basic psychological needs (Mediator) of the programme; Subjective vitality and physical activity (Outcomes)

Step	Predictor	Outcome	*b (SE)*
Perceived Autonomy Support		Autonomy	Subjective Vitality
Direct effect	Perceived AS	Subjective Vitality	.19(.14)
1	Perceived AS	Autonomy	.33(.08) ***
2	Autonomy	Subjective Vitality	.32(.17)
Perceived Autonomy Support		Relatedness	Subjective Vitality
Direct effect	Perceived AS	Subjective Vitality	.19(.14)
1	Perceived AS	Relatedness	.22(.09) *
2	Relatedness	Subjective Vitality	.29(.18)
Perceived Autonomy Support		Autonomy	Physical Activity
Direct effect	Perceived AS	Physical Activity	-198.96(146.03)
1	Perceived AS	Autonomy	.33(.08) ***
2	Autonomy	Physical Activity	196.07(285.57)
Perceived Autonomy Support		Relatedness	Physical Activity
Direct effect	Perceived AS	Physical Activity	-198.96(146.03)
1	Perceived AS	Relatedness	.22(.09) *
2	Relatedness	Physical Activity	25.99(156.48)

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

Promoting the adoption and maintenance of physical activity is a growing public health priority (Department of Health, 2011). Investigating determinants of exercise motivation has become an important area to aid the understanding of the motivational processes that underpin behaviour change (Fortier, Duda, et al., 2012). From a Basic Needs Theory (Ryan & Deci, 2000) perspective, the aim of this study was to build on previous work within various lifestyle domains (Rouse et al., 2011; Fortier et al., 2012; Moustaka et al., 2012; Rahman et al., 2011; Williams et al., 2002) by exploring the unique contributions of sources of autonomy support (provided via a walk leader versus the overall programme) to psychological need satisfaction, subjective vitality and physical activity from baseline to week 16 (post-intervention) and at a 4 month follow-up. Furthermore, the study aimed to examine the mediating effects of autonomy and relatedness derived from the walk leader and via the walking programme, separately on the relationship between perceived autonomy support and the outcome measures (subjective vitality and physical activity behaviour). Findings add to previous literature which has demonstrated the role of psychological need satisfaction, behaviour and well-being outcomes (Sebire, Standage, & Vansteenkiste, 2009).

Analysis showed that both sources of autonomy support could positively predict change in subjective vitality from baseline to post intervention although the walk leader was the key source of autonomy support in the prediction of changes to physical activity from baseline to four months following the end of the intervention. These results build on previous evidence (Moustaka et al., 2012; Ryan & Deci, 2000; Williams et al., 2002) by suggesting that aspects of a walking intervention beyond that of the walk leader can be perceived as autonomy supportive and predict changes in psychological well-being following the end of an intervention. Adding to extant research by Rouse et al., (2011) who differentiated between sources of autonomy support, the current study indicates that non-human sources can also be

perceived as autonomy supportive and predict satisfaction of both autonomy and relatedness need satisfaction. Further research is needed to explore this finding in more detail by pinpointing which aspects of support (i.e., text message, email, and motivational booklet) within the programme can enhance perceived autonomy support. By employing multi level modelling through ML-Win, it was possible to provide a longitudinal view of the data thus, allowing information of change over time rather than the snapshot that a cross-sectional design would provide. Furthermore, ML-Win allowed for theinclusion participants with missing data without compromising the ability to generalise the findings. In ML-Win,the data is non-independent and time points are nested within the individual, which not only reduces error but ensures that data represents intra-individual change and not simply a group change over time.

Perceived autonomy support from both the leader and the walking programme predicted the autonomy and relatedness need satisfaction derived from both the walk leader and the walking programme respectively. These results extend previous research supporting the premise of Basic Needs Theory (Ryan & Deci, 2000) that the provision of an autonomy supportive environment is associated with the satisfaction of the three basic psychological needs (Edmunds et al., 2008) and that it is possible to differentiate between sources of autonomy support (Rouse et al., 2011).

The findings also highlight that autonomy need satisfaction from the walk leader might explain the relationship between perceived autonomy support from the walk leader and subjective vitality plus total physical activity four months later. Contrary to the findings of Edmunds and colleagues (2008) but in accordance with those of Moustaka et al. (2012), the need for relatedness was not significantly associated with subjective vitality or physical activity derived from either perceived autonomy support from the walk leader or the walking programme. Relatedness however, has been shown to be key to the initial uptake of a

behaviour (Edmunds et al., 2008) and is considered necessary for autonomous forms of external motivation and well-being in the initial stages of the process (Rahman et al., 2011). Deci and Ryan, (1985) propose that relational support may not be necessary as proximal factors to maintain intrinsic motivation, which can be applied in the context of physical activity.

Autonomy need satisfaction is key to full internalisation which is deemed necessary for behaviour maintenance (Rahman et al., 2011). Results support the proposal of Deci and Ryan (1985); at four months following the end of the walking programme autonomy need satisfaction is the only significant mediating influence on physical activity behaviour. Long-term behaviour is linked to a more internalised motivation (Edmunds et al., 2008) when autonomy need satisfaction is met and thus, providing an explanation for autonomy need satisfaction being the key mediator and not relatedness when predicting long-term adaptive outcomes. As Moustaka et al. (2012) suggested; within the context of physical activity, individuals do not necessarily partake in an activity for the social context but for physical fitness, an improvement of health or to improve their physique. In the present study, for the first 10 weeks participants took part in walking groups. Within this context one could expect the satisfaction of relatedness to be prominent (Edmunds et al., 2008). It is possible that the participants felt a connection with other members of their walking group and therefore satisfied the need for relatedness through their walk peers. Depending on the interpretation of the questions relating to the perceived autonomy support from the walking programme, the participants may not have reported this aspect when completing the questionnaire and thus impacting on the results. For example, if the participants did not include their peers as part of the walking programme they may not have reported a feeling of relatedness. As there were several walk leaders involved in the intervention and the groups changed continuously, relatedness need satisfaction may not have developed from interactions with any particular

leader. Rouse et al. (2011) indicated that perceived autonomy support from a significant other, not directly involved in an exercise referral programme (i.e., partner, clinician or offspring), could have a positive influence on physical activity behaviour and psychological well-being. Relational support was not measured from beyond the programme. This could also have had an influence on the levels of relatedness perceived by the individual.

Contrary to previous studies (Edmunds et al., 2008; Moustaka et al., 2012) our results show that there were no significant direct effects of perceived autonomy support from either the walk leader or the walking programme on subjective vitality and total physical activity (including a 4 month follow up). This suggests that the outcomes of subjective vitality and physical activity are not a direct result of perceived autonomy support from the programme or the walk leader but rather, in this case, as a consequence of autonomy need satisfaction achieved from the walk leader through perceived autonomy support of the walk leader. With this in mind, future research should include measures of need satisfaction from the intervention experience as a whole (i.e., walk leader and walking programme) as well as separately. This will enable researchers to explore whether the effects of perceived autonomy and relatedness can be strengthened when considering perceived autonomy support from separate elements collectively within a programme (i.e., emails versus text).

Limitations and Future Direction

As well as the strengths within this study, it also possesses a number of limitations. Firstly, the inclusion of participants from one university setting limits the generalisability of the findings. Future studies involving more male exercisers that take place outside of a university setting would be beneficial. The walk leaders received one 2-hour long workshop to educate them in creating an autonomy supportive environment. More research is needed to determine optimum training levels and strategies to educate walk leaders in the provision of autonomy

support. Questions could be raised regarding the fidelity of the delivery of the techniques because there was more than one walk leader and it is possible that their techniques on the provision of autonomy support could have been influenced by individual differences.

Competence need satisfaction was removed from the analysis in this study due to poor Cronbach alpha scores. This is a limitation because competence need satisfaction has been shown to decrease in certain exercise groups lacking in autonomy support (Moustaka et al., 2012). Increases in competence need satisfaction with a control group were also highlighted in separate research (Edmunds et al., 2008). Rahman et al. (2011) suggested in the context of exercise referral that patients' confidence in their ability to exercise has a significant impact on the likelihood of programme completion. This therefore indicates that further knowledge is needed surrounding competence need satisfaction as well as autonomy and relatedness need satisfaction. Future research within a lifestyle physical activity context could consider competence need satisfaction of completing a programme as well as competence associated with the behaviour itself.

Limitations regarding the measurement of autonomy support to effectively differentiate fully between perceived autonomy support of the leader and the programme deserve further mention. For example one of items from the HCCQ "*Through the walking programme I have felt understood"* could be understood to involve a consideration of the walk leader as part of the broader programme. Future research could consider implementing a randomised controlled trial where participants either experience a supervised programme (with a walk leader) or a non-supervised programme (without walk leader) in order to achieve a true comparison. Preliminary analysis indicated that it was appropriate to measure need satisfaction from the walk leader and need satisfaction from the walking programme separately, as they were relatively distinct. However, including a control group could further

address issues surrounding perception of need satisfaction and autonomy support that may overlap.

Implications to Practice

The findings of study 2 carry practical implications that should be considered in the promotion of physical activity. The positive effects from autonomy support from the walk leader on physical activity and subjective vitality were predicted up to 4 months post-intervention This supports the rationale of training walk leaders within a walking programme to create an autonomy supportive environment to improve long-term physical activity adherence. However, as the findings show, attention must also be paid to other techniques (i.e., using text messages, motivational booklets and emails) within an intervention that could be used to satisfy the basic psychological needs of autonomy and relatedness which have been linked to long term persistence to physical activity and psychological well-being (Edmunds et al., 2008; Fortier, Duda, et al., 2012; Rahman et al., 2011). Furthermore non-human sources can also be perceived as autonomy supportive.Using such tools in an autonomy supportive manner could improve the efficiency and effectiveness of programmes designed to promote a physically active lifestyle.

Conclusion

It has been suggested previously (Edmunds et al., 2008; Rouse et al., 2011; Fortier, Sweet; Moustaka et al., 2012) that autonomy support plays a key role in need satisfaction, exercise adoption and maintenance. Our results suggest that these environments are not necessarily created solely by the walk leader (the individual in the position of authority). The individual may also perceive autonomy support from non-human sources (i.e., emails or text messages) which, as a consequence lead to satisfaction of the basic psychological needs (autonomy and

relatedness). Perceived autonomy support from a non-human source was also able to predict changes over time to psychological well-being and physical activity behaviour. Whilst considering the results of this study and previous research, by creating environments that can facilitate perseverance to exercise (autonomy support), it is possible to design and implement a more effective and successful walking intervention designed to increase long term physical activity participation in physically inactive adults.

CHAPTER 4

Study 3:

THE EFFECT OF AUTONOMY SUPPORTIVE TEXT MESSAGES ON MOTIVATION, PSYCHOLOGICAL WELL-BEING AND PHYSICAL ACTIVITY BEHAVIOUR

Abstract

Objective: Text messages or SMS (short messaging service) have been used, alongside other intervention components, to support health behaviour change (i.e., smoking cessation, physical activity). Few SMS studies have used a theoretical underpinning (Cole-Lewis & Kershaw, 2010) therefore, the study aimed to explore the effects of SMS, based on principles of Self-Determination Theory (SDT; Deci & Ryan, 2000), in the promotion of physical activity (PA) behaviour and psychological well-being in beginner exercisers.

Method: Sixty five beginner exercisers were included in the 10 week intervention (n=61 females, 4 male; BMI M= 24.06 kg/m^2, SD = 5.49; Age range= 18-66 years, M=25.7, SD = 10.23). Participants were randomised to an intervention group (autonomy supportive SMS) or control group (neutral SMS). Text messages were sent bi-weekly at random times between 9am – 6pm Monday to Friday via an online text service. The messages were constructed based on the individual participant's 5 most prominent motives to exercise (EMI-2). Outcome measures included perceived autonomy support, psychological need satisfaction, motivation (BREQ-2), positive and negative affect, quality of life and PA. Self-report PA (minutes) was also measured at a four month follow up.

Findings: A series of mixed design ANCOVA's revealed increased levels of autonomy support and psychological need satisfaction (p<.01) in the intervention group as a result of the intervention. Moderate intensity physical activity was significantly greater in the experimental than the control group at 4 month follow-up (p<.05). Improvements to levels of vigorous intensity PA, identified regulation and intrinsic motivation, quality of life and negative affect occurred in both groups (p<.05) as a result of the intervention.

Conclusion: The findings provide some preliminary causal evidence to support the use of SDT-grounded SMS messages to optimise physical activity behaviour change in novice exercisers.

Introduction

Despite a wealth of evidence showing that physical inactivity contributes to overweight, obesity (Department of Health, 2011) and chronic non-communicable diseases (Lee et al., 2012), over two thirds of the population in the UK (60% of adult males and 75% of adult females) do not meet the recommended levels of physical activity to improve or maintain health. Current public health guidance encourage individuals between the ages of 18-64 years old to accumulate 150 minutes (2.5 hours) of moderate intensity activity bouts per week in bouts of 10 minutes or more (Department of Health, 2011).

Physical activity interventions aimed at increasing levels of physical activity, within a physically inactive population, have shown significant benefits to both physical (Haerens et al., 2006) and psychological well-being (Netz et al., 2005). However adherence to a physically active lifestyle is still a concern with an average of 50% of participants discontinuing participation within 6 months of starting (Buckworth & Dishman, 2002). There is an urgent need to identify effective interventions. Some strategies, for example pedometers (Baker et al., 2008) and self-report paper diaries (Thøgersen-Ntoumani et al., 2010) used for self-monitoring purposes, have been successful at increasing motivation in adult participants attempting to adopt physically active behaviours.

The Role of Text Messages in Health Promotion

More recently, technological devices have been introduced to support health behaviour changes. Text messaging or SMS (short message service) operates on essentially all mobile phones. With 5.9 billion mobile-cellular subscriptions, and approximately 87% of the global population owning a mobile phone (ITU, 2011) a SMS can be a powerful health promotion tool to reach a large portion of the population instantly, with little expense, and without requiring great technological expertise. Mobile phones are used widely by adults with low

self-rated health (Koivusilta, Lintonen, & Rimpelä, 2007) and high BMI (Lajunen et al., 2007) demonstrating their potential usefulness in health promotion initiatives targeting hard-to-reach groups. SMS text messages have been used with some success as a tool in conjunction with other intervention components, to facilitate smoking cessation (Berkman, Dickenson, Falk, & Lieberman, 2011), change sexual behaviour practices; (Gold et al., 2011), facilitate weight loss (Shapiro et al., 2012; Patrick et al., 2009) and to optimise physical activity behaviour change (Kim & Glanz, 2013; Prestwich et al., 2010). Studies have shown that prompts and reminders via messaging (e.g., emails, text messages) are an effective method to encourage and reinforce healthy behaviours (Fry & Neff, 2009). However, given the immature nature of the field, further research is needed to address gaps and limitations of the literature available. This is particularly the case for preventative health care as focus has been predominantly from a clinical health perspective (i.e., diabetes management; Kim, 2007). Existing research has lacked general scientific rigour (Cole-Lewis & Kershaw, 2010) with few studies reaching statistical power to detect significant differences because of low sample sizes (Kim & Glanz, 2013). Studies have not always isolated the effect of text message technology (e.g., Newton, Wiltshire, & Ranina Elley, 2009) and very few have examined the long-term effects of text messages (Hurling et al., 2007; Kim & Glanz, 2013).

Messaging Interventions and Behavioural Theory

Research has shown that messaging interventions designed and measured using behavioural theory are more likely to be successful (Pelletier & Sharp, 2008) allowing for better understanding of the mechanisms of change (Van't Riet, Ruiter, Werrij, & de Vries, 2010). However, few studies involving text messages are underpinned by theory (Cole-Lewis & Kershaw, 2010; Shapiro et al., 2012). While some researchers have attempted to incorporate constructs of multiple behaviour change theories (i.e., Theory of Planned Behaviour and

Reasoned Action; Ajzen, 1985, 1987, Health Belief Model; Janz & Becker, 1984), they have not been explicit in the description of the theoretical constructs that are being targeted (Fjeldsoe, Marshall, & Miller, 2009). Examples of the few existing studies that have employed a theoretical underpinning include Fjeldsoe, Miller, and Marshall (2010) and Shapiro et al. (2012) who used constructs of Social Cognitive Theory (Bandura, 2007) and Prestwich et al. (2010) who employed implementation intentions to increase physical activity and weight loss behaviours in a physically inactive population.

Self-Determination Theory

As detailed in previous chapters Self-determination Theory (SDT; Deci & Ryan, 2000) has been applied successfully to a range of life settings, including health and physical activity (Ng et al., 2012; Teixeira et al., 2012). SDT theorists posit that an individual will posses more or less self-determined motivation to engage in a particular behaviour (i.e., physical activity). Within SDT it is proposed that the quality of motivation lies on a continuum which distinguishes types of behavioural regulation varying in the extent to which they are self-determined. This includes autonomous motivation (intrinsic regulation, identified regulation), controlled motivation (introjected regulation, external regulation) and amotivation (Ryan & Deci, 2000). An individual with amotivation will typically hold the belief that the activity will not result in desired outcomes (Markland & Tobin, 2004). External regulation is evident when an individual engages in a behaviour because of external pressures; to satisfy others or for a financial incentive. External regulation has consistently been shown to be a negative predictor of adherence to physical activity (Teixeira et al., 2012). Introjected regulation, an internally controlling type of regulation is commonly posited to be related to more maladaptive outcomes, i.e., negative affect, a sense of guilt and lowered self esteem (Deci & Ryan, 2000). However, Ingledew and Markland, (2008) suggested that possessing controlled motivations is

not necessarily problematic if an individual also displays high levels of self-determined regulations (identified regulation and/or intrinsic motivation). Thøgersen-Ntoumani and Ntoumanis, (2006) also showed that both introjected and identified regulation (the most autonomous form of external regulation) can be a positive predictor of exercise intentions. Edmunds, Ntoumanis and Duda, (2006) suggested that because persistence to a physically active lifestyle requires a large amount of effort and is often repetitive in nature, identified regulation may be more important than exercising for fun and enjoyment(i.e., health benefits as a result of a physically active lifestyle). Finally, intrinsic motivation is associated with positive behavioural outcomes and sustained behavioural changes in the health domain (Ng et al., 2012).

Autonomy Support and Text Messages

According to SDT, the social contextual environment (i.e., autonomy support) can facilitate the internalisation process whereby an individual begins to actively endorse the utility of performing a particular behaviour and this, in turn, is shown to predict adaptive outcomes (i.e., behavioural engagement, maintenance and well-being; Fortier et al., 2012). Autonomy support can be provided by significant others who play instrumental roles in shaping an individual's experience within a particular domain (including, for example exercise instructors or general health practitioners). Intervention research in the physical activity domain has provided support for these processes (Teixeira et al., 2012). Moustaka et al., (2012) and Edmunds et al., (2008) both tested an autonomy supportive teaching style within the context of an exercise classes (8 weeks and 10 weeks respectively). The intervention group in both studies reported increases in autonomous motivation. However, it was not possible, in either study, to determine whether other influences (i.e., significant others)

beyond the programme could have provided autonomy support and their independent roles in achieving the desired outcomes.

Further research, is therefore needed to explore who, or indeed what, can provide autonomy support and the unique impact of each source on the individual's initial motivation, intentions to be active and associated psychological well-being. Williams et al., (2006) demonstrated that abstinence to tobacco was predicted by autonomy support from a health care professional and by important others. No distinction, however, was made between the two to fully understand if autonomy support from both sources made a unique or similar contribution towards behavioural and affective outcomes. Rouse et al. (2011) is the only study, to the knowledge of the author, within the context of physical activity that has differentiated between different sources of autonomy support to show the unique contribution of a pre-specified significant other. Rouse et al., (2011) showed that effects of autonomy support on mental health and physical activity intentions differed as a function of who provided the support (offspring, partner or physician), with a partner or physician having the stronger effects. Current research has focused on creating an autonomy supportive environment through a figure of authority (i.e., exercise professional) (Edmunds et al., 2008; Moustaka et al., 2012). No SDT grounded research has previously investigated the possibility that an inanimate object could provide a source for autonomy support or has the theory been applied in the development and delivery of a text message intervention. Participants of the *MobileMums* 12 week, SMS based, physical activity intervention for post natal women (Fjeldsoe et al., 2010) reported a perceived personal connection from the text messages they received. The personal connection described can be associated with feelings of relatedness (feeling related to, connected to, and accepted) and indicates that it could be possible to increase need satisfaction via SMS.

The Development and Design of Text messages

Developing and designing appropriate messages within the limited character space available (160 characters) is a challenge and has been the focus of some research, albeit very little (Hingle, Nichter, Medeiros, & Grace, 2012; Redfern et al., 2012). Redfern et al., (2012) and Hingle et al. (2012), separately, developed a bank of text messages from pilot research and participant feedback, based on behaviour change techniques used in conventional interventions (Abraham & Michie, 2008). Conventional behaviour change techniques can be viewed in Abraham and Michie's (2008) Taxonomy of Behaviour Change Techniques and includes 26 behaviour change techniques with definitions. Examples include; prompting barrier identification, provide general encouragement, prompting self-monitoring goals. The final bank of messages were semi-personalised messages (i.e., names, age, motives, behavioural goals, behavioural barriers, and medical status) to increase engagement but not fully personalised to keep costs to a minimum. Previous research has agreed that tailored messages including motivations to exercise were more successful than un-tailored messages (Suggs, 2006).

The Exercise Motivation Inventory (EMI-2: Markland & Ingledew, 1997) consists of a number of motives for engagement to exercise that are more intrinsically-oriented (e.g., affiliation, enjoyment) and likely to be experienced as autonomous whereas others are extrinsically-orientated (e.g., body-related motives such as weight management) and are likely to be experienced as internally controlling. Given that studies have shown a consistent positive association between more intrinsic motives and exercise (Teixeira et al., 2012) the text message should acknowledge the specific motive (extrinsic or intrinsic) whilst supporting identification with the outcomes and thus facilitating an autonomous form of external regulation (Ryan & Deci, 2000).

Limited information on specific process measures has been reported on message development, within text message interventions (Cole-Lewis & Kershaw, 2010), making the assessment of different delivery mechanisms difficult because the fundamental elements of message content are not provided (Whittaker et al., 2009). As suggested by Redfern et al., (2012) and Fjeldsoe et al., (2009) future studies should explicitly describe the mechanisms and text message characteristics (dose, message content, number sent, number received) used to promote behaviour change in order to progress the research. The frequency of text messages sent has previously reflected the expected frequency of the targeted behaviour (e.g., smoking: five times per day or physical activity: five times per week) (Fjeldsoe et al., 2009), however some have varied significantly. For example, Gold et al. (2011) sent 12 text messages over a 6 month period in a sexual health awareness intervention and Kim & Glanz (2013) sent 3 text message per day for 6 weeks to increase walking behaviour.

Text Messages in Existing Interventions

Fjeldsoe et al. (2010), Hurling et al. (2007) and Kim and Glanz (2013) all used text messages in conjunction with other intervention components to increase physical activity. For example Fjeldsoe et al. (2010)'s text message based intervention (MobileMums) resulted in increases to moderate and vigorous physical activity however, the mothers reported high use of other intervention components (i.e., social support, a goal setting fridge magnet). Cole-Lewis & Kershaw (2010) emphasised that text messages should not be a standalone model for behaviour change however, it is important to understand the extent that the text messages themselves, can increase the motivation of an individual whilst minimising confounding variables (i.e., significant other, paper diaries, pedometers, emails). This is particularly pertinent if the theoretical framework has not yet been explored within the delivery of SMS which is the case for Self-Determination Theory).

Following a 12 month text message intervention aimed at encouraging weight loss, Shapiro et al. (2012) found that adherence to the text messaging was associated with improvement in weight-related behaviours and weight outcomes at 6 and 12 months. Shapiro et al. (2012) however, like Hurling et al. (2007) and Kim and Glanz (2013) used a financial incentive which also could impact on the extrinsic motivation to adhere to the programme. No follow up information was provided. The current study offers no such financial gain in order to eliminate controllable external factors that could impact on the motivation to engage in physical activity. In line with SDT, controlled forms of extrinsic motivation (i.e., financial remuneration) are expected to motivate short-term behaviour (Ryan & Deci, 2000; Thøgersen-Ntoumani & Ntoumanis, 2006), a point which is supported in the aforementioned studies. However, individuals externally driven are less likely to sustain an activity (Deci & Ryan, 1985) and with a lack of follow up data the long-term effect of the text-messages remains unclear. The aim was to improve autonomous motivation through autonomy supportive messages and facilitate long-term behaviour change in line with SDT.

Aims and Hypotheses

In light of the existing research and using a randomised controlled intervention, the overarching aim of this study was to investigate the unique effects of tailored text messages, based on principles of SDT, compared to neutral text messages in the promotion of physical activity behaviour and psychological well-being within a physically inactive population beginning a series of exercise classes. These effects were investigated whilst controlling for a variable (perceived autonomy support from the exercise class instructor) that has previously shown to affect outcomes (Moustaka et al., 2012). To contribute to the gap in literature regarding deliver mechanisms of text messages the messages were initially piloted and details of their development were included to compare the theory driven messages to neutral

messages. It is proposed that those in the intervention group will report greater levels of perceived autonomy support (H1) need satisfaction (H2) and experience a higher quality of motivation in comparison to the control group (H3). It is also hypothesised that those receiving autonomy supportive text messages will experience increases in self-reported physical activity (H4), quality of life, positive affect and will report reductions in negative affect (H5) as a result of the intervention.

Methods

Pilot

A pilot study testing the content of the text messages was conducted prior to the intervention to determine if the intervention messages were perceived as autonomy supportive and the control messages were perceived as neutral. A list of neutral and autonomy supportive messages (based on dimensions of SDT; please see Table 4.1), written by the first author (FK), were randomly mixed into one questionnaire and given to five experts in the field of Self-Determination Theory (doctoral researchers and academic staff).

Table 4.1: Dimensions of SDT included in the autonomy supportive texts in relation to each psychological need

Autonomy	Providing a meaningful rationale - information
	Enhance perceptions of value of activity
	Provision of choice and variety
	Facilitating enjoyment
Relatedness	Social Support – trust/feel connected to
	Respect, understanding & care
	Acknowledge negative feelings associated with the activity
Competence	Confidence - information, relevant feedback
	Help setting challenging goals
	Advice on resisting and overcoming barriers
	Focus on intrinsic goals i.e., health, personal growth

The field experts rated the text messages based on how autonomy supportive they perceived the messages to be on a scale ranging from 1 (not at all autonomy supportive) to 7 (highly autonomy supportive). They were also encouraged to provide further comments and feedback. A paired samples *t*-test was used to analyse the difference between the 2 groups of messages. Text messages were altered if deemed necessary based on the results and feedback of the pilot.

Participants

Following approval from an ethics board within a large UK University, a total of 102 participants volunteered to participate in the study. Participants were included if they were physically inactive according to the recommended levels of physical activity set for adults by

the Department of Health (2011), owned a mobile phone and were participating or intended to participate in their first week of exercise classes following a physically inactive period of at least 2 years. Of the 102 who volunteered, 24 did not meet the inclusion criteria, 9 experienced problems with their mobile phones (could not receive messages, lost phones, changed number, incorrect number given) and therefore their data was not included in the analysis. A further 4 participants did not provide sufficient baseline data to be included in the intention to treat analyses. A total of 65 physically inactive participants were therefore included in the 10 week text message based intervention (*n*=61 females, 4 male; BMI *M*= 24.06 kg/m^2, *SD* = 5.49; Age range: 18-66 years, *M*=25.7, *SD* = 10.23). Participants were recruited via advertisements on the university website and posters located in the sports centre where the exercise ('Active Lifestyle') classes took place. Over a one week period (the recruitment period), the primary researcher attended a total of 25 exercise classes that were part of the 'Active Lifestyles' programme at the university sport centre in order to recruit participants and complete baseline measures. The classes consisted of a range of activities including aerobic, toning or dance elements.

The Intervention

Participants were randomly allocated to one of two groups, the intervention group, *n*=34, ('autonomy supportive SMS') or the control group, *n*=31, ('neutral SMS'). Participants were not given instructions on how many or which classes to attend. Each participant received 2 text messages per week to their personal mobile phones for a total of 10 weeks. The length of the intervention was determined by the duration of the structured group exercise classes which took place only during the University autumn term.

The intervention group received autonomy supportive framed messages (e.g., minimising pressure and control, supporting individual volition, offering choice, provide

respect, understanding and care, advice on resisting and overcoming barriers, acknowledging participant perspective and feelings and providing a meaningful rationale for engaging in the exercise classes). The control group received neutrally framed text messages (examples of texts sent to both groups can be seen in Table 4.2). Suggs, (2006) suggested that tailored messages were more effective than untailored. Therefore, all participants completed the Exercise Motives Inventory (EMI-2; Markland & Ingledew, 1997) once, prior to beginning the intervention, to assess their motives for engaging in the classes which helped to frame and personalise the autonomy supportive messages for the intervention group participants. The nature of the intervention messages were determined by the 5 most prominent motives for participating in the exercise classes. Each participant received different messages on each occasion.

Table 4.2 Examples of autonomy supportive text messages and neutral messages

Autonomy Supportive Text Messages
Stress Management
1. Hi ....! Feeling relaxed & experiencing a reduction in stress can be a fab benefit of regular exercise. These feelings can perhaps be intensified if you choose the activities that you enjoy.
Enjoyment
2. Hi ....! We understand that you may not always feel like going to your exercise class; if you are busy or the weather is bad. Perhaps try & think about the elements you enjoy, whether it's your favourite exercise or instructor?
Affiliation
3. Hi ....! You indicated that the social aspect of your physical activity is important to you. Exercising with friends can increase the positives of physical activity further! Who said gossiping was a bad thing?!
Ill-Health Avoidance
4. Hi ....! Osteoporosis, a common disease as you age can be offset by physical activity: no matter your age! It is possible for you to accrue the benefits by remaining physically active!
Positive Health
5. Hi ....! Are you generally feeling better in yourself, healthier and more energetic? By sustaining regular physical activity, these benefits can only improve further!!
Neutral text Messages
1. Physical activity includes "the full range of human movement, from competitive sport and exercise to active hobbies, walking and cycling or activities of daily living".
2. There are over 20 different activities to choose from within the 'Active lifestyle' timetable.
3. The British population spends around £110 billion on healthcare per year which is equal to 8.5% of all income.
4. The Government has set a target in England and Wales for 70% of the population (in Wales, people up to the age of 65) to be "reasonably active" by 2020
5. The economic benefits of physical activity extend beyond health to other sectors of the economy such as transport and environment.

One-way directional text messages were sent bi-weekly at randomised times between 9am – 6pm Monday to Friday via an online text service (www.textanywhere.com). Participants were not required to reply but did have the option should they want to comment or ask a question. The university exercise class system works on a credit basis which means that class attendees buy a specified number of credits to attend whichever exercise class they wished. Therefore the text messages were sent at random times throughout the week because participants may not have attended the same classes at the same time each week.

Participants were asked to complete a questionnaire and return it via post (they were given a pre-paid self addressed envelope) or via the university's internal postal system. Questionnaires were completed at baseline (week 0), at mid-intervention (week 5), post intervention (week 11) and at a four month follow up (please refer to appendix 3 for the questionnaires).

Measures

Body Mass Index

Height, measured with a Stadiometer, and weight, measured with an Omron BF508 Body Composition Scales (Omron, UK) were recorded at the point of recruitment by the researcher (first author) in order to calculate participants Body Mass Index (BMI). This was used as a descriptive variable to determine if there were any group differences between the intervention group and the control group.

Exercise Motivation Inventory

Participants' specific motives for engaging in exercise were measured, on a single occasion, baseline using the validated Exercise Motivation Inventory-2 (EMI-2; Markland & Hardy, 1993) and grouped according to the participants' scores. The EMI-2 classifies motives into 14 categories (i.e., stress management, enjoyment, social recognition). Some motives are

intrinsically-oriented (i.e., enjoyment) while others are extrinsically oriented (i.e., weight management). In line with principles of SDT, the participants who reported extrinsically oriented motives (i.e., weight management) were sent messages focusing on the personal value that the motive could hold for the participant. Each participant received text messages targeted to their 5 most important (i.e., highest scoring) motives. The categories have not been reported in the results as they were used to inform the content of the messages.

Health-Care Climate Questionnaire

Perceived autonomy support was assessed mid and post intervention used the 15 item Health-Care Climate Questionnaire (HCCQ: Williams, Grow, Freedman, Ryan, & Deci, 1996). The degree of perceived autonomy support provided by the exercise class instructor (e.g., *I feel the instructor has provided me with choices and options*) and the text messages (e.g., *The text messages convey confidence in my ability to make changes*) were measured separately. Participants responded to the autonomy support items on a 7-point likert scale (1 = *Strongly disagree*; 7 = *strongly agree*). Previous studies using the original HCCQ (Williams et al., 1996) have reported a Cronbach alpha value of .95.

Psychological Need Satisfaction Scale (PNSS)

Participants' perceptions of psychological need satisfaction (Baard et al., 2004) derived from the exercise class (e.g., Autonomy: *I am free to express my ideas and opinions within the class*, Competence: *Most days I feel a sense of accomplishment from the exercise classes*, Relatedness: *The people I exercise with tell me I am good at what I do*) and from the text messages (e.g., Autonomy: *The text messages take my feelings regarding exercising into consideration*, Competence: *The text messages help me feel a sense of accomplishment from exercising*, Relatedness: *The text messages demonstrate caring about me as a person*) were measured separately using adaptations of the 21-item Basic Need Satisfaction at Work Scale (Deci et al., 2001). Participants responded to the items on a 7-point likert scale ranging from 1

(*strongly disagree*) to 7 (*strongly agree*). This measure was administered at mid intervention (week 5) and post intervention. In a sample of U.S. workers, Deci and colleagues (2001) reported Cronbach alpha scores of .73 for competence, .84 for relatedness and .79 for autonomy. A smaller version of 9 items, namely 3 items per sub-scale, was used for need satisfaction derived from the text messages as some items in the longer scale were not deemed to be relevant (e.g., *"I get along with the people in my exercise class"*). The 9 item scale has shown internal reliability (Cronbach alpha scores above 0.9) in previous research on Interpersonal Need Satisfaction (La Guardia et al., 2000).

Behavioural Regulations to Exercise Questionnaire-2

Participants quality of motivation for engaging in exercise was measured at baseline and post intervention using the Behavioural Regulations to Exercise Questionnaire (BREQ-2; Markland & Tobin, 2004). The scale consists of 19 items and participants were asked to respond to the questions in terms of reasons for engaging in exercise. They were rated on a 5-point likert scale ranging from 0 (not true for me) to 4 (very true for me). The five subscales within the questionnaire represent intrinsic motivation (i.e., *I take part in the exercise class because it is fun*), identified regulation (i.e., *I take part in the exercise class because I value the benefits of exercising*), introjected regulation (i.e., *I take part in the exercise class because I feel guilty when I don't exercise*), external regulation (i.e., *I take part in the exercise class because others say I should*), and amotivation (i.e., *I take part in the exercise class but I don't see why I should have to exercise*). Internal reliability analyses have shown acceptable alpha Cronbach scores ranging from 0.73 to 8.86 (Markland & Tobin, 2004) for the five subscales.

Positive and Negative Affect (PANAS)

The Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) includes 20 items and was administered to measure general positive and negative affective valence at baseline and post intervention. This validated measure has been extensively used and has

shown high internal reliability with Cronbach alpha values estimated at .89 for the positive affect scale and .85 for the negative affect scale (Crawford & Henry, 2004). Participants rated their general positive and negative affect using a 5 point scale ranging from 1 (very slightly or not at all) to 5 (extremely).

Dartmouth COOP Charts

The Dartmouth COOP charts (Nelson et al., 1987) was used to measure quality of life at baseline and post intervention. The Dartmouth COOP consists of 9 items scored on a 5-point ordinal scale. Higher scores equate to a higher quality of life. The Dartmouth COOP Charts is a validated measure (Jenkinson, Mayou, Day, Garratt, & Juszczak, 2002) and has previously been used to measure quality of life in a Self-Determination Theory-based intervention to promote physical activity (Fortier, Duda, Guerin, & Teixeira, 2012).

Physical Activity Behaviour: 7-day Physical Activity Recall

The 7- day physical activity recall (7Day-PAR; Blair et al., 1985) was used to determine the duration and intensity of physical activities in the past week. Participants were asked to recall time spent engaging in different types of physical activity throughout the past 7 days (or a typical week of the last month, if the previous week was atypical). The measure was administered via questionnaire at baseline (for a baseline measure and eligibility for the study), post intervention and at the 4 month follow up. Participants were given examples of typical activities for moderate and vigorous intensities and rated each of them in minutes of time spent that week. Values from 'moderate' and 'vigorous' categories of intensity were summed separately to give scores (in minutes) of moderate intensity and vigorous intensity per week. Previous studies have supported the reliability and validity (against pedometer readings) of the 7-Day PAR as an accurate measure for self-reported physical activity (Wilkinson, Huang, Walker, Sterling, & Kim, 2004). A self-report measure of physical activity was deemed appropriate compared to an objective measure because the objective

measure could impact the motivation to exercise of the participant (self-monitoring) and could potentially have confounded the results.

Data Analysis

Independent samples *t*-tests were employed to test demographic and anthropometric differences (age, BMI and physical activity levels), as a manipulation check, between the intervention and control group at baseline. Attendance was also analysed using an independent samples t-test. Intention to treat principles (last observation carried forward for those with missing data) was employed to all analysis to minimise bias in the interpretation of the results.

A series of mixed design analyses of covariance (ANCOVA) were conducted using SPSS (19.0) to determine the effect of condition, time and their interaction on the outcome variables. Perceived autonomy support from the class instructor was treated as a time varying covariate (measured at mid and post intervention) to analyse the effects of the text messages whilst controlling for the effects of perceived autonomy support from the exercise class instructor. Tests of simple effects were conducted to identify where significant differences existed. Dependent variables included perceived autonomy support, psychological need satisfaction (autonomy, competence and relatedness), behavioural regulations (amotivation, external regulation, introjected regulation, identified regulation and intrinsic regulation), affect (positive and negative), quality of life and physical activity behaviour. Most mixed design analyses were 2 (condition; experimental versus control) x 2 (time: pre versus post). Physical activity was measured over 3 time points therefore a 2 x 3 mixed design ANCOVA was used for this variable. Effect sizes (partial eta squared) were classified based on Cohen's cut-points (small = 0.01, medium = 0.06, large = 0.14) (Cohen, 1988).

Results

Pilot to Test the Text Messages

Five experts in the field of SDT rated the randomised autonomy supportive and neutral SMS according to their perceptions of autonomy support from the messages. Feedback was given and the messages were changed accordingly. A paired sample t-test showed that the two groups differed in terms of autonomy support t (4) = 14.26, p<0.01. Autonomy supportive text messages (M=6.01, SD=.45) rated significantly higher in perceived autonomy support than the neutral text messages (M=2.5, SD=.18).

Descriptive Data

Table 4.3 provides descriptive data of the EMI-2 to show the mean and standard deviation of the motives to exercise of the participants. These motives were used to inform the content of the autonomy supportive text messages. Table 4.4 (intervention group) and Table 4.5 (control group) detail descriptive statistics (means, standard deviation and Cronbach α coefficients) for all variables. One item was removed from autonomy need satisfaction from the instructor and autonomy need satisfaction from the text messages to ensure that median internal consistency coefficients were all .70 or greater and therefore showing appropriate reliability according to DeVellis, (2003).

Table 4.3 Descriptive data for participant's motives to exercise measured at baseline (EMI-2).

Motive	Scale range	α	*M (SD)*
Stress Management	0-5	.78	3.16 (1.23)
Revitalisation	0-5	.79	3.47 (1.07)
Enjoyment	0-5	.84	2.78 (1.27)
Challenge	0-5	.72	1.82 (1.23)
Social Recognition	0-5	.82	0.79 (1.01)
Affiliation	0-5	.78	2.44 (1.28)
Competition	0-5	.88	0.72 (1.04)
Health Pressures	0-5	.92	1.11 (1.23)
Ill-Health Avoidance	0-5	.86	3.95 (1.05)
Positive Health	0-5	.96	4.05 (0.99)
Weight Management	0-5	.98	3.67 (1.24)
Appearance	0-5	.79	2.71 (1.38)
Strength and Endurance	0-5	.72	3.32 (1.02)
Nimbleness	0-5	.74	3.61 (1.13

Table 4.4. Intervention group descriptive statistics and internal reliability coefficients for perceived autonomy support, need satisfaction, motivation, psychological well-being and physical activity behaviour

Intervention Group		Pre		Mid		Post	4 month
Variables	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	*M (SD)*
Perceived Autonomy Support							
Instructor/Class	-	-	.95	4.9 (1.0)	.96	4.73 (1.05)	-
Text Messages	-	-	.89	4.13 (1.21)	.92	4.43 (1.29)	-
Perceived Need Satisfaction							
Text Messages							
Autonomy	-	-	.70	4.33 (1.59)	.71	4.82 (1.5)	-
Competence	-	-	.91	4.43 (1.6)	.93	4.69 (1.5)	-
Relatedness	-	-	.89	5.31 (1.1)	.89	5.3 (1.26)	-
Motivational Regulations							
Amotivation	.81	.24 (.59)	-	-	.72	.27 (.44)	
External	.78	.40 (.67)	-	-	.72	.43 (.56)	
Introjected	.76	1.22 (.74)	-	-	.70	1.33 (.69)	
Identified	.78	3.06 (.72)	-	-	.70	3.08 (.66)	
Intrinsic	.92	3.08 (.68)	-	-	.90	3.20 (.61)	
Positive Affect	.88	3.19 (.64)	-	-	.86	3.17 (.58)	-
Negative Affect	.90	1.78 (.76)	-	-	.87	1.69 (.58)	-
Quality of Life	.72	3.75 (.53)	-	-	.73	4.07 (.39)	-
Physical Activity (mins)							
Moderate	-	70.48 (50.2)	-	-	-	97.74 (80.2)	125.8 (112.1)
Vigorous	-	15.8 (25.11)	-	-	-	74.7 (83.08)	85.58 (86.17

Table 4.5 Control group descriptive statistics and internal reliability coefficients for perceived autonomy support, need satisfaction, motivation, psychological well-being and physical activity behaviour

Control Group		Pre		Mid		Post	4 month
Variables	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	*M (SD)*
Perceived Autonomy Support							
Instructor/Class	-	-	.95	4.83 (1.1)	.96	4.46 (1.22)	-
Text Messages	-	-	.89	2.94 (1.29)	.92	2.83 (1.2)	-
Perceived Need Satisfaction							
Text Messages							
Autonomy	-	-	.70	3.22 (1.4)	.71	2.98 (1.33)	-
Competence	-	-	.91	3.102 (1.59)	.93	2.95 (1.61)	-
Relatedness	-	-	.89	3.48 (1.33)	.89	3.4 (1.19)	-
Motivational Regulations							
Amotivation	.81	.31 (.5)	-	-	.72	.39 (.54)	
External	.78	.58 (.64)	-	-	.72	.69 (.70)	
Introjected	.76	1.46 (.96)	-	-	.70	1.51 (.96)	
Identified	.78	2.78 (.85)	-	-	.70	2.94 (.64)	
Intrinsic	.92	2.64 (1.24)	-	-	.90	2.88 (1.0)	
Positive Affect	.88	3.10 (.73)	-	-	.86	3.2 (.70)	-
Negative Affect	.90	1.94 (.8)	-	-	.87	1.67 (.59)	-
Quality of Life	.72	3.79 (.53)	-	-	.73	3.95 (.56)	-
Physical Activity (mins)							
Moderate	-	84.7 (79.78)	-	-	-	129.2 (184.07)	72.9 (80.9)
Vigorous	-	16.32 (27.6)	-	-	-	74.7 (83.08)	85.58 (86.1)

Manipulation check

At baseline, there were no statistically significant differences in demographic characteristics between the groups for age ($t(63) = .219$, $p = 0.83$), BMI ($t(63) = -.82$, $p = .42$), moderate physical activity $t(63) = -.85$, $p = .39$ and vigorous physical activity $t(63) = -.07$, $p = .94$, however there were significantly more females (n=61) than males (n=4) who took part in the study $t(63) = 2.002$, $p = 0.05$.

Testing Hypothesis 1: Perceived Autonomy Support from the Text Messages

A mixed design repeated measure ANCOVA yielded a significant main effect for group in the analysis of perceived autonomy support (F (1,58) = 25.67, p <.01, η^2= .22) indicating that the intervention group perceived greater levels of autonomy support from the text messages. A test of simple effects showed that the intervention group perceived significantly greater levels of autonomy support compared to the control group at both mid-point (p<.01) and post intervention (p<.01).

Testing Hypothesis 2: Autonomy Supportive Text Messages and Satisfaction of the Psychological Needs

Main effects for group were observed for perceptions of autonomy (F(1,61) = 20.5, p <.01, η^2= .19), competence (F (1,60) = 17.13; p <.01, η^2= .17), and relatedness (F (1,59) = 38.95, p <.01, η^2= .28). Tests of simple effects showed significant group differences for all three psychological needs in week 5 (p<.01) and at post intervention (week 10: p<.01).

Analysis of autonomy need satisfaction showed an interaction between group and time for (Figure 4.1); F (1,58) = 5.92, p <.01, η^2= .12. Further investigation showed that the intervention group reported increases in perceptions of autonomy need satisfaction as a result of the intervention (p<.05) with non-significant decreases in perceptions of autonomy in the

control group. The groups significantly differed at mid and post intervention (p<.01). Findings suggest that increases in competence and relatedness need satisfaction from the text messages occurred within the first 5 weeks of the intervention whereas satisfaction of autonomy derived from the text messages continued to increase into the latter stages of the intervention.

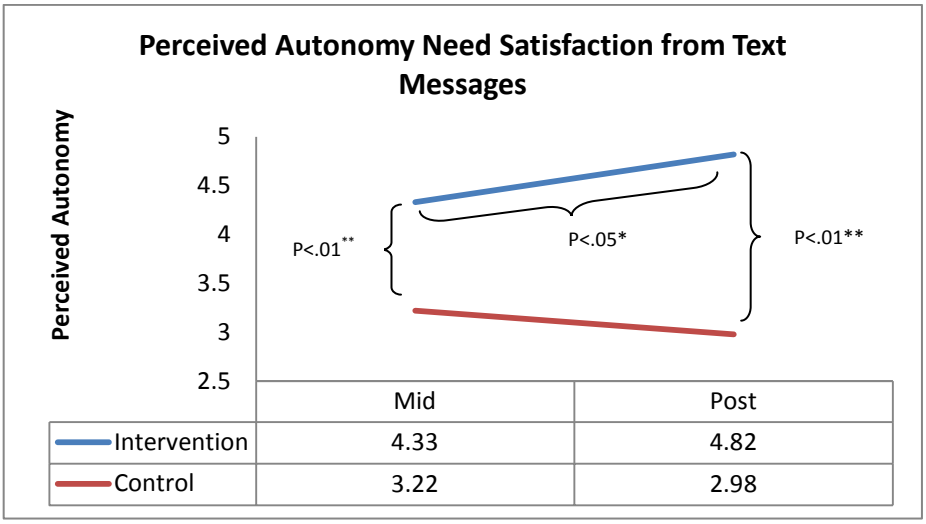


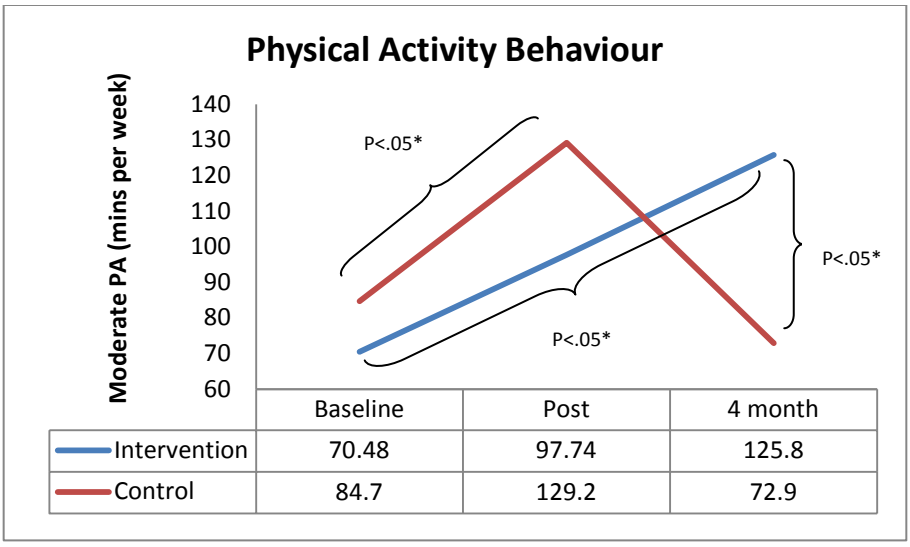
Figure 4.1: Interaction effect of perceived autonomy need satisfaction.

Testing Hypothesis 3: Autonomy Supportive Text Messages and Behavioural Regulations

Analysis of behavioural regulations revealed no significant main effect or interactions for amotivation, external regulation, and introjected regulation. A significant main effect for time was observed following analysis of identified regulation ($F(1,61) = 3.99$, $p < .05$, $\eta^2 = .06$) and intrinsic motivation ($F(1,61) = 6.85$, $p < .05$, $\eta^2 = .08$). Simple effects revealed that levels of identified regulation and intrinsic motivation increased in both the intervention and control group (p<.05) from pre to post intervention.

Testing Hypothesis 4 and 5: The Effects of Text Messages on Physical Activity Behaviour (H4) and Psychological Well-being (H5)

As shown in Figure 4.2, analysis of moderate intensity physical activity yielded a significant group by time interaction from baseline to the four month follow up; $F(1,58) = 4.4$, $p < 0.05$; $\eta^2 = .09$. Simple effects showed that the intervention group significantly increased their moderate intensity physical activity from baseline to the four month follow up ($p<.05$). Although the control group experienced an initial increase during the intervention ($p<.05$), their levels of moderate intensity physical activity had fallen back to similar levels as baseline at the four month follow up. At the four month follow up the intervention group engaged in significantly more ($p<.05$) moderate intensity physical activity than the control group.



	Baseline	Post	4 month
Intervention	70.48	97.74	125.8
Control	84.7	129.2	72.9

Figure 4.2: Interaction of moderate intensity physical activity over time.

Analysis of vigorous intensity exercise resulted in a significant time effect from pre-intervention to the four month follow up, ($F(1,60) = 38.13$, $p <.01$, $\eta^2 = .36$). No group effects or interactions were evident. Participants reported significantly higher levels of vigorous physical activity from pre to most intervention ($p<.01$). Although there was a increase from post intervention to the four month follow up, the increase was not significant (p=.34)

A mixed design repeated measures ANCOVA revealed significant time effects for improvements to both negative affect ($F(1,60) = 7.74$, $p = .01$, $\eta^2 = .09$) and quality of life ($F(1,62) = 21.07$, $p < 0.01$, $\eta^2 = .23$). Further investigation showed that quality of life significantly increased, in both groups, from baseline to post intervention ($p<.05$) and negative affect decreased in both group from pre to post intervention ($p<.05$). No main effects or interactions were seen in the analysis of positive affect however the time-varying covariate of perceived autonomy support from the class leader was significantly significant ($p<.05$) in the analysis of positive affect.

Discussion

Existing research supports the use of text messages as a useful tool, in conjunction with other components, to encourage behaviour change within a variety of contexts (i.e., smoking cessation; Haug et al., 2012, diabetes management; Kim 2007, and sexual health; Gold et al., 2012). This is attributed to SMS based interventions being resource efficient (Haug et al., 2012); having the ability to reach a large proportion of the population instantly, and in a cost effective manner. Using a randomised controlled design the overarching aim of this study was to investigate the effects of text messages, based on principles of SDT, compared to neutral text messages in the promotion of physical activity behaviour and psychological well-being within a physically inactive population beginning a series of exercise classes.

Text Messages and Perceived Autonomy Support

Results indicate that participants in the intervention group perceived greater levels of autonomy support from the text messages compared to those in the control group and thus supporting the first hypothesis. It is known, through existing research, that perceived autonomy support can predict need satisfaction (Ryan, Patrick, Deci, & Williams, 2008) and

consequently, if needs are satisfied, positive outcomes will occur (Teixeira et al., 2012). The intervention group, compared to the control group, perceived significantly higher need satisfaction from the text messages for all three needs (autonomy, competence and relatedness) at both mid-point and at the post intervention measure. This therefore supports our second hypothesis, and tenets of SDT, that an autonomy supportive text message based intervention can lead to increased need satisfaction and can be an effective tool used in the promotion of physical activity.

Text Messages and Psychological Need Satisfaction

Group difference of need satisfaction between the intervention and control group occurred within the first 5 weeks of the intervention. Satisfaction of the need for autonomy was the only psychological need to increase from mid to post measure within the intervention group. This supports the notion that autonomy need satisfaction is more likely to occur, or continue to increase, in the latter stages of an intervention (Williams et al., 2006) while competence and relatedness are likely to increase within the adoption phase of physical activity (Edmunds et al., 2008). Results extend the findings of Moustaka et al., (2012) and Edmunds et al., (2008) where autonomy need satisfaction was increased (in both studies) via perceived autonomy support of the class instructor within an exercise class setting by showing that other facets (i.e., text messages) can increase need satisfaction above and beyond that of the exercise instructor.. Autonomy need satisfaction decreased in the control group (although not significant) which may suggest that without autonomy support sustained autonomy need satisfaction is not possible. Further research is needed to determine this relationship.

Text Messages and Behavioural Regulations

No group differences were apparent for any behavioural regulations however both identified and intrinsic regulation did increase over time in both groups, which partly supports the third hypothesis. Research has suggested that, in beginner exercisers, intrinsic and identified behavioural regulations are likely to increase within the first 8 weeks whereas changes to more controlled regulations may take longer and are not stabilised within the first 6 months of regular exercise (Rodgers et al., 2010).

Text Messages and Physical Activity Behaviour

Moderate physical activity increased in the intervention group following the end of the intervention which supports the fourth hypothesis. SDT theorists posit that the satisfaction of the need for autonomy will result in positive behavioural outcomes (i.e., physical activity; Ng et al., 2012; Ryan & Deci, 2000) when the motivation to engage in the behaviour is internalised. It can therefore be suggested that the individuals, in the current study, who satisfied their need for autonomy were able to persist in moderate intensity physical activity once the text messages ceased. It was, however, not possible to determine whether this was a direct consequence of the text messages due to other confounding elements within a 'real life' setting that could have influenced motivation to engage in physical activity. Research has shown that autonomy support may be perceived from a variety of sources (Rouse et al., 2011; Williams et al., 2006). The particular source of autonomy support is important and therefore should be identified within an intervention (Rouse et al., 20011). All potential sources were not examined in this study. Although it was possible to control for the affects of the exercise class instructor in relation to their autonomy support, it was not possible to monitor or control for other sources of support (spouse or general practitioners) which have previously shown to increase levels of need satisfaction and intentions to exercise (Rouse et al., 2011). Further

research could investigate, more rigorously, unique sources of support beyond the intervention. Ronda, (2001) discusses that lifestyle physical activity has the greatest potential for physically inactive adults. Separate research suggests that moderate physical activity and self-paced physical activity is perceived as the most pleasant in terms of affective valence (Ekkekakis et al., 2011). The exercise intensity within the exercise class context is dictated by the instructor and was predominantly of vigorous intensity. It can therefore be argued that the beginner exercisers who perceived autonomy support and satisfied their need for autonomy self-selected moderate intensity exercise to experience more pleasurable feelings. Further, more rigorous research is needed to clarify these outcomes. Physical activity was measured using a self-report tool (7-day PAR) and included physical activity for the entire week and not solely from the exercise classes. Both groups attendance resulted in a mean attendance of 12 classes over the 10 weeks (although there was a large standard deviation in both groups). Further research should investigate if the text messages could influence other forms of physical activity, for example lifestyle physical activity (i.e., walking).

Text Messages and Psychological Well-being

Findings revealed no group differences in the improvements to quality of life or negative affect between the intervention group and the control group, partly supporting hypothesis five. It was not possible to determine whether the text solely (autonomy supportive or neutral) had an impact on this psychological improvement. Research has consistently reported the positive effect of physical activity on psychological well-being (Netz et al., 2005) therefore improvements could feasibly have been caused, or influenced, by other factors within the individual's lives including the reported increase in physical activity behaviour (vigorous intensity in both groups and moderate intensity in the intervention group). Although the

findings regarding intrinsic motivation, negative affect and quality of life support the use of text messages, findings regarding the content of the messages are less conclusive.

Limitations and Future Direction

Using a physically inactive sample is a strength of this study as the participants could benefit from any positive effects of increased physical activity. However the participants all attended the university as students or staff and were predominantly youthful (*M*=25.7 years *SD*=10.2) and female (*n*=61). Psychological responses and motivations occur differently with age (Fox, Stathi, Mckenna, & Davis, 2007). Future research could therefore include a broader age range that takes place outside of a university setting in order to explore the effects of the text messages within a wider population and increase the generalisability of the findings. There was a very small number of males (*n*=4) that took part in the study. This could be due to the fact that participants were being recruited from the classes that had higher female attendance. This should be considered when interpreting the results. Future studies involving a larger sample of male beginner exercisers would be beneficial.

To optimise the effectiveness of the text messages future research should consider incorporating previously successful behaviour changes techniques, such as those in Abraham and Michie (2008)'s taxonomy of behaviour change techniques, from an autonomy supportive perspective. For example, messages could provide general encouragement, information on consequences, aid time management, and prompt barrier identification using autonomy supportive language (i.e., minimising control, limiting negative feedback). Further the inclusion of implementation intentions (Gollwitzer, 1993), similarly to the study by Prestwich et al. (2010), could further tailor the text messages to the individual. Sending messages at specific times that correspond to when the individual is due to engage in physical activity could be an example. This was not possible within the current study as the participants did not

attend specific exercise classes but chose from a variety of classes throughout the week. It was feasible that a participant received a message on a Monday but did not attend a class until Wednesday. Extant research has varied greatly in their approach to the frequency of messages sent. Although a description of the messages and the frequency of text messages sent were documented in this study future direction should include an investigation into the optimum frequency of text messages sent.

The inclusion of a control group who did not receive any text messages at all would allow for further assessment of the effect of the messages. It was not possible to determine, whether simply receiving a text, regardless of the content, had an impact on quality of life, negative affect or vigorous physical activity. A complete control would aid to clarify this further.

Using validated measures are a strength of this study. Online questionnaires may have increased adherence to completing the questionnaires and decreased participant burden. Further, implementing an objective measure of physical activity (i.e., a pedometer) could improve accuracy of physical activity measurement and capture an objective measure of lifestyle physical activity outside of the classes. Taking a SDT standpoint, the researcher should then be mindful of the implications of including a tool such as a pedometer with regards to creating a more external form of motivation.

There are some limitations which should be considered when using a tool, such as a mobile phone, within an intervention. Participants were only included in this study if they were already familiar with the use of mobile phone technology (Haug et al., 2012). Participation to the study would be exclusive to those who are challenged with illiteracy (Lalji & Good, 2008). Similarly to previous text message based studies (e.g., Kim & Glanz, 2013), it was possible to view the delivery status of the text messages however it was not possible to ascertain whether the texts had been opened or read. Including an element which required a

response from the participant could go some way to establishing whether the messages had been read. This could also increase feelings of relatedness by increasing the personal connection to the text message that was reported by the participants taking part in Hingle et al. (2012)'s text based study aimed at developing a healthy lifestyle among young adults.

The participants recruited for this study already possessed a certain level of motivation as they had already bought credits to attend the exercise classes at the sport centre. Further research should investigate the effect of autonomy supportive text messages on those who are reluctant to engage (amotivated) in physical activity.

Finally, due to the constraints of the university term, the study was only 10 weeks long. This intervention length is short in comparison to other text based interventions (Cole-Lewis & Kershaw, 2010). Future research would benefit from observing changes over a longer period.

Implications to Practice

Findings from this 3rd empirical study carry some practical implications. Text messages are inexpensive, efficient and can reach large proportion of population. They are therefore a useful addition when promoting physical activity groups and autonomy supportive content can result in increases to longer-term physical activity behaviour and well-being responses. Levels of autonomy need satisfaction did increase compared to the control group within the first 5 weeks. It is therefore important to be mindful, when delivering an intervention aimed at increasing physical activity levels that although autonomy need satisfaction is more likely to occur in the latter stages of an intervention all three needs should still be targeted throughout. The exercise instructor was a key factor for improvements to positive affect. This further emphasises that within an intervention there are unique sources of autonomy support that can influence different positive outcomes and thus supporting the argument of Cole-Lewis and

Kershaw (2010) that a text message is a useful tool to be used in conjunction with other elements of an intervention and not a standalone intervention technique.

Conclusion

In conclusion, there is some evidence to support the use of autonomy supportive text messages however long term effects are less conclusive. Findings suggest that it is possible for an individual to perceive autonomy support via an inanimate object, (i.e., text message) and satisfy the three basic psychological needs. Whereas an autonomy supportive text message is unlikely to replace traditional behaviour change interventions incorporating principles of SDT (Edmunds et al., 2008; Fortier, Duda, et al., 2012; Ng et al., 2012), they appear to be an effective and a useful addition. Given the promising results of this study and current literature, text messages grounded in SDT principles may improve existing practices and interventions. This re-emphasises that text messages can be a cost effective and accessible tool to use in conjunction with other components of an intervention aimed at increasing quality of motivation and levels of physical activity and psychological well-being within a physically inactive population participating in exercise classes.

CHAPTER 5

Study 4:

THE EFFECT OF THE PHYSICAL ENVIRONMENT AND LEVELS OF ACTIVITY ON AFFECTIVE STATES AND THE ROLE OF NATURALLY OCCURING MINDFULNESS

Abstract

Objective: The physical environment can improve positive affective states, as can physical activity. A higher level of mindful attention and awareness is associated with more positive, and less negative, affective states. This study investigated the effects of levels of activity (walking and sitting) in opposing environments (urban versus natural) on affective states in a laboratory or an outdoor setting and explored the moderating effect of mindfulness.

Method: Experimental within subject design, 70 physically inactive participants were randomly allocated to study arm 1 (laboratory; 32 female, 8 male; BMI; M=23.35 kg/m^2, SD = 5.1) or study arm 2 (outdoor; 17 females, 13 males; BMI: M= 23.11 kg/m^2, SD = 3.67). Participants completed 4 conditions over 2 visits, exactly one week apart. Participants either watched film clips of urban and natural outdoor settings (study arm 1) or were naturally immersed in an urban or a natural environment (study arm 2). All participants engaged in a 15-minute walk and a 15-minute sedentary activity (sitting) in each environment. Measures of mood, affect and mindfulness were administered pre, mid and post each condition.

Findings: Endorsed the benefits of being immersed in a natural outdoor environment with physical activity being key for positive effects on energy (Study arm 1 and 2: p<.05) and positive affect (Study arm 1: p<.05). Short bouts of sedentary behaviour increased situational negative affect (Study arm 1: p<.05*)*, tiredness (Study 1: p<.05, Study arm 2: p<.01), calmness (Study arm 1 p< .05), and decreased energy levels (Study arm 1 & 2: p<.01). High levels of mindfulness resulted in decreased levels of calmness when sitting in the urban environment (Study arm 1: p<.05). The natural environment increased levels of energy regardless of the levels of mindfulness (Study arm 2: p<.01).

|Conclusion: Attempts by policy-makers, urban planners and public health promoters should encourage greater use of natural open space in order to increase physical activity levels to promote acute psychological well-being.

Introduction

As part of Lancet's (Beaglehole et al., 2011) worldwide effort to implement action on non-communicable diseases (i.e., diabetes, several cancers, cardiovascular disease), Lee (2012) and colleagues quantified the negative effects of physical inactivity, finding that inactivity causes 9% of premature mortality, or more than 5.3 of the 57 million deaths that occurred worldwide in 2008 (World Health Organisation, 2012). There is now strong support for the causal role of physical activity on health and well-being (Wen & Wu, 2012). According to public health recommendations, individuals are encouraged to accumulate 150 minutes (2.5 hours) of moderate intensity physical activity (i.e., brisk walking), per week, in bouts of 10 minutes or more. However, over two thirds of the population in the UK, 60% of adult males and 75% of adult females, are insufficiently physically active to accrue or maintain health (Department of Health, 2011).

Physical Activity Intensity and psychological Well-being

Psychological well-being factors of physical activity include enhanced subjective well-being, mood, affect, improved sleep and reduced stress (Ekkekakis et al., 2011; Netz et al., 2005). Specifically to walking, Ekkekakis et al. (2000) investigated the effect of short walks (10-15 minutes) on affective states and found that walking was the most 'pleasurable' physical activity in terms of mood and affect. Pleasure is reduced mainly above the ventilatory threshold or at the onset of blood lactate accumulation (Ekkekakis, Parfitt, & Petruzzello 2011). Ekkekakis et al. (2011) explain that feelings of pleasure are experienced at sub-threshold intensities (low/moderate intensity i.e., brisk walking) for most individuals. Both laboratory experiments and field tests have shown that walking at a self-selected intensity is associated with shifts toward increased activation and more positive affective valence, albeit these tend to be short lived (Ekkekakis et al., 2000). Ekkekakis et al. (2000) also showed that

a 10-15 minutes recovery period following a walk was associated with decreases in perceived tension and increases in calmness which left participants in a pleasant low-activation state. However, these levels were no different to baseline. Ekkekakis et al., (2011) and Williams et al. (2008) explain the importance of basic affective variables (good/pleasure versus bad/displeasure) and how these possess motivational qualities. Williams et al. (2008) found that when previously physically inactive participants reported more positive affective responses to a single bout of moderate-intensity physical activity at baseline they also reported engaging in more minutes of physical activity both 6 and 12 months later. There is general agreement (Thompson Coon et al. 2011; Williams et al., 2008) that how an individual feels during and following brief bouts of walking can influence the likelihood that they will walk for exercise in the future. This is thought to be particularly true in an outdoor setting (Focht, 2010) and carries important public health implications. However, previous research examining the role of physical activity on affect has exhibited a number of methodological problems. For example, confounding variables such as a favourable social environment may cause positive affective responses and increased exercise participation (Annesi, 2002).

Adding to the existing research on the effects of physical activity intensity and its impact on immediate mood and affect, the aim of this study was to directly compare moderate intensity physical activity (brisk walking) to a sedentary alternative (sitting) within two contrasting environments (natural and urban).

Sedentary behaviour is associated with an increased risk of type 2 diabetes, cardiovascular disease, cancer and all cause mortality, independent of the effect of physical activity (Edwardson et al., 2012). Much less research has examined sedentary behaviour and its associations with psychological well-being, in particular affective states (Webb, Benjamin, Gammon, McKee, & Biddle, 2012). The majority of research on sedentary behaviour has focused on its longer-term effects on mental well-being, for example, self-esteem (Tremblay

et al., 2011) and self-perception (Webb et al., 2012). Small, direct associations showed that sedentary behaviour may be important to aspects of mental well-being (self-perception and physical competence) independent of moderate to vigorous physical activity engagement (Webb et al., 2012). It could be argued that a reason why individuals engage in large amounts of sedentary activity is that it is perceived to be pleasant. Conversely, as Ekkekakis (2010) suggests, many individuals may not participate in regular activity because they perceive it to be unpleasant.

The Natural Environment and Psychological Well-being

The natural environment is known to provide positive effects on affect and well-being (Mitchell & Popham, 2008) and despite findings suggesting that brief walks result in affective benefits, the literature remains unclear as to the influence of the physical walking environment on affective states (Gay, Saunders, & Dowda, 2011). The effects of an urban environment is particularly inconclusive (Johansson et al., 2011). The positive impact of natural environments on recreation, well-being and quality of life has been documented (Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Ward Thompson & Aspinall, 2011) and the restorative effects of nature and being outdoors is becoming a factor of increased interest in terms of its effects on psychological well-being. Building on previous work on the restorative effects of nature, a multi-study paper by Ryan et al. (2010) highlighted the vitalizing effects of being in nature and states that natural elements bring about a sense of energy and wellness. The five studies carried out by Ryan et al. (2010) together allude to the positive impact of being around natural elements in an outdoors setting on subjective vitality (high energy state), whilst participating in physical activities that can take place in natural settings. Ryan et al. (2010) suggested that future research should address the wide array of elements that can constitute outdoor and/or natural environments thus providing a rationale

for examining the urban environment as a comparison to a natural setting. The positive impact on psychological well-being after being exposed to natural, as opposed to urban, environments has been associated with a restorative effect (Kaplan & Kaplan, 2011; Tzoulas et al., 2007; Van den Berg, Koole, & Van der Wulp, 2003).

Attention Restoration Theory

Attention restoration theory (Kaplan & Kaplan, 1989; Kaplan, 1996) suggests that natural environments are characterised by a variety of different and novel objects of interest that can replenish depleted energy and attention. Restoration research highlights the potential of natural outdoor environments (for example, trees, lakes, mountains) for reducing stress, fatigue, and improving mood. For example, in an investigation of environmental preferences of a university based population, Van den Berg, Koole, and Van der Wulp (2003) found that looking at images of natural (versus urban) environments was linked to mood restoration and also reductions in feelings of stress and depression.

Restorative effects have generally focused on positive, low energy states (e.g., relaxation following stress) (Groenewegen, Van den Berg, de Vries, & Verheij, 2006). The present study examines a fuller range of affective states including low and high energy states (i.e., energy, arousal, perceived tension). This range reflects those seen in Russell (1980)'s Circumplex Model of Affect. According to the circumplex, the affective space is defined by an affective valence dimension and an activation dimension. The model is divided into quadrants to produce the following four areas: (1) unactivated pleasant affect (relaxation and calmness); (2) unactivated unpleasant affect (boredom, fatigue, or depression); (3) activated unpleasant affect (perceived tension and distress); and (4) activated pleasant affect (energy, excitement, and enthusiasm) (Ekkekakis et al., 2000).

Links have been made between psychological restoration and physical activity behaviour (Johansson et al., 2011). Bowler, Buyung-Ali, Knight, and Pullin (2010) suggest the link could be explained by natural elements relieving mental stress, and such places in turn, encourage people to walk or be more active. Using information from the Scottish Health Survey 2008, Mitchell (2012) carried out an observational study to examine associations between different environments and physical activity. The study concluded that physical activity in natural environments was associated with a reduction in the risk of psychological ill-being to a greater extent than physical activity in other environments, but also that activity in different environments may promote different psychological responses. This research (Mitchell, 2012) has focused on long term effects and repeated exposure to these environments. More research is needed to examine the acute responses to these environments as such responses are likely to be critical for repeated behaviour (Williams et al., 2008).

The Urban Environment and Psychological Well-being

Urban areas have been investigated much less frequently than natural environments (Kaplan & Kaplan, 2011). Research on environmental stress has indicated that urban conditions such as noise and crowding can overwhelm the ability to direct attention and in turn create further negative emotions/affect or drain attention (Evans & Cohen, 1987; Kaplan & Kaplan, 2011). Sellers et al. (2012) found that parks better facilitated the achievement of reaching the recommended levels of physical activity because participants were less interrupted than when in a busy built up environment. Because of the attentional demands of monitoring vehicles, signs, other people, and the aversion to noise, urban streets may counteract psychological benefits of walking. Attention restoration is also thought to be promoted when observing the environment and the aesthetically pleasing features within it as it requires effortless attention, or fascination (Kaplan & Kaplan, 2011). When an individual is fascinated they are less likely

to direct attention with effort and consequently attentional capacity does not become fatigued. It is important for urban planners to understand the differences in attentional demands, and their influence on affect, in both the natural and built up environments and consider their unique elements in relation to design and construction of our surroundings (Coombes, Jones, & Hillsdon, 2010).

Mindfulness

The role of mindfulness to psychological well-being has been a subject of an increasing amount of research (Geschwind, Peeters, Drukker, Van Os, & Wichers, 2011; Prazak et al., 2012). It is commonly defined as the state of being attentive to and aware of what is taking place in the present (Brown & Ryan, 2003). Consciousness involves both attention and awareness; awareness is an element of consciousness, which constantly monitors the inner and outer environment (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). An individual may be aware of their surroundings without an element of that environment being at the centre of their attention. Attention is a process of focusing conscious awareness, thus providing a greater sensitivity to the specific experience (Cardaciotto et al., 2008). Mindfulness can be described as an improved attention to and awareness of a specific experience (Prazak et al., 2012) and can be compromised when individuals are preoccupied by the future or the past or behave compulsively or automatically, without awareness of or attention to their behaviour (Deci & Ryan, 1980).

Several theories of self-regulation discuss awareness and attention in the maintenance and enhancement of psychological and behavioural functioning. For example Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000), posits that full awareness may be particularly valuable in facilitating the choice of behaviours that are consistent with one's needs, values, and interests (Deci & Ryan, 1980). Individuals with

greater mindful attention and awareness are more likely to engage in self-regulatory behaviours to fulfil their basic psychological needs, which in turn produce more positive momentary affective responses (Hodgins & Knee, 2002). Findings from Brown and Ryan (2003) indicate that both dispositional and state mindfulness predict self-regulated behaviour and positive emotional states. Weinstein and Ryan (2011) have argued that mindful attention can facilitate stress resilience and adaptive coping responses, both directly and indirectly, through its impact on autonomous motivation and its association with higher quality or optimal moment-to-moment experiences. The majority of research on mindfulness has focused on the effects of clinical interventions either based on or incorporating practices to enhance this quality of consciousness i.e., Mindfulness training (Weinstein & Ryan, 2011). There has been little work examining this attribute as a naturally occurring characteristic. This study aims to investigate state mindful attention and awareness, at the midpoint of each condition to examine whether mindfulness can play a moderating role in the relationship between the environment, physical activity and affect. Given the associated benefits of mindfulness and psychological well-being, the findings could carry important implications. If mindfulness is shown to act as a moderator between physical activity and the environment on mood and affect, findings would support previous work of Weinstein and Ryan, (2011) and make a case regarding the potential of mindfulness training in participants who are more susceptible to low mood and negative affect.

Weather as a Barrier to Outdoor Physical Activity

Weather has been identified as a perceived barrier to participation in physical activity undertaken outdoors (Chan & Ryan, 2009), however, to our knowledge, which adverse weather conditions are most important, and the extent to which they contribute to any changes in affective states have rarely been quantified in any populations (Kööts, Realo, & Allik,

2011). Outdoor studies have often specified taking participants outside only when weather conditions permitted in order to keep the weather conditions as neutral as possible (Ryan et al., 2010). Also, Martens, Gutscher, and Bauer (2011) excluded data of their participants when they were exposed to adverse weather conditions. They did, however, measure temperature during the testing phase and found that it bared no influence. The present study adds to previous literature by collecting objective measures of weather (temperature, sunlight, rainfall) through a weather station. This enabled the researcher to interpret direct and accurate measures from the exact location in real time. Recent studies that include exposure to the outdoor environment (e.g.,Klenk, Büchele, Rapp, Franke, & Peter, 2012) suggest that weather conditions can influence the results of a study, yet it is the effect of season (Tucker & Gilliland, 2007) or day-to-day changes (daily temperature, barometric pressure, humidity, precipitation and average daylight cover) on physical activity, which has been the focus of previous research.

Limitations of Previous Research

Experimental studies have shown that natural environments have restorative properties. However, most studies have drawn on homogenous, healthy and young participants (Bowler et al, 2010; Thompson Coon et al, 2011). Greater public health impact can be achieved if physically inactive populations are used to examine such effects. When discussing further direction of research Thompson Coon et al. (2011) alluded to a need to concentrate on populations who may benefit most from the potential advantages of outdoor physical activity. Another limitation discussed by Thompson Coon et al. (2011) relates to the importance of scientific rigour. This two-armed paper is the first, to our knowledge, investigating the effect of the physical environment and physical activity on psychological well-being using an

experimental within subject design in both a controlled laboratory setting and an outdoor setting

Aims and Hypotheses

Physical environment can enhance affective states (Focht, 2010) as can physical activity (Ekkekakis et al., 2000). Mindful attention and awareness has also been associated with more positive, and less negative, affective states (Brown & Ryan, 2003) but has not been explored within a physical activity setting. This two-armed paper aims to investigate the effect of exposing participants to contrasting physical environments (built up urban versus natural) in a laboratory environment (study arm 1) and an outdoor setting (study arm 2) on affective states. As part of the study, the effects of walking and a sedentary alternative (i.e., sitting) are directly compared. This study intends to build on previous research using images of a variety of settings (Ryan et al., 2010) by showing participants recorded footage, including sound, of an urban, built up environment and of a natural environment. Testing these effects in a laboratory setting allows for control of confounding variables such as social interaction, noise, traffic and weather which is less controllable within an outdoor setting. The aim was then to conduct the second study arm, replicating the first, within an ecologically valid (outdoor) setting. . Furthermore, the aim was to measure feelings of pleasure and affect along with state mindfulness at the mid-point of each condition to further understand any changes that may occur during the activity which may not otherwise be detected with a pre/post measure as has been done previously (Ekkekakis et al., 2000; Ekkekakis, Hall, & Petruzzello, 2005; Johansson, Hartig, & Staats, 2011). Few studies have administered measures of well-being during a walking task (Focht, 2010).

Considering the existing research, it is hypothesised that (H1), walking compared to sitting in both environments will result in greater positive effects on mood, affect, (H2) Being

immersed in the natural environment compared to the urban environment will result in more positive effects on mood and affect. (H3) Walking in the natural environment will result in the most positive outcomes for mood and affect. Furthermore the aim was to investigate the moderating effects of mindfulness in the relationship between physical activity and the physical environment on mood and affect.

The Present Study Arms

Following approval obtained from an ethical review committee at a large University in the UK, 70 participants were recruited through an online advert, posters and flyers. All data collection was completed during the months of October 2011 to January 2012. Participants were asked to complete a baseline questionnaire through Survey Monkey, an online questionnaire site. Via this online tool, participants reported their levels of physical activity and were screened to make sure that they met the criteria of being physically inactive and therefore did not reach the recommended levels according to the Department of Health, (2011) (accumulating 150 minutes, in bouts of 10 minutes or more, of moderate intensity physical activity per week). They completed a PAR-Q (Physical Activity Readiness Questionnaire) to ensure they were not at risk of adverse physical activity-related outcomes. Once the participants were deemed eligible they were randomly allocated to one of two studies, (a laboratory arm or an outdoor arm). On completion of the study participants were given the choice of either class credit (for students only) or £10 compensation.

Independent t-tests showed that the laboratory group (study arm 1) and the outdoor group (study arm 2) did not differ on BMI: t (68) = -.22. p =.82, or age: t (47.5) = 1.15, p=.25. However, significantly more females than males were included in arm 1, t (54.4) = -2.08, $p<.05$.

The Outdoor Environment and the Footage of the Environment

Both types of environment (natural and urban) were used in study arm 1 and 2. Arm 1 used footage of each environment, recorded via a Panasonic V500 Camcorder. Participants were physically immersed in the corresponding environments in arm 2.

The natural environment was a park which was primarily made up of green space with small areas of woodland and a pond. Wildlife that participants would have witnessed included birds and dogs (numbers varied per visit). The built up urban environment was a busy commercially dominant area where participants walked on pavements and were required to cross roads.

A sample photo for each environment can be seen below in Figure 5.1.

Figure 5.1 Images of the Urban and Natural Environment used in Study 1 and Visited in Study 2

In preparation of study arm 1, the researcher filmed the route that participants would walk in study arm 2 using a Panasonic V500 Camcorder. The footage was filmed to mimic how an individual would walk and take in what was around them, therefore turning the focus of the camera when an individual would naturally turn their head.

Study Arm 1

Method

Participants

A total of forty physically inactive participants (32 female, 8 male; BMI; *M*=23.35 kg/m^2, *SD* = 5.1), ranging between the ages of 18 to 60 years (*M*=23, *SD* = 7.65) were recruited for this first study arm. Participants were deemed physically inactive if they did not reach the recommended levels of physical activity according to the Department of Health (2011).

Procedure

Participants were invited to attend two 90-minute sessions in a laboratory. The sessions took place exactly one week apart and at a similar time of day to control for potential diurnal variations in affect. All participants were randomised to 2 of 4 conditions (natural or urban) per visit. Both a sitting and walking condition were completed in both visits to the laboratory. The order in which the sessions were carried out (walking condition and sitting condition) was randomised and presented in a counterbalanced fashion. A within subject design was used in this Stu; all participants completed all conditions. Height, measured with a Stadiometer, and weight, measured with Ohaus CD-31 scales (Ohaus, USA) were taken at the start of the first visit to calculate participants' BMI. Participants were then asked to sit for 20 minutes to familiarise themselves with their environment. During this time participants were fitted with a Polar heart rate monitor (Polar Electrode, Finland) and asked to complete an

initial questionnaire prior to starting the first condition (please refer to appendix 4 for all questionnaires). A screen was positioned around the edge of the laboratory to eliminate any potential distractions (e.g., from pictures or equipment). To minimise social effects all sessions were carried out on a one-to-one basis with only one researcher and the participant present.

Sitting Condition

Once the initial questionnaire, with items relating to mood, positive and negative affect, had been completed, participants were asked to sit in a comfortable chair directly in front of a television screen. Whilst remaining seated, participants watched 15 minutes of footage of either the natural or urban environment. Participants were encouraged to take in what they saw. Participants were asked a further 7 questions at the mid-point (minute 7). The 7 items included one item relating to how they felt in that moment in terms of levels of pleasure, 1 item regarding their current perceived arousal and 5 items regarding state mindfulness. Immediately following the 15 minutes, average heart rates were recorded and participants were asked to complete a post-condition questionnaire (mood, positive and negative affect).

Walking Condition

The general procedure for the walking condition was followed as per the sitting condition with the following differences. Upon completion of the initial questionnaire, the participants were asked to step onto the treadmill (hpcosmos quasar) situated directly in front of a television screen. Participants increased the resistance of the treadmill to a self-selected pace equating to their own interpretation of a brisk walk. To clarify the intensity of a brisk walk they were asked to walk at a rate which equated to level 12/13 (somewhat hard) using the Rate of Perceived Exertion scale (RPE; Borg, 1982). The speed was recorded and used for the

second visit thus keeping the intensity constant for both walking conditions. Participants walked for an initial 2 minutes before the film began in order to get used to the pace of the walk. Participants then watched 15 minutes of footage of the same environment as for the sitting condition for 15 minutes. The procedure then continued as per the sitting condition.

Measures

Positive and Negative Affect (PANAS):

The PANAS (Watson, Clark, & Tellegen, 1988) includes 20 items measuring positive and negative affect and was administered pre and post condition. This validated measure has been extensively used showing high reliability with a Cronbach alpha value estimated at .89 for the positive affect sub-scale and .85 for the negative affect sub-scale (Crawford & Henry, 2004). State positive and negative affect was measured pre and post each condition using a 5 point scale ranging from 1 (very slightly or not at all) to 5 (extremely).

The Activation-Deactivation Adjective Check List (AD ACL):

The AD ACL (Thayer, 1986), a 20-item checklist, is a rapid multidimensional self-report measure testing various arousal and activation states (i.e., Active, Calm, Fearful, Vigorous). Participants rated the extent to which they felt each adjective on a scale ranging from 1 (Definitely Do Not Feel) to 4 (Definitely Feel). The AD ACL is reliable; Thayer, (1978) reported a Cronbach's alpha coefficients of 0.75 (Thayer, 1978). This scale can be grouped into four distinct sub-scales namely perceived energy, tiredness, tension, and calmness (Ekkekakis, Hall, & Petruzzello, 2005). The AD ACL was administered pre and post condition.

Feeling Scale (FS):

The FS (Hardy & Rejeski, 1989) is a single item 11 point scale that assesses an individual's immediate feelings of pleasure or displeasure regarding a specific experience on a scale

ranging from -5 to 5. This scale has previously been used within physical activity contexts (Focht, 2010) and extensively used specifically in walking experiments (Ekkekakis et al., 2000; Ekkekakis et al., 2011). The item was asked mid-condition at minute 7.

Felt Arousal Scale (FAS):

Arousal states were measured alongside the FS using the 6 point single item FAS (Svebak & Murgatroyd, 1985). Participants rated their current level of perceived activation using a scale ranging from 1(low arousal) to 6 (high arousal). This state measure was also measured mid condition. Both the FS and the FAS have been used extensively in research studies examining the exercise and affect relationship, (Ekkekakis, Hall, & Petruzzello, 2005).

Mindfulness Attention Awareness Scale (MAAS):

The MAAS (Brown & Ryan, 2003) assesses individual differences in the frequency of mindful states. The MAAS focuses on the presence or absence of attention to and awareness of what is occurring in the present. Participants rate their perceptions on a 6 point likert scale ranging from 1 (almost always) to 6 (almost never). A 5 item state version (Brown & Ryan, 2003) was used as the intention was to measure state rather than trait mindfulness which involved a longer 15 item version of the MAAS. The MAAS has previously shown internal consistencies with a Cronbach alpha value of .81 (Brown & Ryan, 2003). This scale was administered mid condition.

Systematic Pedestrian and Cycling Environment Scan Instrument (SPACES):

Pikora et al., (2002) developed SPACES as an instrument to assess the physical environment specifically for walking and cycling. For the current study arm this instrument was used as a manipulation check to assess whether the environments were sufficiently different in terms of 'walkability'. The adapted 37 items from the instrument incorporated four categories (functionality, safety, aesthetics and destination) and answers were rated on a scale ranging from 1, representing poor walkability to 10, representing excellent walkability. Inter and intra

reliability has been shown as high (High > 70% agreement; low < 70% agreement) and observers reported that the instrument was practical and easy to use (Pikora et al., 2002).

Data Analysis

Separate 3 way (time (pre and post or pre, mid and post) x environment (urban, natural) x activity (sitting, walking)) repeated measures analyses of variance (ANOVAs) were performed for each variable using SPSS. Tests of simple effects were conducted to probe the interaction effects. Paired sample *t*-tests were carried out to determine whether any significant differences existed across conditions using scores from the FS and FAS measured at the mid-point. Furthermore, the mid-point measure of Mindfulness was analysed as a moderator in the relationship between levels of physical activity and the physical environment on psychological well-being (mood and affect). This relationship was analysed using a 4 way mixed design ANOVA (time (pre and post) x environment (urban, natural) x activity (sitting, walking) x mindfulness (high, low). Mean scores of mindfulness were dichotomised into high or low mindfulness via a mean split procedure (3.5). A test of simple effects was conducted to further investigate significant findings.

Results

Manipulation Checks

Using the SPACES instrument developed by Pikora et al. (2002), five volunteers (who were not participants of the main study) watched the footage of both the natural and urban environment prior to starting the study and rated them immediately. The footage of the natural environment (M=6.74, SD=0.87) was rated as significantly more walkable (functionality, safety, aesthetics and destination) t (4) = -5.64, p<0.01, than the footage of the urban environment (M = 3.66, SD=0.55).

The participants' average heart rates were measured (beats per minute) using a Polar Electrode Heart Rate monitor during the 15 minute walking and sitting conditions. Heart rate was significantly higher when participants were walking watching both the natural (M=100.3, SD =11.99), and urban environment (M=102.36, SD=13.76) compared to sitting watching the natural environment (M=72.7, SD=11.1), t (39) = 19.1, p<.005 and sitting watching the urban footage, (M=72.7, SD=11.1), t (37) = 20.96, p<.01.

Descriptive Data

Descriptive analysis and Cronbach alpha scores are summarised in Table 5.1 along with the average percentage heart rate maximum (HRM) of the participants for each condition.

Table 5.1 Study Arm 1: Exercise responses of participants, Cronbach alpha scores and descriptive statistics of variables measured.

Condition		Urban Walking	Urban Sitting	Natural Walking	Natural Sitting
	α	*M SD*	*M SD*	*M SD*	*M SD*
Self-Selected Walking (%HR max)	-	58.03(8.63)	41.01(6.69)	56.84(7.94)	41.14(6.4)
Positive Affect	.93				
Pre	-	2.47(.89)	2.55(.83)	2.8(.98)	2.73(.87)
Post	-	2.55(.88)	2.05(.84)	2.93(.79)	2.32(.98)
Negative Affect	.86				
Pre	-	1.31(.34)	1.27(.37)	1.28(.43)	1.26(.36)
Post	-	1.24(.30)	1.28(.33)	1.13(.23)	1.16(.24)
Energy	.88				
Pre	-	2.1(.66)	2.33(.73)	2.31(.69)	2.36(.67)
Post	-	2.4(.64)	1.88(.72)	2.63(.56)	1.96(.68)
Tiredness	.89				
Pre	-	2.23(.81)	2.16(.74)	2.3(.9)	2.14(.86)
Post	-	1.95(.64)	2.53(.81)	1.88(.68)	2.43(.85)
Tension	.87				
Pre	-	1.35(.38)	1.42(.4)	1.4(.41)	1.76(.41)
Post	-	1.42(.4)	1.55(.51)	1.33(.47)	1.29(.32)
Calmness	.82				
Pre	-	2.25(.69)	2.34(.77)	2.67(.64)	2.55(.57)
Post	-	1.9(.56)	2.34(.77)	2.18(.63)	2.8(.58)
Mindfulness	.92				
Mid	-	2.92(1.4)	2.82(1.44)	3.78(1.23)	3.41(1.55)
Feeling Scale	.908	2.22(1.62)	1.15(1.95)	2.97(1.34)	2.27(1.73)
Felt Arousal Scale	.878	3.12(1.15)	2.57(1.1)	3.35(1.0)	2.62(1.07)

Note: *M*=Mean, *SD*=Standard deviation, HR= Heart Rate

Testing Hypothesis 1,2,and 3:Effects of Activity and Physical Environment on Affective States

Analyses of positive affect yielded a significant interaction between time and activity, $F(1,34) = 25.078$ $p<0.01$ $\eta^2=0.42$ (see Figure 5.2). A test of simple effects showed that positive affect decreased significantly when sitting in both environments ($p<0.01$). Positive affect was higher when walking than when sitting post condition across both environments ($p<0.01$).

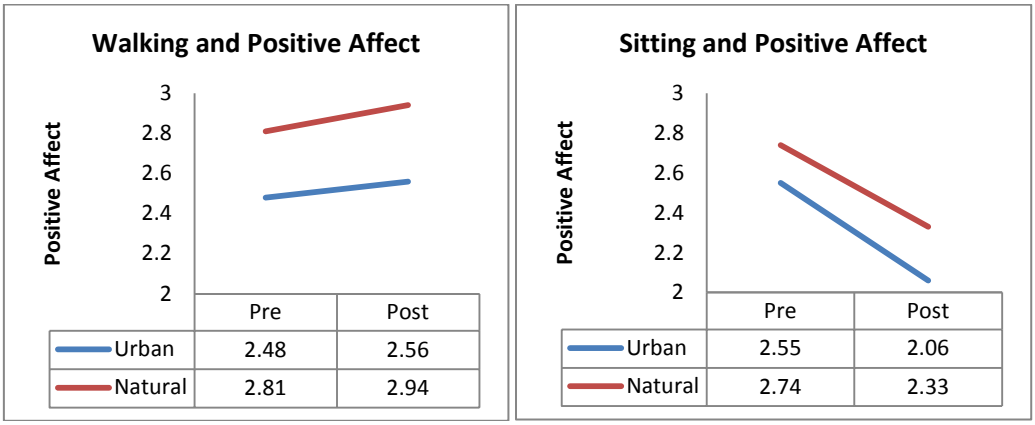


Figure 5.2: Interacting Effects from Footage of Urban and Natural Environments and Activity on Positive Affect.

Results for negative affect showed a significant interaction, between time and environment $F(1,37) = 3.990$, $p=0.05$ $\eta^2=0.09$ (see Figure 5.3). Simple effects revealed that over time when watching the natural environment, negative affect decreased in both activity conditions ($p<0.01$). Negative Affect was greater post-intervention ($p<0.05$) whilst both walking and sitting, watching the urban footage in comparison to watching the natural footage.

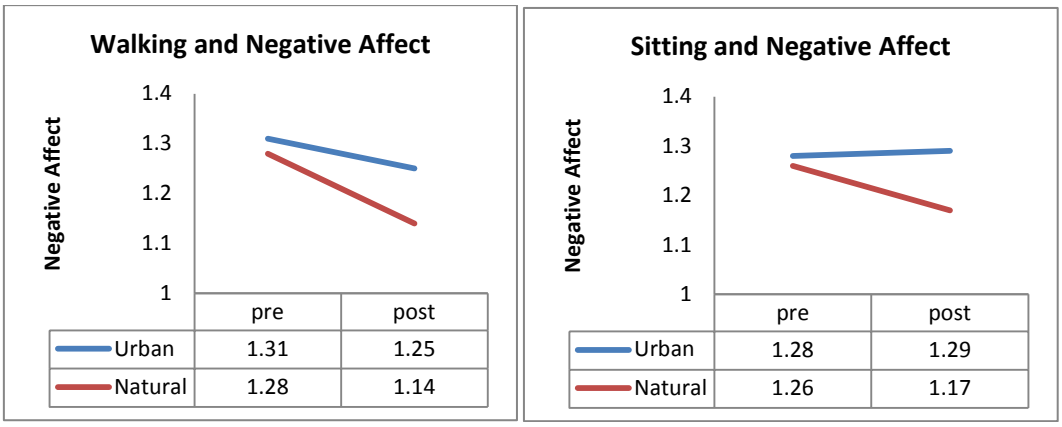


Figure 5.3: Interacting Effects from Footage of Urban and Natural Environments and Activity on Negative Affect.

Analyses of energy resulted in a significant interaction F (1,36) =37.191 $p<0.01$ $\eta^2=0.51$ between time and activity (Figure 5.4). Simple effects showed that over time energy increased in the urban ($p<0.05$) and natural ($p<0.01$) walking condition. Energy decreased in both sitting conditions ($p<0.01$). Energy was higher post condition in both environmental conditions when walking compared to sitting ($p<0.01$).

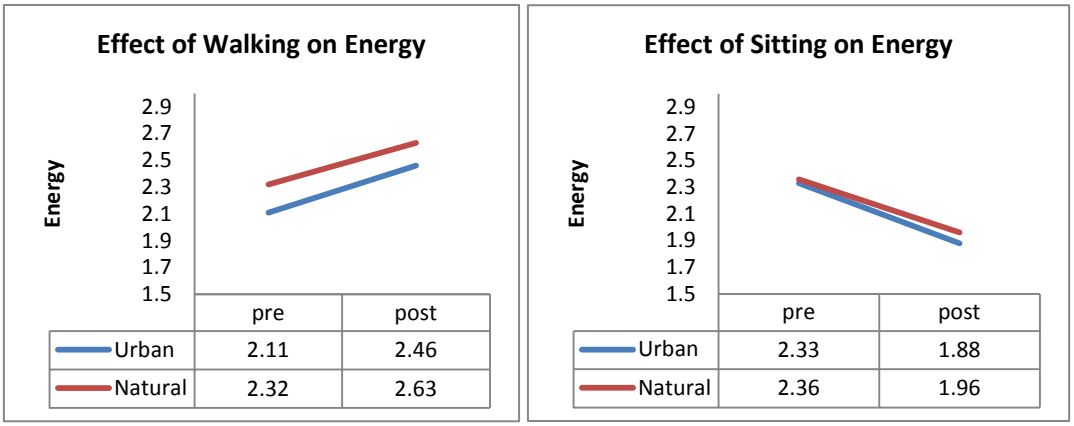


Figure 5.4. Interacting Effects from Footage of Urban and Natural Environments and Activity on Energy.

Analyses of tiredness revealed a significant 2-way interaction F (1,35) =35.64 $p<0.01$ $\eta^2=0.51$ between time and activity as shown in Figure 5.5. Tests of simple effects showed that tiredness decreased when walking in both environmental conditions (urban; $p<0.05$; natural;

p<0.01) but increased when sitting (p<0.01). Furthermore, participants reported feeling less tired post condition when walking compared to sitting in both environmental conditions (p<0.01).

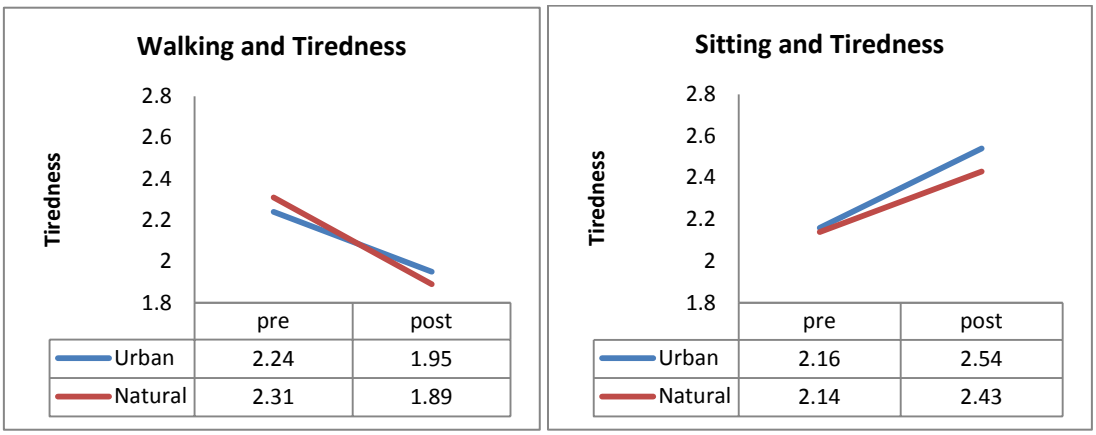


Figure 5.5. Interacting Effects from Footage of Urban and Natural Environments and Activity on Tiredness.

Results of perceived tension yielded a significant 3-way interaction F (1,38) =13.31 p<0.01 η^2=0.26 between time, environment and activity (Figure 5.6). A test of simple effects showed perceived tension decreased (p<0.01) when sitting watching the natural environment and was lower post condition in comparison to watching the urban environment. At pre-condition, perceived tension when sitting was lower (p<0.01) in the urban, compared to the natural, environment.

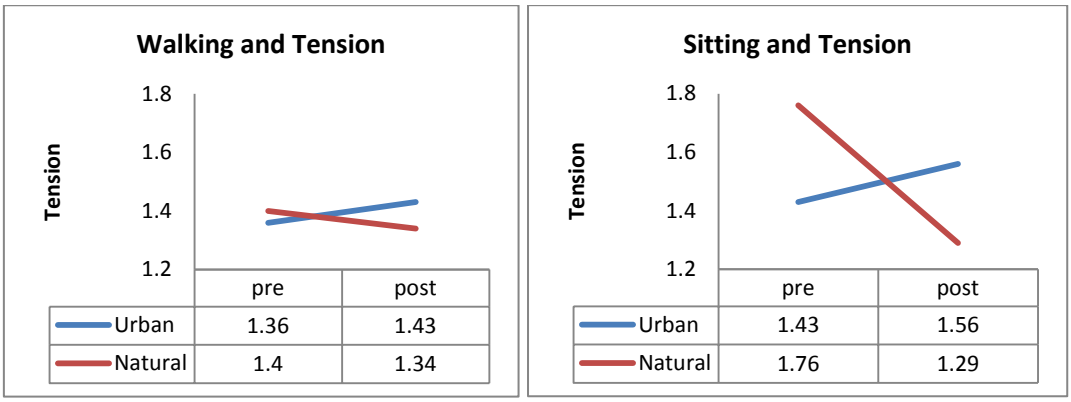


Figure 5.6. Interacting Effects from Footage of Urban and Natural Environments and Activity on Tension

A significant 3 way interaction F (1,37) =10.39 $p<0.05$ $\eta^2=0.22$ for environment, activity and time was identified for calmness (Figure 5.7). Tests of simple effects showed that calmness decreased ($p<0.01$) when walking in both environments, although calmness was greatest both pre- ($p<0.01$) and post-condition ($p<0.05$) when watching the natural environment. Whilst sitting watching the natural environment, calmness increased ($p<0.05$) and was lower post condition when sitting watching the urban footage ($p<0.01$) compared to sitting watching the natural footage. Calmness was higher ($p<.01$) post condition when sitting compared to walking when watching footage of both environments.

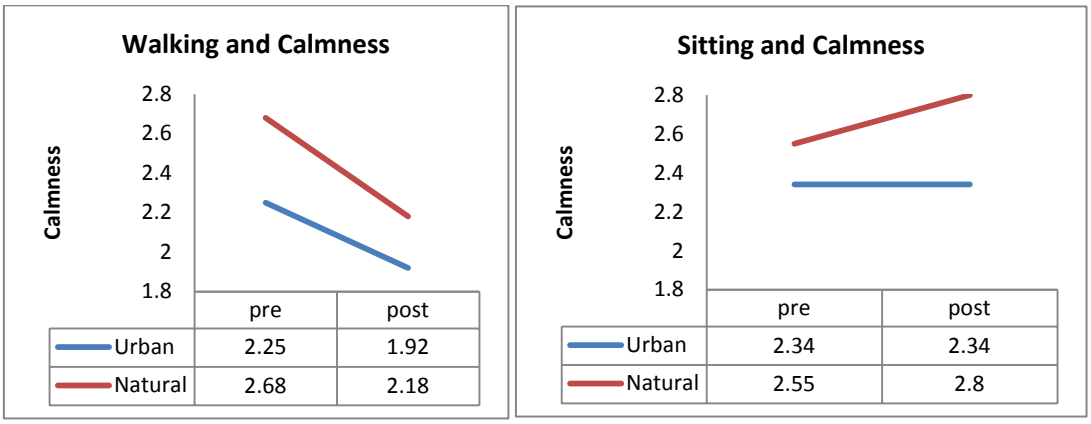


Figure 5.7 Interacting Effects from Footage of Urban and Natural Environments and Activity on Calmness

Analysis of the Feeling Scale revealed that participants felt better when walking rather than sitting when watching the urban, (t (39) = 4.91, $p<0.01$), and natural environment (t (39) = 2.94, $p<0.01$). In addition, participants felt better sitting whilst watching the natural setting than sitting and watching the footage of the urban environment t (39) = -3.40, $p<0.01$. Paired sample t-tests showed that participants felt significantly higher levels of activation when walking rather than sitting watching footage of the urban environment $t(39)=4.88$,

p<0.005. In the natural environment condition, perceived levels of activation were higher when walking than when sitting (t (39) = 4.53, p<0.01).

The Role of Mindfulness as a Moderator in the Relationship Between Activity and the Environment on Affect states.

When investigating the role of mindfulness acting as a moderator on affective states, a 3 way significant interaction showed that mindfulness was indeed a moderator on calmness (Figure 5.8) in the relationship between physical activity and the environment F (1,36) = 4.408 p<0.05 η^2=0.109. Further investigation revealed that those with high levels of mindfulness experienced significantly lower level of calmness (p<0.05) when sitting and watching the urban footage compared to watching the natural footage. Participants who walked watching the natural environment experienced significantly greater levels of calmness (p<0.05) compared to watching the urban environment regardless of levels of mindfulness.

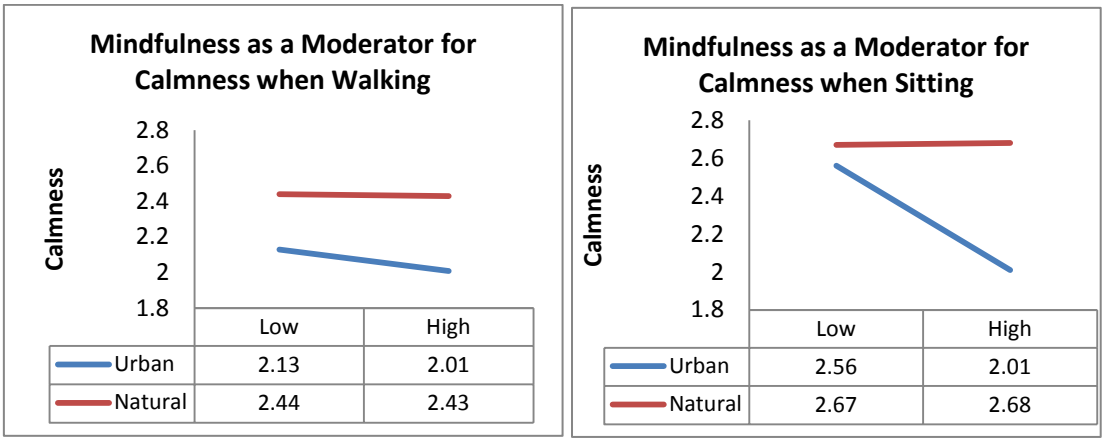


Figure 5.8: Moderating Effects of mindfulness on the physical environment, physical activity and calmness.

Summary of Study Arm 1

Study arm 1 provided experimental insight into the effect of levels of physical activity (walking versus a sedentary alternative) and the physical environment on psychological well-

being within a controlled laboratory setting. The findings support the hypotheses (H1) that walking will produce increased levels of psychological well-being in comparison to sitting and watching footage of a natural environment will add to these effects (H3). The findings partly support the second hypothesis (H2) by showing that watching footage of a natural environment regardless of the activity has beneficial effects on negative affect over time. Furthermore, regardless of the environment, walking is more effective than sitting in increasing positive affect, energy and reducing tiredness in people who are usually physically inactive. Sitting significantly increased tiredness in both environments. This suggests that with regards to several affective outcomes, the activity may override any effects of the environment (H1). Three way interactions of time, activity and environment were seen in the analysis for perceived tension and calmness. Sitting watching the footage of the natural environment was most effective in reducing perceived tension and increasing calmness suggesting that for these outcomes, the environment is the key influence (H2). Participants felt best when walking in the natural environment and reported higher levels of activation when walking in either of the environments in comparison to sitting, suggesting that for high energy states physical activity is the strongest influence on affective states. Mindfulness can play a moderating role when sitting and watching the urban footage suggesting that increased attention and awareness can decrease levels of calmness when watching a busy built up area.

Study Arm 2

Methods

Participants

Thirty physically inactive participants (17 females, 13 males; BMI: M= 23.11 kg/m^2, SD = 3.67) who ranged between 18 to 61 years (M=25.86, SD = 11.52) took part in study arm 2.

Procedure

Similarly to study arm 1, participants were asked to participate over 2 days exactly one week apart. The order of these sessions were randomised and counterbalanced to prevent order effects. One visit took place in the actual (i.e., not filmed) green, natural environment and the second took place in the built-up urban environment, previously described in study arm 1. Participants completed each of the 4 conditions; 2 conditions on each visit (a sitting and a walking condition). They took part individually in order to minimise social influences and the researchers remained at a distance to minimise any interaction. Height and weight were measured at the beginning of the first visit and each participant was fitted with a heart rate monitor, as per study arm 1, before making the journey to the selected environment. Upon arrival to the area participants were asked to sit for 20 minutes to acclimatise and familiarise themselves with the environment. During this time they completed the pre-condition questionnaire. The pre, mid and post questionnaires were identical to those of study arm 1.

Sitting Condition

Following the initial 20 minutes familiarisation, participants were asked to sit on a bench in the chosen environment and encouraged to take in their surroundings as they sat. They were then asked to sit for a further 15 minutes and complete the mid-condition questionnaire after 7 minutes and the post-condition questionnaire immediately following the 15 minutes. Average heart rates were recorded for the 15 minute condition.

Walking Condition

Following the 20 minutes acclimatisation period and completion of the pre condition questionnaire, the participants were encouraged to take in their surroundings. They were asked to follow an allocated researcher at a distance of approximately 20 metres to ensure that

they knew in which direction to walk. Participants received a phone call at minute 7 when they were asked the 7 item mid-condition questionnaire. Following the 15 minute walk, each participant completed the post-condition questionnaire and their average heart rate was recorded.

Measures

The measures administered in the pre, mid and post-condition questionnaire were identical to those of study arm 1.

Weather:

The Edgbaston Weather station provided average values of temperature (°C), rain fall (mm) and sunlight (%) for the duration of all trials. The mean, standard deviation and range of each variable can be seen in Table 5.2.

Data Analysis

The analyses were identical to study arm 1. Additionally, weather was entered into the analyses as a covariate to examine its influence on affective states. The decision was made to exclude rain in the analysis because the range of rainfall was very small (less than 1mm: see Table 5.2). The ranges of temperature and percentage of sunlight were large and were therefore included. To illustrate the importance of including weather variables as a covariate, analyses omitting the weather covariates are briefly reported as a comparison.

Results

Manipulation check

Similarly to study arm 1, a manipulation check was carried out to ensure the environments were different in terms of walkability. Five volunteers who were not involved in the main

study visited both the natural environment and the urban environment and rated them using the SPACES scale developed by Pikora et al. (2003). The natural environment, (M=6.7 SD=0.58) was rated as having significantly more walkability, t (4) = -7.738, p=0.01, in comparison to the urban environment (M=3.8 SD=0.39).

As a second manipulation check, each participant's average heart rate was measured throughout the walking and sitting conditions. Walking in the natural environment (M=107; SD=9.9) and walking in the urban environment (M=108.7 SD=12.1) significantly differed (natural: t(28) =20.08 p<0.01, urban: t (28) =19.48 p<0.01.) to sitting in the natural environment (M=70.7; SD= 9.1) and the urban environment (M=75.6 SD=8.47).

Descriptive Data

Descriptive statistics, average HR response to exercise, Cronbach alpha scores and objective measures of the weather are summarised in Table 5.2.

Table 5.2. Study Arm 2: Exercise responses of participants, Cronbach alpha scores and descriptive statistics of variables measured including weather.

Condition		Urban Walking	Urban Sitting	Natural Walking	Natural Sitting
	α	*M SD*	*M SD*	*M SD*	*M SD*
Self-Selected Walking (%HR max)	-	56.37(7.78)	39.17(5.31)	55.43(6.56)	36.6(4.96)
Positive Affect	.91				
Pre	-	2.83(.94)	2.96(.84)	2.89(.87)	3.07(.79)
Post	-	2.88(.79)	2.55(.82)	3.30(.75)	2.70(.76)
Negative Affect	.82				
Pre	-	1.39(.57)	1.45(.59)	1.18(.19)	1.16(.21)
Post	-	1.32(.49)	1.47(.55)	1.09(.14)	1.10(.14)
Energy	.84				
Pre	-	2.22(.87)	2.31(.79)	2.23(.78)	2.43(.71)
Post	-	2.66(.80)	1.96(.70)	2.89(.52)	2.10(.577)
Tiredness	.87				
Pre	-	2.31(.81)	2.2(.82)	2.28(.86)	2.13(.66)
Post	-	2.0(.79)	2.38(.78)	2.1(.70)	1.67(.57)
Tension	.89				
Pre	-	1.7(.63)	1.6(.58)	1.32(.48)	1.72(.33)
Post	-	1.62(.58)	1.73(.61)	1.3(.41)	1.31(.40)
Calmness	.79				
Pre	-	2.42(.57)	2.56(.60)	2.77(.48)	2.71(.66)
Post	-	2.01(.45)	2.71(.67)	2.47(.63)	3.08(.66)
Mindfulness	.91				
Mid	-	3.32(1.70)	3.88(1.43)	3.70(1.70)	3.90(1.43)
Feeling Scale	.80	2.12(1.69)	.96(2.03)	3.64(1.25)	2.72(1.33)
Felt Arousal Scale	.84	3.92(.97)	3.00(1.20)	3.57(.90)	3.15(1.22)
Weather	-				
Temperature (°C)	-	6.36(5.39)	Range = -.80-14.0 (14.8)	6.63(4.36)	Range = 0 – 15.2 (15.2)
Sunlight (%)	-	21.21(32.83)	Range = 0 – 85.7 (85.7)	64.24(40.04)	Range = 0-100 (100)
Rainfall (mm)	-	0.106(.255)	Range = 0-1 (1)	0.04(.152)	Range = 0-.6 (.6)

Note: *M*=Mean, *SD*=Standard deviation, HR= Heart Rate

Testing Hypothesis 1,2 and 3:Effects of Activity and Physical Environment on Affective States

Analysis of positive and negative affect, perceived tension and calmness revealed no significant main effects or interactions.

Figure 5.9 shows that the analyses of energy revealed a significant interaction effect for time and activity, $F(1,22) = 7.22$, $p<0.05$, $\eta^2 = 0.25$. Simple effects analysis show that energy increased when walking in the urban ($p<0.01$) and natural ($p<0.01$) environment and decreased in both the urban and natural ($p<0.01$) setting when sitting. Energy was higher post condition when walking compared to sitting in both urban and natural environment ($p<0.01$).

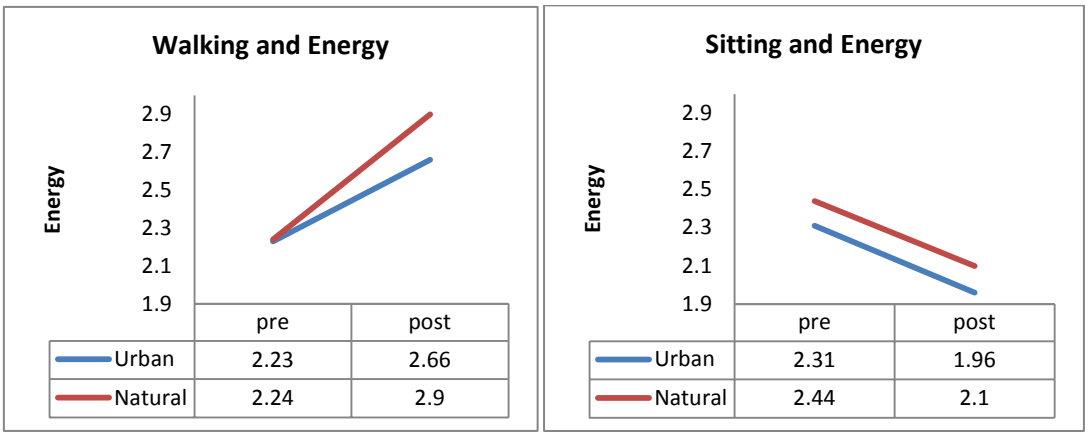


Figure 5.9: Interacting Effects from Urban and Natural Environments and Activity on Energy

The analyses for tiredness yielded a 3 way interaction effect between time, environment and physical activity, $F(1,22) = 5.58$, $p<0.05$, $\eta^2 = 0.20$ (see Figure 5.10). Via a test of simple effects it was evident that tiredness decreased in the urban ($p<0.01$) and natural ($p<0.01$) environment when walking and was lower post condition when walking compared to sitting in both environments ($p<0.01$). Tiredness was greater ($p<0.05$) in the urban setting post walking than in natural environment.

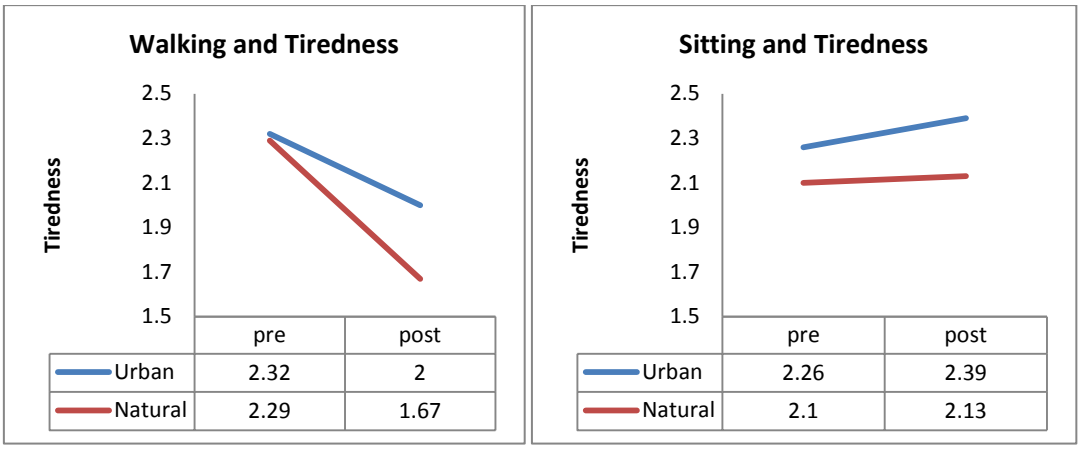


Figure 5.10: Interacting Effects from Urban and Natural Environments and Activity on Tiredness.

Analyses of the Feeling Scale showed that participants felt better walking, compared to sitting, in the urban environment, t (26)=4.09, p<0.01. They perceived the greatest feeling of pleasure when walking in the natural environment compared to sitting in the natural environment, t (27) = 4.67, p<0.01, and walking in the urban environment, t (26) =-3.49, p<0.002. Finally, participants felt better sitting in the natural, compared to the urban, setting t(29)= -3.8, p<0.01.

Paired sample t-tests revealed that participants perceived higher levels of activation when walking in the urban environment in comparison to sitting in the urban environment t(26) = 3.98, p<0.01, and when walking, compared to sitting, in the natural environment t(27) = 2.47, p<0.02.

The Role of Mindfulness as a Moderator in the Relationship Between Level Activity and the Environment on Affective States.

Analyses revealed a 3 way interaction; showing that mindfulness acted as a significant moderator in the relationship between environment and time on feelings of energy, F (1,25)= 4.99 , p<0.05, η^2 =0.20 (Figure 5.11). Further analysis revealed that participants with low levels of mindfulness experienced increases in their energy levels over time in the natural

(p<0.05) environment but not in the urban environment. Participants with high levels of mindfulness experienced more energy (in both environments) at post measure compared to those with low mindfulness following a condition in the urban environment (p<0.01).

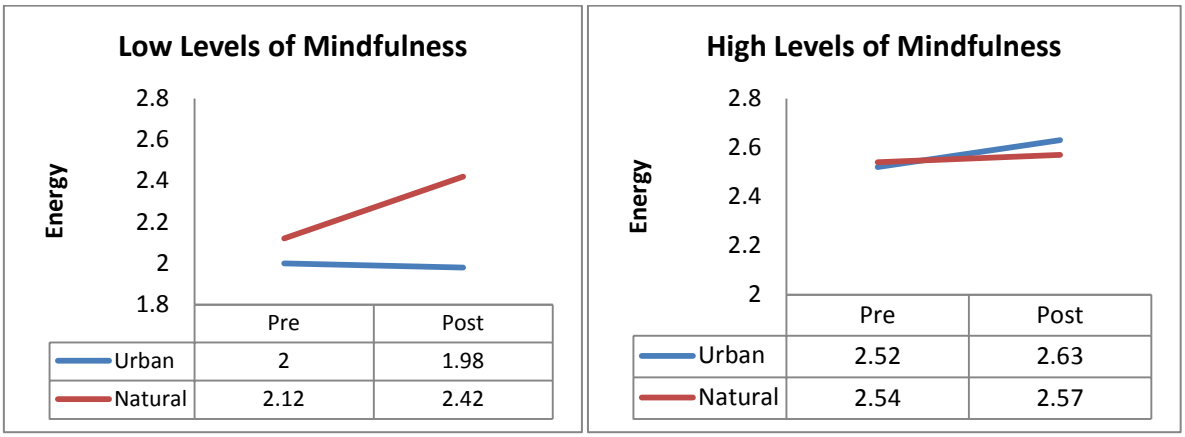


Figure 5.11 Moderating Effects of Mindfulness in the relationship between Environment, time and Energy

Omitting Weather Variables from the Analysis

When the control variables (rain and temperature) were omitted from the analysis, significant findings were seen for the following variables:

Analysis of positive affect revealed a significant 3 way interaction for time, environment and activity $F(1,27)= 3.784$ $p=0.062$, $\eta^2= 0.12$. Simple effects detail that positive affect increased over time when walking in natural environment (p<0.01) and was higher post condition when walking in the natural environment (p>0.05) in comparison to walking in the urban environment. Positive affect decreased over time in both the natural and urban environment (p<0.01) when sitting and was greater post condition when walking compared to sitting in natural environment (p<0.01) and urban environment (p<0.05).

Analyses of Negative Affect resulted in a two way interaction for environment and activity, $F(1,29)=4.29$ p<0.05, $\eta^2 = 0.13$. A test of simple effects showed negative affect decreased over time when walking and sitting in the natural environment (p<0.01). It was

lower post condition when walking (p<0.05) and sitting (p<0.01) in the natural environment compared to the urban environment.

Analyses of Tension resulted in a 3 way interaction between environment, activity and time, $F(1,27) = 13.35$, p<0.01, $\eta^2 = 0.33$. Simple effects revealed that perceived tension decreased (p<0.01) when sitting in the natural environment but was higher in the urban environment post sitting condition (p<0.05). Tension was lower in the natural (p<0.01) environment when walking compared to the urban environment.

Calmness revealed two, 2 way interactions. These were time and environment, $F(1,28) = 6.11$, p<0.05, $\eta^2 = 0.18$, and time and activity, $F(1,28) = 21.87$, p<0.01, $\eta^2 = 0.44$. Simple effects showed calmness decreased (p<0.05) in both the urban and natural environment when walking but increased in the natural environment over time (p<0.01) when sitting. Calmness was higher in the natural environment pre and post condition (p<0.01) when walking compared to sitting. Calmness was lower post condition in the urban environment (p<0.01) compared to the natural environment when sitting and was higher post condition when sitting (p<.01) compared to walking in the natural environment. Calmness was significantly higher post condition when sitting compared to walking (p<0.01) in the urban setting.

Summary of Study Arm 2

Study arm 2 allowed for a replication of the first laboratory study arm and the immersion of participants within the 'real' outdoor settings. Moderate intensity physical activity, across both environments, had a significant effect on energy and tiredness beyond any contribution of weather (H1). Specifically, walking increased levels of energy and decreased tiredness. Sitting decreased levels of energy but had no effect on tiredness. Mid-condition measures showed that participants experienced the most pleasure in the natural

environment and more so when walking compared to sitting indicating that the feelings of pleasure can occur early on during the walk (first 7 minutes). The highest levels of activation were experienced when walking compared to sitting in both environments. Results point towards walking being the important factor in increasing activation and decreasing tiredness and being immersed in a natural environment can intensify these effects. The environment had no effect on energy or tiredness, but did influence activation at mid-point. Specifically, walking in the natural environment produced the highest levels of activation. These results therefore partly support the third hypothesis (H3) that the natural environment enhanced the positive effects of physical activity compared to the urban environment (H1). The results also suggest however, that participants can benefit from walking in the built environment in terms of feelings of energy and tiredness over time compared to sitting in the urban environment. Furthermore mindfulness acted as a moderator in the relationship between environment and time on energy levels. High levels of mindfulness helped to increase levels of energy in the urban environment suggesting that it may be useful to practice mindfulness techniques when immersed in an urban environment. Finally, it is evident that including weather components as control variables is an important consideration for research in an outdoor environment. Temperature and percentage of sunlight had an overriding effect on all affective states with the exclusion of energy and tiredness.

Table 5.3 details a summary of results from both study arms 1 and 2. Included in the table are the conditions that represent the most positive well-being responses.

Table 5.3 Summary of significant results for Study 4: Details of the conditions that represent the most positive well-being responses.

Well-being variable	Condition representing the greatest well-being responses	
	Study arm 1	Study arm 2
Positive Affect	Walking (urban and natural)	-
Negative Affective	Post walking (natural)	-
Energy	Post walking (urban and natural)	Post walking (urban and natural)
Tiredness	Post walking (urban and natural)	Post walking (natural)
Tension	Post sitting (natural)	-
Calmness	Post sitting (natural)	-
Feeling Scale	Walking (natural)	Walking (natural)
Felt arousal Scale	Walking (natural)	Walking (natural)

Discussion

The aim of this two-armed study was to investigate the effects of different physical environments and levels of physical activity on affective states. Furthermore, the study explored the moderating effects of mindfulness in this relationship. The study aimed to add to existing literature by providing evidence within an urban and natural environment using both film clips and being immersed in outdoor settings, and also by directly comparing a sedentary behaviour with a single short bout of walking at a self-selected pace. Study arm 1 investigated these effects in a laboratory setting using film clips and study arm 2 replicated the first to an outdoor setting where participants walked and sat immersed in a natural or urban environment. A within subject design was used for both studies enabling the researchers to directly compare the differences within each condition of the same individual.

Sedentary Behaviour and Well-Being Responses

It has long been known that physical activity provides psychological and physical benefits (Fortier, Duda, et al., 2012; Murphy et al., 2007). There is increased focus on physical inactivity as a growing problem regarding its associated health problems and links to mortality (Lee et al., 2012; Wen et al., 2011). Therefore understanding physical activity, sedentary behaviour and the effect of the surrounding environment within this population can contribute to the future prediction of the burden of physical inactivity (Lee et al., 2012). Edwardson and colleagues (2012) have investigated the effects of sedentary behaviour and its association with negative physiological consequences. Findings from the present study (primarily study arm 1) suggest that short bouts of sedentary behaviour (sitting) can increase situational negative affect, tiredness and decrease energy levels all of which have are indicative of poor psychological well-being (Ekkekakis et al., 2005). Our findings add experimental evidence in support of previous research (Webb et al., 2012) to suggest a

negative influence of sedentary behaviour on affect. It may be expected that sedentary behaviours are associated with some level of psychological benefit (increases in low positive activation, i.e., calmness or the enjoyment of the activity in which an individual engages when sedentary (e.g., watching television or reading) otherwise individuals would be much less likely to engage in such sedentary activities.

Physical Activity and Well-being Responses

Results of increased positive affect and energy support the findings of Ekkekakis et al. (2011)'s review and the work of Focht (2010) that self-selected moderate intensity physical activity (i.e., walking) produces significant increases in pleasure and energy. This can also be used to explain the reduction in tiredness when walking. As energy increases, low activation affect (tiredness) decreases which further supports the suggestion that physical activity enhances high activation affect (Ward Thompson & Aspinall, 2011). Information supporting that moderate intensity physical activity can produce feelings of pleasure and increase levels of energy, and as a consequence increase motivation to exercise, is useful for intervention programming and adds to existing knowledge regarding the benefits that can be achieved through a lifestyle mode of physical activity (Darker et al., 2007). This was seen across both environments in both studies, over and above the effects of temperature and sunlight (study arm 2). In study arm 1, and similarly to outcomes found in research by Ekkekakis et al. (2000), calmness decreased during the walking condition and energy increased. Ekkekakis et al. (2000) found that following a short walk, participants returned to similar levels of calmness to baseline levels after a 10 minutes recovery time. This can be explained by the fluctuating nature of affect during exercise again emphasising the need to measure the cause-effects for a longer period (Ekkekakis et al., 2011).

The Physical Environment, Physical Activity and Well-being Responses

Affect has been shown to fluctuate during exercise (Ekkekakis et al., 2011), thus providing the rationale to measure affect during each condition. It was predicted that the natural environment, in line with previous research (Ryan et al., 2010; Van den Berg et al., 2003) would result in improved psychological well being. The principal finding indicated that walking in, *or* watching footage of, the natural environment resulted in the largest increases in psychological well-being, suggesting a true moderating effect. The mid measure of the Feeling Scale and Felt Arousal Scale showed that individuals generally felt better with higher levels of activation after 7 minutes of walking in both environments but the highest levels were apparent when walking in the natural environment. This information at mid-point signifies that the effect of physical activity and the environment can have an immediate impact and can present itself during the activity itself. Due to current measures for mood and affect (PANAS and AD ACL) having multiple items and potentially detracting from the environmental effects, the single item Feeling Scale (FS) and Felt Arousal Scale (FAS) were administered alongside the 5 item Mindful Attention Awareness Scale (MAAS). Since it was required for participants to focus on the environment, assessing psychological well-being during a task created a potential methodological issue and was therefore kept as brief as possible. Due to the complexity of the exercise affect relationship in relation to the environment, qualitative research could be a direction taken by future researchers. Evan and Jones (2011) proposed walking interviews and geographic information systems as an effective method to obtain data relating to understanding the effects of the physical environment. They argued that richer data can be attained in comparison to sit-down interviews and questionnaires because of the kinaesthetic rhythm being maintained. The time the responses are given can then be referenced in relation to the environment using geographic information systems technology. However, considerations would also need to be taken regarding the

social influences on affective response. As Johansson et al. (2011) demonstrated, being accompanied on a walk can increase positive affective responses more so than when walking alone.

Attention Restoration Theory and the Natural Environment

Further to the current literature, (Focht, 2010; Johansson et al., 2011; Kaplan & Kaplan, 2011), which has shown increases in levels of calmness in a natural environment, study arm 1 showed that whilst watching footage of both the natural and urban environment calmness significantly decreased when walking but increased when sitting. In support of attention restoration theory (Kaplan & Kaplan, 1989; S. Kaplan, 1996) perceived tension also decreased when participants were sitting watching footage of the natural environment. Attention restoration theory assumes that the capacity to direct attention diminishes with use in that it requires effort to inhibit distractions in order to direct attention. As the capacity to direct attention diminishes, a person may commit errors on tasks, show less sensitivity to others, become irritable or impulsive, and show other signs of attentional fatigue (Kaplan, 1996). Restoration is regularly discussed regarding its decreasing effects on arousal and activation (e.g., stress reduction, relaxation). Conversely, vitality is associated with increased energy levels. Evidence suggests that the activated types of positive affect that are associated with vitality can leave individuals more resilient to physical and viral stressors, and consequently less susceptible to illness (Ryan et al., 2010).

The restoration effects were most prominent watching the natural environment when the participants were participating in a sedentary behaviour and high affective states were most prominent when walking in either environment. It is possible that when seated the participants felt that they were able to focus their attention effortlessly as they were not required to direct attention to walking. Entering a situation that does not require directed

attention permits a person to rest the inhibitory mechanism on which directed attention depends (Kaplan, 1996). Participants' increased tiredness when sitting indicated that this activity did not result in full restoration.

Mindfulness, Physical Activity and the Physical Environment

In addition to investigating the effect of the environment and the level of physical activity on affective states, the study also aimed to investigate the moderating effects of naturally occurring mindfulness on mood and affect. Mindfulness was a moderating factor in both studies; in the relationship between physical activity, the environment and calmness in study arm 1 and between the environment, time and levels of energy in the study arm 2. Mindfulness has been linked to enhanced well-being because of its association with increased moment-to moment experience and its ability to enhance calmness (Geschwind et al., 2011; Prazak et al., 2012). The urban environment presents a surrounding that involves several changing and potentially challenging moment-to-moment experiences. Therefore, it can be postulated that decreases in calmness when watching film clips of the urban environment in those who reported high levels of mindfulness could be due to the individual having to direct attention with effort due to factors such as noise, cars and pedestrians. This is concordant with attention restoration theory. This attention or fascination directed with effort has been more prominent in urban surroundings (Van den Berg et al., 2003) as effortless attention can be overwhelmed by these factors. If an individual is directing their attention with effort they may be more likely to experience reductions in calmness. The same increase was not seen when the participants walked in the natural environment suggesting that the combination of both physical activity and natural environment could go some way to counteracting the reductions in calmness. Further research is needed to explore this possibility further.

Those who reported low levels of mindfulness experienced increased levels of energy when they were immersed in the natural environment. The same increase was not apparent when the same participants were immersed in the urban environment. This partly supports the hypothesis that the natural environment is more beneficial than an urban environment for psychological well-being. Further research should investigate not only the links between high affective states and restoration but also the relationship that they both have with naturally occurring mindfulness and how they can be used in the promotion of physical activity.

Limitations and Future Direction

The laboratory condition was advantageous with regard to the attainable control (i.e., social interaction, distraction of equipment in the lab, weather, noise). However, a compromise was reached from the lack of generalizability between laboratory settings and the real world. It can be implied, from our results, that weather plays an important part in influencing affective responses and should be considered within such research. Temperature and percentage of sunlight had an overriding effect on affective states with the exclusion of energy and tiredness. Considering weather components strengthens and adds to existing research. Previous outdoor studies have specified that they only collected data when weather conditions permitted in order to keep the weather conditions as neutral as possible (Ryan et al., 2010) or they excluded data when participants were exposed to adverse weather conditions (Martens, Gutscher, & Bauer, 2011). There is a paucity of research examining the effects of weather on affect (Kööts et al., 2011) or day to day physical activity (Chan & Ryan, 2009) and very few studies have accounted for weather (Ryan et al., 2010). The generally cold temperatures could explain the decline of positive affect when sitting in study arm 2. Data collection took place between September and January where temperatures varied by 15.2°C (mean = 7°C). Chan and Ryan (2009) found that a decrease of 10°C in temperature effected physical activity levels

and Van de Vliert (2007) found that 22°C was the optimum temperature for 'comfort'. Thus it seems plausible that larger decreases in temperature could potentially produce a further negative influence on affective responses (positive and negative affect, perceived tension and calmness). Given seasonal variations (Tucker & Gilliland, 2007), future research should address these concerns and researchers should be encouraged to collect data across all seasons. Increasing knowledge of how weather conditions can effect physical activity, mood, and affect will enable policy makers and providers of health care to adapt their recommendations in order to optimise the effects of weather conditions.

Weather was observed as a covariate within the data analysis. Future research could consider analysing weather as a moderator. Due to the nature of the data collected from the weather station the two conditions carried out during a single visit could not be differentiated because average measures were taken for the 90 minutes that participants were in that area.

Other limitations that should also be considered include that the baseline measures were administered within the environment in which the condition took place. Therefore the scores given were not independent of that particular environment. This could diminish the effects of the environment simply due to the participants being already being exposed to it. Future research should implement baseline measures in a neutral venue.

A single example of an urban and natural environment was used. Further research could account for different natural environments by including, for example, areas predominantly made up of water or forest land, to examine the responses across a variety of natural environments.

Finally, although using a physically inactive sample is a strength of this study given its public health implications, the individuals were predominantly young (Study arm 1: *M*=23 years old, Study arm 2: *M*=26.8 years old). Psychological changes may be different depending

on the age of participants (Fox et al., 2007). Future research could therefore include a broader age range in order to generalise the findings to a wider population.

Implications to Practice

This study carries important implications for policy-makers, urban planners and those interested in public health on how they should encourage greater use of natural open space in order to increase physical activity levels to promote psychological well-being. The physical environment can influence the mood and affective valence of an individual whether they are sedentary or physically active. Current results endorse the benefits of being immersed in a natural outdoor environment but it may be sufficient to watch films of outdoor environments for affective improvements, which could be particularly important for groups of adults living in areas with limited access to natural settings. Furthermore, a self-selected physical activity could further restoration responses of the natural environment (decrease tiredness). Ward Thompson and Aspinall (2011) suggested that, for many people, the attraction of engaging in physical activity in natural open spaces includes mental well-being benefits, stress relief, and psychological restoration, rather than physical activity per se. Our results, however suggest that physical activity can further enhance the positive effects of a natural environment and, for certain affective states, may in fact be the key influence. Attempts by policy-makers, urban planners and those interested in public health should encourage greater use of natural open space in order to increase physical activity levels to promote psychological well-being.

Conclusion

Both studies provided support regarding the restorative effects of a natural environment and the impact of physical activity on high energy states and psychological wellbeing. Findings provide information regarding the physical environment and how it may be used, from a

motivational perspective, to encourage inactive adults to increase their physical activity as part of their daily routine. This is due to positive affective serving motivational function (Williams et al., 2008). Exercise that increases or reduces pleasure may contribute to the formation of a positive or negative memory trace for exercise (Ekkekakis et al., 2011). The memory, consciously or subconsciously, may influence subsequent decisions to engage in, adhere to or drop out from exercise. Further research into the individual, long term affective response to short bouts of walking should be considered.

With future research, and as urbanisation continues to grow (Coombes et al., 2010), urban planning should consider the inclusion of features from a physical environment that can enhance feelings of well-being (e.g., trees, green space).

GENERAL DISCUSSION

Driven by weaknesses and questions that have arisen from the current literature, this thesis had the broad aim of understanding and expanding knowledge of the motivational processes that underpin the transition from a physically inactive to an active lifestyle. Implementing both qualitative and quantitative methodologies, support was provided for the application of SDT to the context of physical activity promotion among previously physically inactive adults. This thesis specifically highlights the importance of the social contextual and environmental determinants of physical activity and their relations with psychological well-being and behaviour (including adherence, drop out and lapse).

Adding to existing research and addressing some of their limitations, the specific aims of this thesis were:

1. To identify key motivational processes involved in the transition from a physically inactive to an active lifestyle, and the processes involved in lapse and drop-out behaviour in the context of a walking intervention.
2. To test the associations between unique sources of autonomy support (human and non-human), psychological need satisfaction, well-being and physical activity behaviour.
3. To investigate the effects of perceptions of autonomy supportive from a non-human source on (sustained) physical activity behaviour and psychological well-being.
4. To investigate the effect of the physical environment, on affective states as a function on levels of activity (i.e., walking versus sitting) and the moderating role of naturally occurring mindfulness.

This final chapter draws together the key findings from empirical studies 1-4 (chapters 2-5) and identifies practical implications and general limitations that have arisen from this thesis. Directions for future research will also be considered. It is hoped that the findings from this thesis can inform health promotion practice and policy.

Summary of Research Findings and Implications

Study 1

Grounded in SDT, study 1 (chapter 2) set out to apply a predominantly qualitative, longitudinal case study design to investigate inactive women's experiences of physical activity within a walking intervention in order to understand and identify the underlying (changing) motivational processes related to physical activity adoption, adherence, lapse and drop-out. Such knowledge would add to existing research which has predominantly employed cross-sectional designs to explore the processes and changes in need satisfaction involved in behaviour change within physical activity settings (Fortier et al., 2012; Huberty et al., 2008; Rodgers et al., 2010; Sabiston et al., 2009; Vandelanotte et al., 2007; Rahman et al., 2011).

Findings showed that the satisfaction of the needs for competence and relatedness were critical to the exercise adoption stages, whereas satisfaction of autonomy became increasingly important in the adherence phase. This provides qualitative elaboration on the work of Rahman et al. (2011) who found that relatedness need satisfaction was particularly important early in the behaviour change process while autonomy need satisfaction was critical *throughout* the behaviour change process. Furthermore, in support of SDT and previous research (McDonough & Crocker, 2007; Wilson & Rodgers, 2004), all adherers to the intervention displayed autonomously regulated behaviour throughout the latter stages of the programme. In those who lapsed and restarted their physical activity, increased feelings of autonomy were mainly evident at the point of re-uptake of physical activity.

Environmental support is proposed to be particularly important during the uptake of a behaviour (Kahn et al., 2010). Sources of support were found to be key driving forces in both the adoption phases of the walking behaviour, and in terms of adherence. Support from within the programme was pertinent at the initial uptake and support from beyond the programme was important for continuation of physical activity. In their quantitative study with women

undergoing exercise rehabilitation, Markland and Tobin (2010) showed that a reliance on social support (social assimilation) in the absence of feelings of autonomy was related to introjected regulation. The findings of study 1 extend those results by suggesting that a reliance on people within an intervention in the absence of autonomy might also lead to physical activity lapses (as apparent for participants who lapsed and experienced a re-uptake of physical activity) when the intervention ceased.

Participants saw obligation as a positive motivator to help them attend initially. Those who were exercising at the 6 month follow up experienced a decrease in introjected regulation over the period of the intervention. However, it was only at the re-uptake of physical activity (between 6-10 months) that those who had lapsed and re-started physical activity showed decreases in introjected regulation. As Thøgersen-Ntoumani and Ntoumanis (2006) showed, introjected regulation can be related to both adaptive and maladaptive outcomes. Markland and Ingledew (2007) argued that an individual can exhibit controlled forms of motivation and persist with physical activity as long as they also experience autonomous forms of motivation. The current findings suggest that identified regulation can offer similar benefits to intrinsic motivation and also result in persistence to exercise. Therefore, within this exercise context, full internalization might not be necessary for adherence. In research comparing, longitudinally, behavioural regulations of beginner exercisers to regular exercisers Rodgers et al. (2010) found that at 6 months of regular exercise, beginner exercisers did not reach the same levels of self-determined motivation as regular exercisers and did not experience full internalization of motivation. Findings of the current thesis found that at 10 months of regular exercise both adherers and those who lapsed showed signs of internalising behaviour. At the 4 months and 10 months interview, levels of controlled motivation were evident (although progressively decreasing) alongside more self-determined motivation. This highlights that motivational regulations can still be changeable after 10 months of exercise and therefore

individuals are potentially still susceptible to inconsistencies in behaviour (i.e., lapses or drop out).

Study 1 carries important practical implications and could inform future interventions that aim to support physical activity behaviour change through internalisation of behaviour. Specifically, it seems particularly pertinent to increase a sense of competence and relatedness during the adoption phases. Results point to the importance of devoting increasingly more attention to satisfying the need for autonomy throughout the intervention. Participants reported experiencing perceived support through the wider programme (i.e., text and emails). Future research should consider the effects of such tools as a source of support. Findings also suggest the importance of need supportive training for walking leaders before the programme begins (Williams et al., 2006) to help them create an environment aimed to facilitate participants' satisfaction of autonomy, competence and relatedness. Along with satisfying the psychological needs of the participants from within the programme, findings from this study also highlighted the importance of need support from beyond the programme (e.g., family member, work colleagues, general practitioners) to help participants continue the activity post intervention. The provision of information on how family members/friends could adopt an autonomy supportive approach, information on external groups (e.g., walking groups) and teaching participants planning strategies and self-regulation skills which could be used following the end of the intervention to enhance perceptions of autonomy, could be incorporated as part of future interventions.

Study 2

From a Basic Psychological Needs Theory (Ryan & Deci, 2000) perspective and in contrast to the qualitative design employed in study 1, the second study (chapter 3) implemented a quantitative longitudinal perspective to build on previous work within various

lifestyle domains (Rouse et al., 2011; Fortier et al., 2012; Moustaka et al., 2012; Rahman et al., 2011; Williams et al., 2002). Using multi-level modelling (ML-Win), and therefore allowing the researcher to include missing data of those who did not adhere or suffered a period of lapse. This study extended study 1 by exploring the unique contributions of sources of autonomy support (provided via a walk leader versus the overall programme) to psychological need satisfaction, subjective vitality and physical activity from baseline to week 16 (post-intervention) and at a 4 month follow-up. Furthermore, the study aimed to examine the mediating effects of autonomy and relatedness derived from the walk leader and via the walking programme, separately on the relationship between perceived autonomy support and the outcome measures (subjective vitality and physical activity behaviour).

Perceived autonomy support from both the leader and the walking programme predicted autonomy and relatedness need satisfaction. These results extend previous research supporting the premise of Basic Needs Theory (Ryan & Deci, 2000) and the provision of an autonomy supportive environment being associated with the satisfaction of the three basic psychological needs (Edmunds et al., 2008). The findings show that it is possible to differentiate between sources of autonomy support (Rouse et al., 2011) and suggests that aspects of a walking intervention beyond that of the walk leader (i.e., a non-human source) can be perceived as autonomy supportive and predict the satisfaction of the three basic needs and predict changes in subjective vitality from baseline to post intervention. A non-human source of support is therefore 1an important consideration of physical activity promotion.

The findings show that four months following the end of the programme, autonomy need satisfaction from the walk leader could explain the relationship between perceived autonomy support from the walk leader and subjective vitality and total physical activity. Relatedness, as seen in study 1, has been shown to be key to the initial uptake of a behaviour (Edmunds et al., 2008) and is considered necessary for internalisation of extrinsically

regulated behaviours and for well-being in the initial stages of the behaviour change process (Rahman et al., 2011). Given that long-term behaviour is linked to internalised motivation when autonomy need satisfaction is met (Edmunds et al., 2008),this provides an explanation for autonomy need satisfaction, and not relatedness, being the key mediator when predicting long-term adaptive outcomes. As Moustaka et al. (2012) suggested, within the context of physical activity, individuals do not necessarily partake in an activity for the social benefits but for physical fitness, an improvement of health or to improve their physique. As there were several walk leaders involved in the intervention and the groups changed continuously, relatedness need satisfaction may not have developed from interactions with any particular leader.

The positive associations from autonomy support from the walk leader on physical activity and subjective vitality were predicted up to 4 months post-intervention. This supports the rationale of training walk leaders within a walking programme to create an autonomy supportive environment to facilitate long-term physical activity behaviour. However, as our findings show, attention must also be paid to other strategies within an intervention that could be used to satisfy the basic psychological needs of autonomy and relatedness which have been linked to long term persistence to physical activity and psychological well-being (Edmunds et al., 2008; Fortier, Duda, et al., 2012; Rahman et al., 2011).

Study 3

The findings of study 2 suggested that individuals participating in a physical activity intervention could perceive autonomy support from aspects within an intervention which were non-human (i.e., email, SMS). Further research was needed to isolate each of their influences and investigate the effects further. Therefore, the overarching aim of study 3 (chapter 4) was to investigate the effects of text messages, based on principles of SDT, compared to neutral

text messages in the promotion of physical activity behaviour and psychological well-being in a physically inactive population beginning a series of exercise classes.

Results indicate that participants in the intervention group perceived greater levels of autonomy support from the text messages than those who received neutral messages. The intervention group also perceived significantly greater need satisfaction from the text messages for all three needs (autonomy, competence and relatedness) at both mid- and at post- intervention compared to the control group. This supports the broader tenets of SDT, that an autonomy supportive text message based intervention can lead to increased need satisfaction and therefore could be used as an effective tool in the promotion of physical activity. Findings show that increases in autonomy support can result from non-human contact above and beyond any effects of an instructor. The effects on physical activity and well being are comparable to those seen in studies where autonomy support is provided via the exercise instructors (i.e., Edmunds et al., 2008; Moustaka et al., 2012).

The need for autonomy in the intervention group was the only psychological need to further increase from mid to post measure. Although previous research (e.g., Williams et al., 2006) and our findings (study 1 and 2) suggest that autonomy need satisfaction is likely to increase in the latter stages of behaviour, autonomy need satisfaction also increased compared to the control group within the first 5 weeks of the intervention. When delivering an intervention based around principles of SDT aimed at promoting physical activity, it is therefore important to be mindful not to negate any of the psychological needs at any one time.

The exercise instructor was also the key influence for improvements to positive affect. This further emphasizes that within an intervention there are unique sources of autonomy support that can influence positive outcomes and thus supports the argument of Cole-Lewis

and Kershaw (2010) that a text message is a useful tool to be used in conjunction with other elements of an intervention and not as a standalone intervention technique.

Findings, however, revealed no group differences in the improvements to quality of life or negative affect. It was not possible to determine whether the text message alone (autonomy supportive or neutral) had an impact on these psychological improvements. The improvements could also have been caused by factors external to the exercise environment or the increases in physical activity reported during the 10 week intervention.

Study 3 also carries implications for future interventions employing strategies based on SDT principles. This study shows some evidence to support the use of autonomy supportive text messages. Results suggest that it is possible for an individual to perceive autonomy support via an inanimate object, (i.e., text message) and thus satisfy the three basic psychological needs. Whereas an autonomy supportive text message is unlikely to replace traditional behaviour change interventions incorporating principles of SDT (Edmunds et al., 2008; Fortier, Duda, et al., 2012; Ng et al., 2012), they appear to be an effective and a useful addition. Given the promising results of this study and the existing literature, and the increasing uptake of mobile technologies, providing text messages grounded in SDT principles within an intervention may improve existing practices and interventions.

Study 4

It is evident from the findings of Studies 1, 2 and 3 that social contextual and environmental determinants are key to the satisfaction of psychological needs in improving the quality of motivation when promoting physical activity effectively. It has long been known that physical activity provides psychological and physical benefits (Fortier, Duda, et al., 2012; Murphy et al., 2007). Therefore understanding physical activity, sedentary behaviour and the surrounding physical walking environment motives of an inactive

population can further knowledge on how to effectively promote physical activity. Employing an experimental design, the final 2 armed study (chapter 5) aimed to explore the effects of contrasting physical environments and levels of physical activity on affective states. Furthermore, the aim was to investigate the moderating effects of naturally occurring mindfulness.

This study added to existing literature by providing evidence within an urban and natural environments both indoor and outdoor and directly comparing a sedentary behaviour with a single short bout of walking at a self-selected pace. Findings suggest that short bouts of sedentary behaviour (sitting) can increase momentary negative affect, tiredness, decrease energy levels and thus having negative impact on psychological well-being (Ekkekakis et al., 2005). The current data supports existing research showing that sedentary behaviour can produce immediate negative psychological consequences. Further research is needed, however, to ascertain the duration and impact of these influences.

Results indicated that walking increased positive affect and levels of energy. This supports the findings of Ekkekakis et al. (2011)'s review and the work of Focht (2010) which showed that self-selected low-moderate intensity physical activity (i.e., walking) produces significant increases in pleasure and energy. This data further support the suggestion that physical activity enhances high level affective states (Ward Thompson & Aspinall, 2011). The principal finding indicated that walking, in or watching footage of, the natural environment was associated with the largest increases in psychological well-being. The mid measure of the Feeling Scale and Felt Arousal Scale showed that individuals generally felt better with higher levels of activation after 7 minutes of walking in both environments but the highest levels were apparent when walking in the natural environment. This information at mid-point signifies that the effect of physical activity and the environment can have an immediate impact and can present itself during the activity itself.

Attention restoration theory (Focht, 2010; Johansson et al., 2011; R. Kaplan & Kaplan, 2011) assumes that the capacity to direct attention diminishes with use in that it requires effort to inhibit distractions in order to direct attention. Restoration is generally discussed in terms effects on decreased arousal (e.g., relaxation; stress reduction), however vitality is associated with increased levels of energy. Evidence posits that it is particularly the activated types of positive affect (i.e., vigorous, lively) linked with vitality that can leave an individual more resilient to stressors, and consequently less susceptible to illness (Ryan et al., 2010). Participants' experienced increased tiredness when seated even though their calmness increased indicating that not all aspects of restoration were realised when seated. This is interesting particularly considering that participants were usually physically inactive.

The urban environment presents a surrounding that involves several changing and potentially challenging moment to moment experiences (Van den Berg et al., 2003). Mindfulness was a moderating influence in both studies. Mindfulness has been linked to enhanced well-being because of its association with increased moment-to-moment experience and its ability to enhance calmness (Geschwind et al., 2011; Prazak et al., 2012). In concordance with attention restoration theory, it can be postulated that decreases in calmness when watching film clips of the urban environment in those who reported high levels of mindfulness could be due to the individual having to direct attention with effort due to factors such as noise, cars and pedestrians. This attention or fascination directed with effortless attention can be overwhelmed by these factors. The same increase was not seen when the participants walked in the natural environment suggesting that the combination of both physical activity and the natural environment could go some way to counteracting the reductions in calmness. Further research is needed to explore this possibility further.

The generally cold temperatures could explain the decline in positive affect during the sitting condition in the outdoor study arm. Knowledge of how weather conditions effect

physical activity, mood, affect can help health care providers to adapt recommendations to mitigate its effects (e.g., provide an umbrella as part of a physical activity intervention that promotes walking outdoors).

Study 4 provides data to support the restorative effects of a natural environment and the impact of physical activity on high energy states and psychological wellbeing. Findings provide information regarding the physical environment and how it may be used, from a motivational perspective, to encourage inactive adults to increase their physical activity as part of their daily routine. Ward Thompson and Aspinall, (2011) suggested that, for many individuals, the attraction of open natural spaces and their perceived benefits are related to mental well-being, stress relief, and psychological restoration, rather than exercise for its own sake. However, for certain activation states (energy and tiredness) the results of the current study suggest that physical activity can further enhance the positive effects of a natural environment and may in fact be the key influence. This study carries important implications for policy-makers, urban planners and those interested in public health on how they should encourage greater use of natural open space in order to increase physical activity levels to promote psychological well-being. Current results endorse the benefits of being immersed in a natural outdoor environment but it may be sufficient to watch films of outdoor environments for affective improvements, and that could be particularly important for groups of adults living in areas with limited access to natural settings. As urbanisation continues to grow and as Coombes et al., (2010) urge, urban design and planning should consider the inclusion of features from a physical environment that can enhance feelings of well-being.

Limitations and Future Directions

This thesis provides further supportive evidence for the importance of understanding and considering social contextual and environmental determinants in the promotion of physical

activity behaviour. Studies 1, 2 and 3 provide additional evidence for SDT's propositions in the relationship with psychological well-being and physical activity behaviour. Study 4 supports the use of the natural environment to promote physical activity. However, it is important to acknowledge the limitations of this thesis when drawing conclusions. As a consequence of the research detailed in this thesis and its limitations, further research may be explored with important outcomes to increase knowledge further. The specific limitations for each study have been discussed at length within each separate empirical chapter. Some general limitations will be described in the following.

Participants

When considering future directions of research surrounding the promotion of physical activity, Thompson Coon et al., (2011) alluded to a need to concentrate on populations who may benefit most from the potential advantages of physical activity. Using a physically inactive sample is a strength of this thesis. However samples were relatively heterogeneous: the inclusion of participants who were mostly healthy British women from one university setting limits the generalisability of the findings. Similar research using more diverse populations, and larger sized samples should be conducted to make definitive conclusions. Additionally it can be assumed that all participants who took part in the 4 empirical studies possessed an initial level of motivation to participate in a physical activity intervention or engage in some physical activity as part of the study. Individuals who are amotivated (a lack of either intrinsic or extrinsic motivation) to exercise may be at an increased risk of the negative consequences of a physically inactive lifestyle and thus should be targeted in future research. Including participants who had dropped out or experienced lapses in behaviour is a particular strength of this thesis. Current research has often focused on those who adhere (Rodgers et al., 2010) and it is equally important to examine processes related to drop out or

lapses to obtain a true understanding of the behaviour change process (Prochaska & DiClemente, 1983; Rodgers et al., 2010).

Use of a Theoretical Framework

SDT has gained increasing popularity for its relevance in explaining behavioural patterns in the physical activity domain (Ng et al., 2012; Hagger & Chatzisarantis, 2008). Although the findings within this thesis (studies 1-3) have supported the tenets proposed by SDT, our interpretations grounded within SDT (Deci & Ryan, 1985) provide only one set of perspectives to the findings (Brocki & Wearden, 2006). Incorporating other psychological frameworks in conjunction with SDT may prove to be complimentary. For example Fortier, Sweet, et al., (2012) examined SDT alongside Stages of Change (Prochaska & DiClemente, 1983) to explain the process of physical activity adoption and adherence. For example, it is important to consider existing, successful methods of facilitating behaviour change. Abraham and Michie (2008) promote a taxonomy of Behaviour Change Techniques which details 26 techniques linked with various theories of behaviour change. Implementing techniques that represent more than one theoretical view point can increase the success of behaviour change interventions.

Fidelity of Autonomy Support

It is important to consider fidelity of delivering an intervention based on SDT principles. Within the current thesis, this is particularly relevant within the walking intervention where there was more than one walk leader and it is possible that their techniques on the provision of autonomy support could have been influenced by individual differences. Fortier, Sweet, O'Sullivan, and Williams, (2007) suggests further research should investigate both the quality of autonomy support and amount of autonomy support provided in order to better understand the underpinnings of the changes in key self-determination variables and their relationships with physical activity. Future research could also include a measure that considers support for

autonomy but also support for the needs for structure and involvement to help clarify the relationships that exist between SDT based constructs and physical activity.

Methods

Using a variety of research methodologies is a strength of this thesis. Studies 1 and 2 provide an important longitudinal view of the changing psychological processes that underpin behaviour change. Although study 3 provided insight into the unique contribution that autonomy support from the text messages and exercise classes can provide on need satisfaction and physical activity behaviour a longitudinal view of this research would provide information necessary to support whether an autonomy supportive text message can differentially influence relationships between motivational processes and physical activity behaviour.

Furthermore, study 4 provides an important insight into short term effects of a single bout of physical activity (or sedentary behaviour) on affective states. Future direction should investigate the effects of repeated exposure to a given environment which can further inform physical activity promotion.

Measures

Using validated measures was also a strength of this study. However the current thesis solely implemented self-reported measures of motivational constructs, well-being and behaviour. Although self-reported measures are a frequently employed method of collecting data and are important to provide insight into the psychological constructs, this method raises issues regarding validity due to issues concerning memory distortion, misinterpretation of questions or alterations in responses due to social desirability (Vansteenkiste et al., 2004). Objective measures of physical activity (e.g., pedometer/accelerometer) and well-being (e.g., markers of immune functioning such as cortisol) should be considered for use in future research. An objective measure of physical activity (i.e., an accelerometer) could have improved accuracy

of physical activity measurement across all studies. Given the seasonal variations evident within the UK (Tucker & Gilliland, 2007), and that the majority of data within this thesis required participants to spend time outdoors, future directions should include these considerations and collect data across the span of a full year.

Implications to practice

Key findings of this study have provided important implications to carry forward into practice. By considering these implications, the design and delivery of future programmes aimed at increasing physical activity levels could ameliorate adherence rates by facilitating autonomous reasons for exercising. Improving persistence to exercise will, in turn, lead to maintained or improved health which is an increasing focus of policy makers within the UK (DoH, 2011).

Table 6.5 details a summary of key findings and corresponding implications to practice.

Table 6.4. Summary of Key Findings and Implications to practice

Key Findings	Implications to Practice
Autonomy need satisfaction is essential for long-term persistence to physical activity, but competence and relatedness important to adoption phases.	Increasing focus on perceptions of autonomy support throughout a programme should be implemented (i.e., planning strategies, self-regulation skills, information on external groups) Important for health promotion specialists not to negate any of the needs at any one time.
Sources of support beyond the programme are important for persistence to exercise	Information on how family member/friends/important others could adopt an autonomy supportive approach should be made available to the important others that are involved in a physical activity programme.
Sources of support beyond a walk leader within an intervention can provide autonomy support	Within an intervention attention should be paid to tools that can provide perceptions of autonomy support (i.e., text messages, motivational booklets, emails)
Autonomy supportive text messages can increase need satisfaction, well being response and physical activity behaviour	Text messages are inexpensive, efficient and can reach large proportion of population groups.They are therefore a useful addition when promoting physical activity. Autonomy supportive content can result in increases to longer-term physical activity behaviour and well-being responses.
Walking or watching a natural environment is associated with greatest well-being responses	This is important for groups of adults living in areas with limited access to natural settings. well-being responses can be achieved from watching clips of a natural environment
Physical activity could further restoration responses of the natural environment (decreases in tiredness)	Full restoration can be achieved with short bouts of physical activity in a natural setting to decrease tiredness.

Conclusion

This final chapter has discussed pertinent findings from this thesis. Collectively, these results highlight the importance of social contextual and environmental determinants in those who are beginner exercisers in their efforts to persist in their quest to become regular exercisers. Previous research has clearly and overwhelmingly established the positive outcomes that can be accrued from regular physical activity. Despite overwhelming knowledge, a large proportion of the population in the UK is not sufficiently active to improve or maintain health. Employing a variety of research designs this thesis has shown that social contextual and environmental determinants do play an essential role in developing more autonomous motives for engaging and persisting with physical activity behaviour whilst they also play an important role in the improvement of psychological well-being. Information can aid to improving the efficiency and effectiveness of programmes designed to increase levels of physical activity. Health promotion specialists and urban planners are encouraged to consider these determinants when designing, implementing and delivering physical activity interventions.

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APPENDICES

Appendix 1: Chapter 2 materials

UNIVERSITY OF BIRMINGHAM

Information Sheet of FAQs (for you to keep)

A Case study investigating the processes of physical activity engagement: adoption to adherence

What is this research about?

Current recommendations suggest that individuals should engage in at least 30 minutes of moderate exercise, such as brisk walking, for at least five days each week to gain health benefits. However, the majority of adults (60% males, 75% females) do not meet these requirements. It appears that many find the transition from a sedentary lifestyle to a physically active one challenging and very little research has been conducted to examine this transition. Individuals may react in different ways to the uptake of a programme such as 'Step by Step', (for example with coping mechanisms for temptation to stop the walks), and we are interested in examining some of the psycho-social factors that might explain such differences. Understanding more about these factors may influence how healthcare professionals decide upon suitable strategies designed to assist individuals in making the transition from a sedentary lifestyle to a physically active one thus improving their quality of life.

What are you asking me to do?

You have been asked to participate in this study because you have indicated that you are interested in increasing your physical activity levels through the 'step-by-step' programme and are currently not participating in any levels of physical activity. We are asking you to agree to participate in 4 separate semi-structured one to one interviews. The first prior to beginning the 'step by step' programme, the second half way through the programme, the third at the end of the programme and the fourth interview 6 months following the end of the programme whether you have completed the programme or not. These interviews will take place at your convenience and will last approximately one hour.

Please read through this information sheet and ask **any** further questions you have regarding the study. If you are happy with the information, you will be asked to fill out the consent form. Once you have done this you will be contacted to arrange the date and time of the first interview.

What happens to the information I give in the interviews?

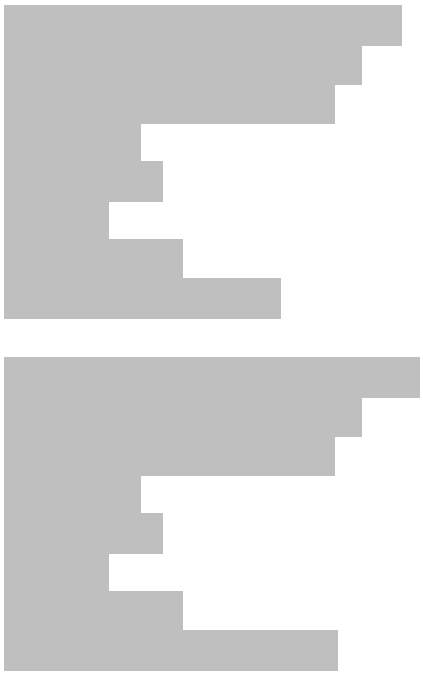
Once a consent form has been received by the research team, these will then be locked in filing cabinets and the data will therefore be confidential from this point onwards. Your identity and data will remain confidential and an ID code will be used in order for the

researchers to match up the information from each interview transcript at each stage of the programme and the follow up. The locked filing cabinets will be at the School of Sport and Exercise Sciences at the University of Birmingham, and code identification information will be stored on the researcher's password protected PC. Thus, your identity is not anonymous, but only the researchers on this project will be able to identify your individual responses. When the findings are distributed to the public and professionals in related fields, your identity will be anonymous as only a summary of the results will be reported. In line with the University's Code of Conduct for Research, data will be retained intact for a period of five years from the date of any publication which is based upon it.

You have the right to withdraw from this study at any time without needing to give a reason. There will be no negative consequences. Your data will not be included in the study and you can take your data or it will be destroyed by the researchers.

At this stage, please ask any further questions you have about this research project.

Please retain this information sheet in case you have any questions later on. You may contact the researchers at any time using the following contact details. In the first instance, please refer to Florence.



Consent form (For you to hand in to researcher.)
The consent form will be separated from the questionnaire by the researcher.

Study title: *A case study investigating the processes of physical activity engagement: adoption to adherence*

Questionnaire

Please read the following statements and tick the box if you agree:

I have read and understand the purpose of the study. ☐

I understand what is expected of me during the study ☐

I agree to the researchers interviewing me a total of 4 times over the next 12 months ☐

I understand that my identity and data **will** remain confidential. ☐

I understand that my identity **will not** remain anonymous to the researchers working within the research project.

☐

I understand that my identity will not be revealed when the findings are distributed to the public and professionals in related fields, my identity will be anonymous as only a summary of the results will be reported.

☐

I understand that I have the right to withdraw from this study **at any time** without needing to give a reason and without negative consequence. ☐

Please ask any further questions you have about this research project at any time.

Please print your name, sign and date below if you give your consent to participate in this study according to the conditions stated above.

Participant	**Researcher**
Print name:	Print name:
Sign:	Sign:
Date:	Date:

So that we can contact you with to arrange interviews, please fill out your contact details below (these details will be kept separate from your questionnaire and your details will remain confidential and will NOT be passed on to any other parties).

Name: ……
Email address:
……
Telephone number (mobile number is preferable)……

Interview schedule

Pre Walking programme

1. Can you summarise the experiences of physical activity throughout your life, i.e., childhood/teenage years/young adulthood?

2. (if applicable) What made you give up in the past?

3. Why do you want to become more physically active now?

4. Which challenges do you think you will face in trying to become more physically active?

5. Which challenges have you faced in the past (give e.g.,'s)?

6. What do you think will help you remain physically active?

7. Who supports you in your efforts to become more physically active? How do they support you?

8. What are your expectations of the walking programme?

9. What do you hope to gain from participating in the programme?

10. Why are you interested in the walking programme?

11. What would be your barriers to this programme in particular?

12. How can we help you to increase the likelihood of you continuing with the programme?

13. To what extent do you think you will be successful in completing the programme/successful in increasing your walking behaviour?

14. Do you feel you will be able to commit to the programme? What makes you feel that you can or can not?

15. To what extent do you feel that it was your own decision to take part in the programme? (if applicable:who/what pressures you to do it?)

16. Any further comments?

During Walking Programme (week 10).

1. Could you explain how you feel about your confidence towards physical activity at the moment? Has it changed? How? Why do you think it has changed?

2. Who supports you in your efforts to stay physically active?

3. What role does family/friends/walk peers play in your attempts to stay physically active?

4. How do they support you?

5. To what extent is the programme meeting your expectations?

6. How are you finding committing to the walks?

7. Are you experiencing any barriers/challenges to taking part in the walks? Which?

8. If applicable: What have you done to overcome these barriers?

9. How are you dealing with temptations to stop being physically active?

10. Can you think of a time when you feel tempted not to go on a walk and describe how you dealt with it? What did you do? How did you feel?

11. What are the main reasons for wanting to continue with the walks?

12. What role does the walk leader/family/partner/friends/walk peers play in your attempts to stick with the programme? How do their roles affect you?

13. To what extent to do you feel that you make your own decisions regarding elements of the programme?

14. To what extent do you feel listened to by the walk leader and walk peers?

15. To what extent do you feel you have a "say" in what happens in the programme?

16. To what extent has any elements of the programme helped you make decisions about your health?

17. How is your decision-making supported (if at all)?

Any further comments?

Post Walking Programme (week 16)

1. How are you feeling with regards to your physical activity levels now?

2. Where will you go from here (i.e., physical activity intentions)?

3. Do you feel you are able to maintain your physical activity levels?

    If applicable: What makes you think that you can be successful in maintaining these levels?

    Alternatively: what makes you think that you will *not* be successful in maintaining these levels?

4. If current levels have continued to be low: why is this the case?

5. How committed do you feel about staying physically active and what makes you feel you can commit to these levels?

6. Can you describe your reasons for engaging in for physical activity at the moment? Have they changed over the course of the programme? Why?

7. How have you dealt with temptations to stop being physically active?

8. To what extent do you think you have control over continuing these levels of walking now the programme has finished?

9. Who supports you in your efforts to stay physically active? In what way do you feel that they support you?

10. Did the programme meet your expectations?

11. Would you have wanted anything further from the programme?

12. How has the programme impacted your life?

(if applicable) which factors have helped you stay physically active?

13. To what extent have you managed to sustain your walking levels on your own/ independently (i.e., following the end of the programme)?

    Why do you think you were able to?

    Alternatively: why do you think you were not able to?

14. Why do you think you were successful in adhering to the programme?

For those who adhered omit question 18.

For those who did not adhere omit this question (15).

15. Think of a situation during the programme when you felt really successful - what contributed to you feeling that way?

16. Did anyone or anything help you feel that you were able to do the programme? How did they/it help you?

17. Why do you think you experienced a return to your old lifestyle, i.e., why didn't the programme work for you?

18. Think of a situation during the programme when you found it impossible to stick with it – what contributed to you feeling that way?

19. Did anyone/anything made it harder for you to stick with the programme?

20. To what extent has any elements of the programme helped you make decisions about your health?

21. How is your decision-making supported (if at all)?

Any further comments?

Follow up interview – 6 months post programme

1. How do you feel about physical activity at the moment?

    What has happened since we last met?

2. If applicable: Can you describe your reasons for participating in physical activity at the moment?

    Has it changed since you finished the programme 6 months ago?

    Why do you think this has happened?

3. How have you dealt with temptations to stop being physically active?

4. To what extent do you think you have control over continuing these levels of walking now the programme has finished?

5. Who supports you in your efforts to stay active? How do they support you?

6. To what extent have you managed to sustain your walking levels on your own/independently (i.e., following the end of the programme)?

    If applicable: How have you managed to do that?

7. Why do you think you are successful in maintaining your physical activity levels as part of your lifestyle?

If participant has not adhered go to question 10.

8. How confident are you in continuing with these levels or increasing them?

9. Is anyone/anything helping you feel like you are able to commit to physical activity as a part of your lifestyle?

10. Why do you think you experienced a return to your old lifestyle? Why do you think the programme didn't work for you?

11. Think of a situation since the programme when you found it impossible to stick with. What contributed to you feeling that way?

12. Did anyone/thing make it harder for you to stay being physically active?

Appendix 2: Chapter 3 materials

Please answer the following questions with regards to the walking programme walking in the past few weeks/month using the scale provided:

1	2	3	4	5	6	7
strongly disagree			neutral			strongly agree

1.	I feel that the walking programme	1	2	3	4	5	6	7
	has provided me choices and options.	1	2	3	4	5	6	7
2.	Through the walking programme	1	2	3	4	5	6	7
	I feel understood.	1	2	3	4	5	6	7
3.	The walking programme as a whole conveys confidence in my ability to make changes.	1	2	3	4	5	6	7
4.	Through the walking programme I am encouraged to ask questions.	1	2	3	4	5	6	7
5.	Through the walking programme, I feel listened to regarding how I would like to do things.	1	2	3	4	5	6	7
6.	The walking programme as a whole tries to understand how I see things before suggesting a new way to do something.	1	2	3	4	5	6	7

Please answer the following questions with regards to your walking programme using the scale provided:

1	2	3	4	5	6	7
not at all true			somewhat true			very true

1.	I feel like I can make a lot of input to deciding how the walks get carried out.	1	2	3	4	5	6	7
2.	I really like the people I walk with.	1	2	3	4	5	6	7
3.	I do not feel very competent when I am walking	1	2	3	4	5	6	7
4.	People I walk with tell me I am good at what I do.	1	2	3	4	5	6	7

5.	I feel pressured when I am walking.	1	2	3	4	5	6	7
6.	I get along with people on the walks.	1	2	3	4	5	6	7
7.	I pretty much keep to myself when I am on the walks.	1	2	3	4	5	6	7
8.	I am free to express my ideas and opinions within the walking programme.	1	2	3	4	5	6	7
9.	I consider the people I walk with to be my friends.	1	2	3	4	5	6	7
10.	I have been able to learn interesting new skills on the walking programme.	1	2	3	4	5	6	7
11.	When I am on the walks, I have to do what I am told.	1	2	3	4	5	6	7
12.	Most days I feel a sense of accomplishment from the walks.	1	2	3	4	5	6	7
13.	My feelings are taken into consideration during the walks.	1	2	3	4	5	6	7
14.	During the walks I do not get much of a chance to show how capable I am.	1	2	3	4	5	6	7
15.	People on the walking programme care about me.	1	2	3	4	5	6	7
16.	There are not many people on the walking programme that I am close to.	1	2	3	4	5	6	7
17.	I feel like I can pretty much be myself on the walks.	1	2	3	4	5	6	7
18.	The people I walk with do not seem to like me much.	1	2	3	4	5	6	7
19.	When I am walking I often do not feel very capable.	1	2	3	4	5	6	7
20.	There is not much opportunity for me to decide for myself how to go about the walks	1	2	3	4	5	6	7
21.	People within the programme are pretty friendly towards me.	1	2	3	4	5	6	7

Please answer the following questions with regards to your walk leaders within the walking programme. Please rate your walk leaders as a whole and not one specific leader:

1	2	3	4	5	6	7
strongly disagree			neutral			strongly agree

1. I feel that the walk leaders have provided me choices and options.
2. I feel understood by my walk leaders.

3. I am able to be open with my walk leaders on our walks.
4. My walk leaders convey confidence in my ability to make changes.
5. I feel that my walk leaders accept me.
6. My walk leaders have made sure I really understand about the benefits of walking and what I need to do.
7. My walk leaders encourage me to ask questions.
8. I feel a lot of trust in my walk leaders.
9. My walk leaders answer my questions fully and carefully.
10. My walk leaders listen to how I would like to do things.
11. My walk leaders handle people's emotions very well.
12. I feel that my walk leaders care about me as a person.
13. I don't feel very good about the way my walk leaders talk to me.
14. My walk leaders try to understand how I see things before suggesting a new way to do things.
15. I feel able to share my feelings with my walk leaders.

Please answer the following questions with regards to the walking leaders within the walking programme. Please rate your walk leaders as a whole and not one specific leader. Please answer how you have felt in the past few weeks/months using the scale provided:

		1	2	3	4	5	6	7
		not at all true			somewhat true			very true
1.	I like the walk leaders.	1	2	3	4	5	6	7
2.	The walk leaders help me to feel competent at walking.	1	2	3	4	5	6	7
3.	The walk leaders make me feel pressured to walk.	1	2	3	4	5	6	7
4.	The walk leaders help me feel a sense of accomplishment from walking.	1	2	3	4	5	6	7
5.	The walk leaders take my feelings regarding walking into consideration.	1	2	3	4	5	6	7
6.	The walk leaders demonstrate caring about me as a person.	1	2	3	4	5	6	7
7.	The walk leaders do not make me feel very capable at walking.	1	2	3	4	5	6	7
8.	The walk leaders provide me with the opportunity to decide for myself how to go about the walks.	1	2	3	4	5	6	7
9.	The walk leaders are friendly towards me.	1	2	3	4	5	6	7

UNIVERSITY OF BIRMINGHAM

Information Sheet of FAQs (for you to keep)

Investigation into the use of motivational text messages within an organised exercise class

What is this research about?

Current recommendations suggest that individuals should engage in at least 30 minutes of moderate exercise, on at least five days each week to gain health benefits. However, the majority of adults (60% males, 75% females) do not meet these guidelines. It appears that many find the transition from a sedentary to a physically active lifestyle challenging and very little research has been conducted examining such transitions. Research that has been conducted shows that motivational messages have been linked with long term behaviour change, for example in smoking cessation, weight loss programmes and adherence to medical regimens. There is limited research on this topic within the exercise domain, and even less using text messages provided via mobile phones to convey these messages. The knowledge gained from this study can help health professionals in designing individually tailored interventions that optimise adoption and adherence to physical activity, thus improving participants' quality of life.

What are you asking me to do?

You have been asked to participate in this study because you have indicated that you are interested in increasing your physical activity levels through an organised exercise class. We are inviting you to complete 4 questionnaires via the post over a six month period. You will also receive two text messages per week during a 10 week intervention. The first postal questionnaire 1 will be completed prior to beginning the walking programme and text message trial. Questionnaire 2 will be sent to you midway through the text message trial (at 5 weeks). Questionnaire 3 will take place on completion of the 10 week trial and the final Questionnaire will be sent 3 months after the end of the 10 week text message trial. Each of the questionnaires will take approximately 15 minutes to complete. We would like to include you in all 4 stages, even if you, due to unforeseen circumstances, don't manage to continue with the exercise classes.

Please read through this information sheet and ask **any** further questions you have regarding the study. If you are happy with the information, you will be asked to fill out the consent form. Once you have done this you will be contacted via e-mail or phone to arrange the date and time of the first telephone interview.

What happens to the information I give in the questionnaires?

Once a consent form has been received by the research team, it will be stored in locked filing cabinets and the data will therefore be confidential from this point onwards. Your identity and data will remain confidential and an ID code will be used in order for the researchers to match up the information from each questionnaire at each stage of the trial and the follow up. The locked filing cabinets will be at the School of Sport and Exercise Sciences at the University of Birmingham, and code identification information will be stored on the researcher's password protected PC. Thus, your identity is not anonymous, but only the researchers on this project will be able to identify your individual responses. When the findings are disseminated to the public and professionals in related fields, your identity will be anonymous as only a summary of the results will be reported. In line with the University's Code of Conduct for Research, data will be retained intact for a period of ten years from the date of any publication which is based upon it.

You have the right to withdraw from this study at any time without needing to give a reason. There will be no negative consequences for your participation in the walking programme. You can continue with this as normal. Your data will not be included in the study and you can take your data or it will be destroyed by the researchers.

At this stage, please ask any further questions you have about this research project.

Please retain this information sheet in case you have any questions later on. You may contact the researchers at any time using the following contact details. In the first instance, please refer to Florence.

Consent form (For you to hand in to researcher.)
The consent form will be separated from the questionnaire by the researcher.

Investigation into the use of motivational text messages within organised physical activity walking classes.

Questionnaire
Please read the following statements and tick the box if you agree:

I have read and understand the purpose of the study. ☐

I understand what is expected of me during the study ☐

I agree to completing a total of 4 questionnaires over the next 6 months ☐

I understand that my identity and data **will** remain confidential. ☐

I understand that my identity **will not** remain anonymous to the researchers working within the research project. ☐

I understand that my identity **will not** be revealed when the findings are distributed to the public and professionals in related fields ☐

I understand that I have the right to withdraw from this study **at any time** without needing to give a reason and without negative consequence. ☐

Please ask any further questions you have about this research project at any time.

Please print your name, sign and date below if you give your consent to participate in this study according to the conditions stated above.

Participant	**Researcher**
Print name:	Print name:
Sign:	Sign:
Date:	Date:

ID code: (office use only)…….

So that we can send questionnaires and deliver text messages, please fill out your contact details below (these details will be kept separate from your questionnaire and your details will remain confidential and will NOT be passed on to any other parties).
Name and address (including postcode):
……

……

Email address: ……

Telephone number (mobile number is preferable)……

Text Messages

Neutral Messages

1. The Munrow Sports Centre at the University of Birmingham runs over 80 ‘Active Lifestyle’ classes per week.
2. There are over 20 different activities to choose from within the ‘Active lifestyle’ timetable.
3. ‘Active Lifestyle’ classes are open to staff and students of the University of Birmingham and members of the Munrow Sports Centre.
4. Bodycombat is an energetic programme inspired by martial arts.
5. Regular physical activity can benefit communities and economies through increased productivity in the workplace and improved health.
6. Physical activity is defined as "any force exerted by skeletal muscle that results in energy expenditure above resting level"
7. Physical activity includes "the full range of human movement, from competitive sport and exercise to active hobbies, walking and cycling or activities of daily living”.
8. Bodybalance is a Yoga, Pilates and Tai Chi workout aimed at building flexibility and strength.
9. The British population spends around £110 billion on healthcare per year which is equal to 8.5% of all income.
10. Bodypump is a barbell class that strengthens your entire body.
11. The University of Birmingham Sport programme ‘Active Lifestyle’ offer a variety of aerobic, toning, holistic and dance classes.
12. For every £1 spend on establishing healthy walking schemes the NHS could save £7.18 in the cost of treating conditions such as heart disease, stroke and diabetes.

13. The Health Survey for England estimates that 37% of men and 24% of women meet the recommended levels of physical activity of 5 x 30mins per week.
14. The four main risk factors for coronary heart disease in the UK are high blood pressure, high cholesterol, smoking and physical inactivity.
15. 40% of men and 28% of women meet the minimum recommendations for physical activity in adults within the UK.
16. 'Health is a state of complete physical, mental and social well being and not merely the absence of disease and infirmity' (World Health Organisation)
17. Physical inactivity costs the NHS between £1 billion - £1.8 billion each year
18. The economic benefits of physical activity extend beyond health to other sectors of the economy such as transport and environment.
19. Bodyattack is a sports inspired cardio workout aimed to improve speed, fitness, strength and agility.
20. The Government has set a target in England and Wales for 70% of the population (in Wales, people up to the age of 65) to be "reasonably active" by 2020
21. Shorter bouts of physical activity, of 10 minutes or more, interspersed throughout the day are as effective as longer sessions of activity.

Autonomy Supportive Text messages

- **Stress Management (1)**

a. Some benefits that you can gain from regular exercise include reductions in feelings of stress and tension.You may already have noticed a difference.

b. Feeling relaxed and experiencing a reduction in stress can be a great benefit of regular exercise. These feelings can perhaps be intensified if you choose the activities that you particularly enjoy.

c. You have now been exercising regularly for a while! Some benefits that can be felt around this time include; generally feeling better, having increased self-confidence and feeling less stressed!

d. Feeling revitalised and experiencing a reduction of stress is a fantastic benefit of exercising. Perhaps you could use this as a tool when you are feeling particularly uptight or stressed?

- **Revitalisation (2)**

a. When you feel tired it's often difficult to motivate yourself to go to an exercise class! Remember doing some physical activity can help you feel more energised and more productive.

b. Have you noticed a new spring in your step? This could be down to all the physical activity you are now doing regularly!

c. We understand that exercising when you are busy with work can be very challenging. Why not try and remember how you feel after the classes to encourage yourself to get out there? It’s a good investment!

d. Do you feel revitalised after having been to an exercise class? Remembering this could be used as a motivational tool to help you get out there and attend a class!

e. Feeling revitalised and experiencing more energy is a fantastic benefit of exercising.

Perhaps you could use this as a tool when you are feeling particularly down or lethargic?

- **Enjoyment (3)**

a. By trying different exercise classes, you can identify your favourite ones. Why not then note the days/times of them and sign up to classes?
b. Do you have a favourite type of exercise? Why not find the classes that cover those exercises for a particularly enjoyable session?
c. If you enjoy an activity you are doing or how you do it, you may be more likely to carry out the activity and keep repeating it! Perhaps try reminding yourself of the aspects you are enjoying the most?
d. Now that you are exercising regularly, why not listen to a bit of music whilst you do, you could put on your favourite tunes to enjoy the session that little bit more?
e. We understand that you may not always feel like going to your exercise class, particularly when you are busy or the weather is bad. Perhaps try and think about the elements you enjoy about the class, whether it's your favourite exercise or a particular instructor?

- **Challenge (4)**

a. As you are keen to set yourself goals, why not increase the length of time you exercise by 5% every week? You will be able to see the improvements very quickly!
b. Setting yourself personal goals can increase your motivation as you become more determined to reach those goals. Why not add 10 mins to your weekend walks or when you have that extra bit of time? Good luck!
c. Setting yourself a personal challenge can make things interesting! Why not find out about all the classes in at the Munrow. Then you could set yourself the challenge of attending different ones.

- **Affiliation (6)**

a. Exercising within a group can help you to meet people and socialise and could make the classes more enjoyable for you!

b. Do you have a friend you enjoy talking to and you would like to exercise with? If you enjoy the classes you are more likely to carry on with them.

c. Having positive discussions over the phone can sometimes prove to be difficult and time consuming so why not take the opportunity of your classes to catch up with someone you exercise with!

d. Well done on your regular exercise! If you enjoy exercising with a friend, why not arrange times to exercise together, suitable to you both, in advance so you can still benefit from the company of a friend?

e. You have indicated that the social aspect of your physical activity is important to you. Exercising with friends is thought to increase the positive outcomes of physical activity further! Who said gossiping was a bad thing?!

- **Competition (7)**

a. If you enjoy a bit of healthy competition, why not compare your intensity of exercising over different classes?

b. Why not increase the amount you are exercising that little bit more by taking the stairs instead of the lift?

c. If a bit of healthy competition works positively for your motivation, why not try and include 5 mins of stretching before or after your class?

- **Health Pressures (8)**

a. It is understandable that you are concerned about your health. Joining an exercise class is a great step to leading a healthier lifestyle!

b. As we get older our priorities change and health can become a worry. By continuing to exercise regularly this worry can be reduced significantly as the risk of several common diseases (diabetes, heart disease and osteoporosis) can be reduced by up to 50%!

c. Health may be a concern for you...longevity can be enhanced through regular physical activity and now that you are regularly exercising you will benefit from all your hard work. Well done!

- **Ill-Health Avoidance (9)**

a. By doing 30 minutes of moderate physical activity a day 5 times a week, it is possible to that you can reduce the risk of several common diseases by up to 50% e.g; diabetes and coronary heart disease.

b. By exercising regularly you can reduce cholesterol levels and reduce high blood pressure by a whole 50%! These are some of the most prevalent coronary heart disease risk factors.

c. Osteoporosis, a common disease as you age can be offset by physical activity: no matter your age! It is possible for you to accrue the benefits by remaining physically active!

d. By remaining physically active, you can increase your quality of life by reducing the risk of several common diseases. You may already be able to feel these benefits!

e. Longevity can be enhanced through regular physical activity, if you are regularly attending exercise classes you will be benefiting from all your hard work. Well done!

- **Positive Health (10)**

a. Doing regular physical activity can provide great benefits such as helping you sleep and keeping you energised. You may start to feel better and have more self-confidence!

b. The recommendations of physical activity needed to improve health are 5 x 30 mins per week. If you are reaching these recommendations then your health will benefit greatly!

c. You have been exercising regularly, for some time! Some benefits that can be felt around this time include; generally feeling better, experiencing better focus, having more energy and increased self-confidence!

d. Are you generally feeling better in yourself, healthier and more energetic? By sustaining regular physical activity, these benefits can only improve further!!

e. Fantastic and well done on your regular physical activity. Some great news…by exercising regularly you can improve your vitality which in turn may improve your resilience to physical and mental stress making you less vulnerable to illness.

- **Weight management (11)**

a. You have specified that losing weight is a goal of yours; health benefits such as lowered cholesterol & blood pressure are also linked to weight loss.

b. Losing weight as a result of physical activity can have a positive influence on your mental well-being by increasing your self-confidence!

c. I understand that you are looking to lose weight. A great way to lose some weight while improving your health is to sustain your regular physical activity. Keep up the good work!

d. Now that you are a 'regular exerciser' you may be experiencing some associated health benefits. These benefits can be increased further by weight loss of 10% of your original body weight, if this is something you are looking to achieve!

e. Losing weight by doing regular physical activity and eating a healthy diet can improve other factors of your life along the way. For instance, improving vitality, mental well-being as well as improving your quality of life and reducing the risk of

several common diseases!

- **Appearance (12)**

a. We all know that regular physical activity helps to maintain good health; one fantastic additional benefit is that exercising can help fight the onset of ageing!

b. I understand that when you look in the mirror you want to like what you see. Exercising regularly can improve self-confidence, which helps you to like what you see!

c. You may be experiencing some positive physical changes as a result of your regular physical activity. Changes, such as weight loss and improved posture can have valuable effects on your health and well being! Great news!

d. You may now be feeling a little more confident about engaging in physical activity. This confidence might translate to confidence about how you look and feel.

- **Strength & Endurance (13)**

a. Do you feel slightly less out of breath when you are walking up the stairs? This fantastic benefit may be a result of your regular physical activity!

b. If you are looking to increase your strength and endurance, why not use your regular exercise classes as a tool to do so? It's safe and with a friendly group of people!

c. By exercising regularly you are increasing your strength and endurance… you may have noticed these benefits throughout your everyday life? For example doing gardening, the housework or even walking up and down stairs!

d. After many weeks of exercise classes you will certainly be stronger and fitter. Have you tried to go for more sessions? Or perhaps working with a little more intensity? This will improve your fitness even more! Well done.

e. Exercising regularly as you are doing is a great tool to increase your strength and endurance. Why not include 3 mins of hard brisk walking every 10 mins of your walk

to improve your fitness further?

- **Nimbleness (14)**

a. Regular physical activity will help to increase your agility and flexibility; you can increase it further by adding a few stretches before and after the classes.
b. Have you noticed improved flexibility and nimbleness lately? Another fantastic benefit of regular physical activity!!
c. Do you feel you have a spring in your step? Do your joints feel more supple? This could be the result of regular physical activity! A great all-round benefit.
d. You have now been exercising regularly for a while. Well done! Why not try taking the stairs throughout your day. This will increase your strength, agility and flexibility further!

Stage 1. Questionnaire

(to be posted back to researcher in pre-paid envelope provided)

WHY DO YOU EXERCISE?

Age: _____ years Sex: male female (please circle)

We are interested in the reasons underlying peoples' decisions to exercise, or not exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercising. Your responses will be held in confidence and only used for our research purposes.

I take part in the exercise class...

	Not true for me		**Sometimes true for me**		**Very true for me**
1. because other people say I should	0	1	2	3	4
2. because I feel guilty when I don't exercise	0	1	2	3	4
3. because I value the benefits of exercising	0	1	2	3	4
4. because it's fun	0	1	2	3	4
5. but I don't see why I should have to exercise	0	1	2	3	4
6. because my friends/family/partner say I should	0	1	2	3	4
7. because I feel ashamed when I miss an Exercise class	0	1	2	3	4
8. because it's important to me to exercise regularly	0	1	2	3	4
9. but I can't see why I should bother exercising	0	1	2	3	4
10. because I enjoy my exercise classes	0	1	2	3	4
11. because others will not be pleased with me if I don't	0	1	2	3	4
12. but I don't see the point in exercising	0	1	2	3	4
13. because I feel like a failure when I haven't exercised in a while	0	1	2	3	4
14. because I think it is important to make the effort to exercise regularly	0	1	2	3	4
15. because I find exercising a pleasurable activity	0	1	2	3	4
16. because I feel under pressure from my friends/family to exercising	0	1	2	3	4
17. because I get restless if I don't exercise regularly	0	1	2	3	4
18. because I get pleasure and satisfaction from exercising	0	1	2	3	4
19. I think exercising is a waste of time	0	1	2	3	4

SECTION 2: *ABOUT YOU*

The following questions ask about how you have been over the past 4 weeks. Please mark one box for each question.

➢ Physical fitness

During the past four weeks, what was the hardest physical activity you could do for at least two minutes? (please tick one box)

Very heavy
e.g., run, fast pace ☐
Carry a heavy load upstairs or uphill (25lbs/10kgs)

Heavy
e.g., jog, slow pace
climb stairs or a hill, moderate pace ☐

Moderate
e.g., walk, fast pace
carry a heavy load on level ground (25lbs/10kgs) ☐

Light
e.g walk, medium pace
carry a light load on level ground (10lbs/5kgs) ☐

Very light
e.g., walk, slow pace
wash dishes ☐

2. Feelings

During the past four weeks, how much have you been bothered by emotional problems such as feeling anxious, depressed, irritable or downhearted and sad?

Not at all ☐

Slightly ☐

Moderately ☐

Quite a bit ☐

Extremely ☐

3. Daily activities

During the past four weeks, how much difficulty have you had doing your usual activities or work, both outside the house, because of your physical and emotional?

No difficulty at all ☐

A little bit of difficulty ☐

Some difficulty ☐

Much difficulty ☐

Could not do ☐

4. Social activities

During the past four weeks, how much has your physical and emotional health limited your social activities with family, friends, neighbours or groups?

Not at all ☐

Slightly ☐

Moderately ☐

Quite a bit ☐

Extremely ☐

5. Pain

During the past four weeks, how much bodily pain have you generally had?

No pain ☐

Very mild pain ☐

Mild pain ☐

Moderate ☐

Severe pain ☐

6. Change in Health

How would you rate your overall health now compared to four weeks ago?

Much better ☐

A little better ☐

About the same ☐

A little worse ☐

Much worse ☐

7. Overall Health

During the past four weeks, how would you rate your health in general?

Excellent ☐

Very good ☐

Good ☐

Fair ☐

Poor ☐

8. Social Support

During the past four weeks, was someone available to help you if you needed and wanted help? For example if you:

- Felt very nervous, lonely or sad, Were ill and had to stay in bed, Needed someone to talk to, Needed help with the daily chores, Needed help just taking care of yourself

Yes, as much as I wanted ☐

Yes, quite a bit ☐

Yes, some ☐

Yes, a little ☐

No, not at all ☐

9. Quality of Life

How have things been going for you during the past four weeks?

☐	Very well: Could hardly be better
☐	Pretty good
☐	Good and bad parts about equal
☐	Pretty bad
	Very bad: Could hardly be worse

SECTION 3: ***HOW HAVE YOU BEEN FEELING?***

Please read the following words and mark the appropriate answer in the space next to that word. Indicate to what extent you have felt during the past week using the scale 1-5.

1 Very slightly or not at all
2 A little
3 Moderately
4 Quite a bit
5 Extremely

Interested	_____	Distressed	_____
Excited	_____	Upset	_____
Strong	_____	Guilty	_____
Scared	_____	Hostile	_____
Enthusiastic	_____	Proud	_____
Irritable	_____	Alert	_____
Ashamed	_____	Inspired	_____
Nervous	_____	Determined	_____
Attentive	_____	Jittery	_____
Active	_____	Afraid	_____

Please indicate in every box below the statement which best describes your feelings during the past week. Try to avoid thinking too long about your answer

I feel tense or 'wound up':

- ○ Most of the time
- ○ A lot of the time
- ○ From time to time, occasionally
- ○ Not at all

I still enjoy the things I used to enjoy:

- ○ Definitely as much
- ○ Not quite so much
- ○ Only a little
- ○ Hardly at all

I get a sort of frightened feeling as if something awful is about to happen:

- ○ Very definitely and quite badly
- ○ Yes, but not too badly
- ○ A little, but it doesn't worry me
- ○ Not at all

I can laugh and see the funny side of things:

- ○ **As much as I always could**
- ○ **Not quite so much now**
- ○ Definitely not so much now
- ○ Not at all

Worrying thoughts go through my mind:

- ○ **A great deal of the time**
- ○ **A lot of the time**
- ○ **From time to time, but not too often**
- ○ Only occasionally

I feel cheerful:

- ○ **Not at all**
- ○ Not often
- ○ Some of the time
- ○ Most of the time

I can sit at ease and feel relaxed:

- ○ Definitely
- ○ Usually
- ○ Not often
- ○ Not at all

I feel as if I am slowed down:

- ○ Nearly all the time
- ○ Very often
- ○ Sometimes
- ○ Not at all

I get a sort of frightened feeling like 'butterflies' in the stomach:

- ○ Not at all
- ○ Occasionally
- ○ Quite often
- ○ Very often

I have lost interest in my appearance:

- ○ Definitely
- ○ I don't take as much care as I should
- ○ I may not take quite as much care
- ○ I take just as much care as ever

I feel restless as I have to be on the move:

- ○ Very much indeed
- ○ Quite a lot
- ○ Not very much
- ○ Not at all

I look forward with enjoyment to things:

- ○ As much as I ever did
- ○ Rather less than I used to
- ○ Definitely less than I used to
- ○ Hardly at all

I get sudden feelings of panic:

- ○ Very often indeed
- ○ Quite often
- ○ Not very often
- ○ Not at all

I can enjoy a good book or radio or TV programme:

- ○ Often
- ○ Sometimes
- ○ Not often
- ○ Very seldom

Comments: Is there any additional information that you think may be useful for this study?

(Please feel free to use an extra sheet of paper)

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Thank you very much for your participation!

PLEASE PUT THE COMPLETED QUESTIONNAIRE IN THE PRE-PAID ADDRESSED ENVELOPE. SEAL IT, AND RETURN IT VIA THE POST TO US.

Stage 2 Questionnaire (Mid Intervention)

Questionnaire (to be posted back to Researcher in pre-paid envelope provided)

SECTION 1: *HOW YOU FEEL WITH REGARDS TO THE EXERCISE CLASS?*

Please answer the following questions with regards to your instructor of the exercise classes. Please rate the instructors as a whole and not one specific leader:

	Strongly Disagree			Neutral			Strongly Agree
1. I feel that the instructors have provided me choices and options.	1	2	3	4	5	6	7
2. I feel understood by my instructor.	1	2	3	4	5	6	7
3. I am able to be open with my instructor of the class.	1	2	3	4	5	6	7
4. My instructor conveys confidence in my ability to make changes.	1	2	3	4	5	6	7
5. I feel that my instructor accepts me.	1	2	3	4	5	6	7
6. My instructors have made sure I really understand about the benefits of exercise and what I need to do.	1	2	3	4	5	6	7
7. My instructor encourages me to ask questions.	1	2	3	4	5	6	7
8. I feel a lot of trust in my instructor.	1	2	3	4	5	6	7
9. My instructor answers my questions fully and carefully.	1	2	3	4	5	6	7
10. My instructor listens to how I would like to do things.	1	2	3	4	5	6	7
11. My instructor handles people's emotions very well.	1	2	3	4	5	6	7
12. I feel that my instructor cares about me as a person.	1	2	3	4	5	6	7
13. I don't feel very good about the way my instructor talks to me.	1	2	3	4	5	6	7
14. My instructor trys to understand how I see things before suggesting a new way to do things.	1	2	3	4	5	6	7
15. I feel able to share my feelings with my instructors.	1	2	3	4	5	6	7

Please answer the following questions with regards to your exercise classes using the scale provided:

	Not at all True			Somewhat True			Very True
1. I feel like I can make a lot of input to deciding how the classes are carried out.	1	2	3	4	5	6	7
2. I really like the people I exercise with.	1	2	3	4	5	6	7
3. I do not feel very competent when I am exercising.	1	2	3	4	5	6	7
4. People I exercise with tell me I am good at what I do.	1	2	3	4	5	6	7
5. I feel pressured when I am exercising.	1	2	3	4	5	6	7
6. I get along with people in the classes.	1	2	3	4	5	6	7
7. I pretty much keep to myself when I am in the exercise class.	1	2	3	4	5	6	7
8. I am free to express my ideas and opinions within the exercise classes.	1	2	3	4	5	6	7
9. I consider the people I exercise with to be my friends.	1	2	3	4	5	6	7
10. I have been able to learn interesting new skills in the exercise classes.	1	2	3	4	5	6	7
11. When I am in the classes, I have to do what I am told.	1	2	3	4	5	6	7
12. Most days I feel a sense of accomplishment from the exercise classes.	1	2	3	4	5	6	7
13. My feelings are taken into consideration during the classes	1	2	3	4	5	6	7
14. During the classes I do not get much of a chance to show how capable I am.	1	2	3	4	5	6	7
15. People in the exercise classes care about me.	1	2	3	4	5	6	7
16.There are not many people in the exercise classes that I am close to.	1	2	3	4	5	6	7
17. I feel like I can pretty much be myself in the exercise classes.	1	2	3	4	5	6	7
18. The people I exercise with do not seem to like me much.	1	2	3	4	5	6	7
19.When I am exercising I often do not feel very capable.	1	2	3	4	5	6	7
20.There is not much opportunity for me to decide for myself how to go about exercising	1	2	3	4	5	6	7

21.People within the exercise classes are friendly towards me.	1	2	3	4	5	6	7

SECTION 2: *HOW YOU FEEL WITH REGARDS TO THE TEXT MESSAGES?*

Please answer the following questions in regard to the content of the text messages that have been provided to you about your exercise classes in the past few weeks/months using the scale provided:

	Strongly Disagree			Neutral			Strongly Agree
1. The text messages provide me with choices and options.	1	2	3	4	5	6	7
2.The text messages convey confidence in my ability to make changes	1	2	3	4	5	6	7
3. The text messages ensure I really understand what I need to do	1	2	3	4	5	6	7
4. The text messages encourage me to ask questions.	1	2	3	4	5	6	7
5. The text messages take my perspective and then suggest ways of doing things based on this.	1	2	3	4	5	6	7
6. The text messages do not address me very well.	1	2	3	4	5	6	7

Please answer the following questions in regard to the content of the text messages that have been provided to you about your exercise in the past few weeks/months using the scale provided:

	Not at all True			Somewhat True			Very True
1.I like the text messages.	1	2	3	4	5	6	7
2.The text messages help me to feel competent at exercising.	1	2	3	4	5	6	7
3. The text messages make me feel pressured to exercise.	1	2	3	4	5	6	7
4.The text messages help me feel a sense of accomplishment from exercising.	1	2	3	4	5	6	7
5. The text messages take my feelings regarding exercise into consideration.	1	2	3	4	5	6	7
6. The text messages demonstrate caring about me as a person.	1	2	3	4	5	6	7
7. The text messages do not make me feel very capable at exercising.	1	2	3	4	5	6	7

8. The text messages provide me with the opportunity to decide for myself how to go about exercising.	1	2	3	4	5	6	7
9. The text messages demonstrate friendliness towards me.	1	2	3	4	5	6	7

Comments: Is there any additional information that you think may be useful for this study? (Please feel free to use an extra sheet of paper)

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Thank you very much for your participation!

PLEASE PUT THE COMPLETED QUESTIONNAIRE IN THE PRE-PAID ADDRESSED ENVELOPE. SEAL IT, AND RETURN IT VIA THE POST TO US.

Stage 3. Questionnaire

(to be posted back to researcher in pre-paid envelope provided)

WHY DO YOU EXERCISE?

Age: _____ years Sex: male female (please circle)

We are interested in the reasons underlying peoples' decisions to exercise, or not exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercising. Your responses will be held in confidence and only used for our research purposes.

I take part in the exercise class...

	Not true for me		**Sometimes true for me**		**Very true for me**
1. because other people say I should	0	1	2	3	4
2. because I feel guilty when I don't exercise	0	1	2	3	4
3. because I value the benefits of exercising	0	1	2	3	4
4. because it's fun	0	1	2	3	4
5. but I don't see why I should have to exercise	0	1	2	3	4
6. because my friends/family/partner say I should	0	1	2	3	4
7. because I feel ashamed when I miss an Exercise class	0	1	2	3	4
8. because it's important to me to exercise regularly	0	1	2	3	4
9. but I can't see why I should bother exercising	0	1	2	3	4
10. because I enjoy my exercise classes	0	1	2	3	4
11. because others will not be pleased with me if I don't	0	1	2	3	4
12. but I don't see the point in exercising	0	1	2	3	4
13. because I feel like a failure when I haven't exercised in a while	0	1	2	3	4
14. because I think it is important to make the effort to exercise regularly	0	1	2	3	4
15. because I find exercising a pleasurable activity	0	1	2	3	4
16. because I feel under pressure from my friends/family to exercising	0	1	2	3	4
17. because I get restless if I don't exercise regularly	0	1	2	3	4
18. because I get pleasure and satisfaction from exercising	0	1	2	3	4
19. I think exercising is a waste of time	0	1	2	3	4

SECTION 2: *ABOUT YOU*

The following questions ask about how you have been over the past 4 weeks. Please mark one box for each question.

➢ Physical fitness

During the past four weeks, what was the hardest physical activity you could do for at least two minutes? (please tick one box)

Very heavy
e.g., run, fast pace ☐
Carry a heavy load upstairs or uphill (25lbs/10kgs)

Heavy
e.g., jog, slow pace
climb stairs or a hill, moderate pace ☐

Moderate
e.g., walk, fast pace
carry a heavy load on level ground (25lbs/10kgs) ☐

Light
e.g walk, medium pace
carry a light load on level ground (10lbs/5kgs) ☐

Very light
e.g., walk, slow pace
wash dishes ☐

2. Feelings

During the past four weeks, how much have you been bothered by emotional problems such as feeling anxious, depressed, irritable or downhearted and sad?

Not at all ☐

Slightly ☐

Moderately ☐

Quite a bit ☐

Extremely ☐

3. Daily activities

During the past four weeks, how much difficulty have you had doing your usual activities or work, both outside the house, because of your physical and emotional?

No difficulty at all ☐

A little bit of difficulty ☐

Some difficulty ☐

Much difficulty ☐

Could not do ☐

4. Social activities

During the past four weeks, how much has your physical and emotional health limited your social activities with family, friends, neighbours or groups?

Not at all ☐

Slightly ☐

Moderately ☐

Quite a bit ☐

Extremely ☐

5. Pain

During the past four weeks, how much bodily pain have you generally had?

No pain ☐

Very mild pain ☐

Mild pain ☐

Moderate ☐

Severe pain ☐

6. Change in Health

How would you rate your overall health now compared to four weeks ago?

Much better ☐

A little better ☐

About the same ☐

A little worse ☐

Much worse ☐

7. Overall Health

During the past four weeks, how would you rate your health in general?

Excellent ☐

Very good ☐

Good ☐

Fair ☐

Poor ☐

8. Social Support

During the past four weeks, was someone available to help you if you needed and wanted help? For example if you:

- Felt very nervous, lonely or sad, Were ill and had to stay in bed, Needed someone to talk to, Needed help with the daily chores, Needed help just taking care of yourself

Yes, as much as I wanted ☐

Yes, quite a bit ☐

Yes, some ☐

Yes, a little ☐

☐

No, not at all

9. Quality of Life

How have things been going for you during the past four weeks?

☐	Very well: Could hardly be better
☐	Pretty good
☐	Good and bad parts about equal
☐	Pretty bad
	Very bad: Could hardly be worse

SECTION 3: *HOW HAVE YOU BEEN FEELING?*

Please read the following words and mark the appropriate answer in the space next to that word. Indicate to what extent you have felt during the past week using the scale 1-5.

1 Very slightly or not at all
2 A little
3 Moderately
4 Quite a bit
5 Extremely

Interested	_____	Distressed	_____
Excited	_____	Upset	_____
Strong	_____	Guilty	_____
Scared	_____	Hostile	_____
Enthusiastic	_____	Proud	_____
Irritable	_____	Alert	_____
Ashamed	_____	Inspired	_____
Nervous	_____	Determined	_____
Attentive	_____	Jittery	_____
Active	_____	Afraid	_____

Please indicate in every box below the statement which best describes your feelings during the past week. Try to avoid thinking too long about your answer

I feel tense or 'wound up':

- ○ Most of the time
- ○ A lot of the time
- ○ From time to time, occasionally
- ○ Not at all

I still enjoy the things I used to enjoy:

- ○ Definitely as much
- ○ Not quite so much
- ○ Only a little
- ○ Hardly at all

I get a sort of frightened feeling as if something awful is about to happen:

- ○ Very definitely and quite badly
- ○ Yes, but not too badly
- ○ A little, but it doesn't worry me
- ○ Not at all

I can laugh and see the funny side of things:

- ○ **As much as I always could**
- ○ **Not quite so much now**
- ○ Definitely not so much now
- ○ Not at all

Worrying thoughts go through my mind:

- ○ **A great deal of the time**
- ○ **A lot of the time**
- ○ **From time to time, but not too often**
- ○ Only occasionally

I feel cheerful:

- ○ **Not at all**
- ○ Not often
- ○ Some of the time
- ○ Most of the time

I can sit at ease and feel relaxed:

- ○ Definitely
- ○ Usually
- ○ Not often
- ○ Not at all

I feel as if I am slowed down:

- ○ Nearly all the time
- ○ Very often
- ○ Sometimes
- ○ Not at all

I get a sort of frightened feeling like 'butterflies' in the stomach:

- ○ Not at all
- ○ Occasionally
- ○ Quite often
- ○ Very often

I have lost interest in my appearance:

- ○ Definitely
- ○ I don't take as much care as I should
- ○ I may not take quite as much care
- ○ I take just as much care as ever

I feel restless as I have to be on the move:

○ Very much indeed

○ Quite a lot

○ Not very much

○ Not at all

I look forward with enjoyment to things:

○ As much as I ever did

○ Rather less than I used to

○ Definitely less than I used to

○ Hardly at all

I get sudden feelings of panic:

○ Very often indeed

○ Quite often

○ Not very often

○ Not at all

I can enjoy a good book or radio or TV programme:

○ Often

○ Sometimes

○ Not often

○ Very seldom

SECTION 4: *HOW YOU FEEL WITH REGARDS TO THE EXERCISE CLASS?*

Please answer the following questions with regards to your instructor of the exercise classes. Please rate the instructors as a whole and not one specific leader:

	Strongly Disagree			Neutral			Strongly Agree
1. I feel that the instructors have provided me choices and options.	1	2	3	4	5	6	7
2. I feel understood by my instructor.	1	2	3	4	5	6	7
3. I am able to be open with my instructor of the class.	1	2	3	4	5	6	7
4. My instructor conveys confidence in my ability to make changes.	1	2	3	4	5	6	7
5. I feel that my instructor accepts me.	1	2	3	4	5	6	7
6. My instructors have made sure I really understand about the benefits of exercise and what I need to do.	1	2	3	4	5	6	7
7. My instructor encourages me to ask questions.	1	2	3	4	5	6	7
8. I feel a lot of trust in my instructor.	1	2	3	4	5	6	7
9. My instructor answers my questions fully and carefully.	1	2	3	4	5	6	7
10. My instructor listens to how I would like to do things.	1	2	3	4	5	6	7
11. My instructor handles people's emotions very well.	1	2	3	4	5	6	7

12. I feel that my instructor cares about me as a person.	1	2	3	4	5	6	7
13. I don't feel very good about the way my instructor talks to me.	1	2	3	4	5	6	7
14. My instructor trys to understand how I see things before suggesting a new way to do things.	1	2	3	4	5	6	7
15. I feel able to share my feelings with my instructors.	1	2	3	4	5	6	7

Please answer the following questions with regards to your exercise classes using the scale provided:

	Not at all True					Somewhat True	Very True
1. I feel like I can make a lot of input to deciding how the classes are carried out.	1	2	3	4	5	6	7
2. I really like the people I exercise with.	1	2	3	4	5	6	7
3. I do not feel very competent when I am exercising.	1	2	3	4	5	6	7
4. People I exercise with tell me I am good at what I do.	1	2	3	4	5	6	7
5. I feel pressured when I am exercising.	1	2	3	4	5	6	7
6. I get along with people in the classes.	1	2	3	4	5	6	7
7. I pretty much keep to myself when I am in the exercise class.	1	2	3	4	5	6	7
8. I am free to express my ideas and opinions within the exercise classes.	1	2	3	4	5	6	7
9. I consider the people I exercise with to be my friends.	1	2	3	4	5	6	7
10. I have been able to learn interesting new skills in the exercise classes.	1	2	3	4	5	6	7
11. When I am in the classes, I have to do what I am told.	1	2	3	4	5	6	7
12. Most days I feel a sense of accomplishment from the exercise classes.	1	2	3	4	5	6	7
13. My feelings are taken into consideration during the classes	1	2	3	4	5	6	7
14. During the classes I do not get much of a chance to show how capable I am.	1	2	3	4	5	6	7
15. People in the exercise classes care about me.	1	2	3	4	5	6	7

16.There are not many people in the exercise classes that I am close to.	1	2	3	4	5	6	7
17. I feel like I can pretty much be myself in the exercise classes.	1	2	3	4	5	6	7
18. The people I exercise with do not seem to like me much.	1	2	3	4	5	6	7
19.When I am exercising I often do not feel very capable.	1	2	3	4	5	6	7
20.There is not much opportunity for me to decide for myself how to go about exercising	1	2	3	4	5	6	7
21.People within the exercise classes are friendly towards me.	1	2	3	4	5	6	7

SECTION 5: *HOW YOU FEEL WITH REGARDS TO THE TEXT MESSAGES?*

Please answer the following questions in regard to the content of the text messages that have been provided to you about your exercise classes in the past few weeks/months using the scale provided:

	Strongly Disagree			Neutral			Strongly Agree
1. The text messages provide me with choices and options.	1	2	3	4	5	6	7
2.The text messages convey confidence in my ability to make changes	1	2	3	4	5	6	7
3. The text messages ensure I really understand what I need to do	1	2	3	4	5	6	7
4. The text messages encourage me to ask questions.	1	2	3	4	5	6	7
5. The text messages take my perspective and then suggest ways of doing things based on this.	1	2	3	4	5	6	7
6. The text messages do not address me very well.	1	2	3	4	5	6	7

Please answer the following questions in regard to the content of the text messages that have been provided to you about your exercise in the past few weeks/months using the scale provided:

	Not at all True			Somewhat True			Very True
1.I like the text messages.	1	2	3	4	5	6	7
2.The text messages help me to feel competent at exercising.	1	2	3	4	5	6	7
3. The text messages make me feel pressured to exercise.	1	2	3	4	5	6	7

4.The text messages help me feel a sense of accomplishment from exercising.	1	2	3	4	5	6	7
5. The text messages take my feelings regarding exercise into consideration.	1	2	3	4	5	6	7
6. The text messages demonstrate caring about me as a person.	1	2	3	4	5	6	7
7. The text messages do not make me feel very capable at exercising.	1	2	3	4	5	6	7
8. The text messages provide me with the opportunity to decide for myself how to go about exercising.	1	2	3	4	5	6	7
9. The text messages demonstrate friendliness towards me.	1	2	3	4	5	6	7

Comments: Is there any additional information that you think may be useful for this study? (Please feel free to use an extra sheet of paper)

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Thank you very much for your participation!

PLEASE PUT THE COMPLETED QUESTIONNAIRE IN THE PRE-PAID ADDRESSED ENVELOPE. SEAL IT, AND RETURN IT VIA THE POST TO US.

UNIVERSITY OF BIRMINGHAM

Information Sheet of FAQs (for you to keep)

Walking and your Environment!

What is this research about?

The benefits of a physically active lifestyle are well documented (Department of Health, 2004). Such benefits include an improvement in vitality, health and well-being. Mood and Mindfulness is associated with behavioural and health outcomes and in high energy states individuals have reported greater health and wellness. With enhanced energy and enjoyment an individual's quality of motivation is more likely to increase thus leading to the behaviour (i.e., physical activity) being repeated. With a considerable proportion of the population not reaching recommended levels of physical activity (63% males and 76% females), research into factors that can improve levels of participation is of high importance. We intend to examine the fit between people's individual characteristics in different physical environments when undertaking exercise versus no exercise.

What are you asking me to do?

We are inviting you to participate in two separate stages of this study. You will be randomly assigned to one of 2 groups before being asked to attend two 70 minutes sessions over a 1 week period. You will either be allocated to a laboratory study or a field study. Those assigned to the laboratory study will be asked to sit and watch a 15 minute film or walk at a moderate intensity for 15 minutes on a treadmill whilst watching a 15 minute film. Those who are assigned to the field study will be asked to both sit and walk at a moderate intensity for 15 minutes. You will also be asked to complete 3 short questionnaires: The first before the beginning of the experiment, the second during the experiment and the third at the end of the experiment.

You will then be invited to return to the laboratory or the field (same as 1st condition) and repeat the procedure with a different film or a risk assessed walk in a different area. The experiments will be carried out in Sportex or in the immediate area surrounding the University of Birmingham (Cannon Hill Park and Digbeth). They will last no longer than 70 minutes each. Each of the questionnaires will take approximately 5 minutes to complete and will be asking questions regarding your feelings and emotions in that moment.

Please read through this information sheet and ask any further questions you have regarding

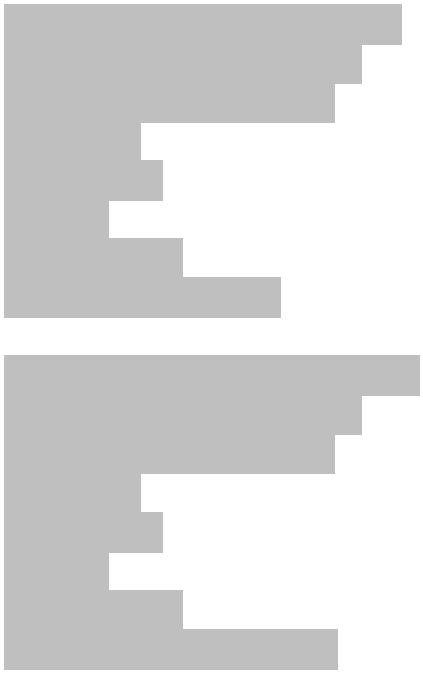
the study. If you are happy with the information, you will be asked to fill out the consent form. Once you have done this you will be contacted via e-mail or phone to arrange the date and time of the first telephone interview.

What happens to the information I give in the study?

Once a consent form has been received by the research team, it will be stored in locked filing cabinets and the data will therefore be confidential from this point onwards. Your identity and data will remain confidential and an ID code will be used in order for the researchers to match up the information from each questionnaire at each stage of the study. The locked filing cabinets will be at the School of Sport and Exercise Sciences at the University of Birmingham, and code identification information will be stored on the researcher's password protected PC. Thus, your identity is not anonymous, but only the researchers on this project will be able to identify your individual responses. When the findings are disseminated to the public and professionals in related fields, your identity will be anonymous as only a summary of the results will be reported. In line with the University's Code of Conduct for Research, data will be retained intact for a period of ten years from the date of any publication which is based upon it.

You have the right to withdraw from this study at any time up until the end of your second visit to Sportex without needing to give a reason. There will be no negative consequences for your participation in the walking programme. You can continue with this as normal. Your data will not be included in the study and you can take your data or it will be destroyed by the researchers. If you wish to withdraw please contact the researcher using the details provided below.

At this stage, please ask any further questions you have about this research project.
Please retain this information sheet in case you have any questions later on. You may contact the researchers at any time using the following contact details. In the first instance, please refer to Florence.



Consent form (For you to hand in to researcher.)
The consent form will be separated from the questionnaire by the researcher.

Study title: Walking and your Environment

Questionnaire

Please read the following statements and tick the box if you agree:

I have read and understand the purpose of the study. ☐

I understand what is expected of me during the study ☐

I agree to visit Sportex on 2 separate occasions, completing each stage with the researcher and completing 5 questionnaires on each occasion ☐

I understand that my identity and data **will** remain confidential. ☐

I understand that my identity **will not** remain anonymous to the researchers working within the research project. ☐

I understand that my identity **will not** be revealed when the findings are distributed to the public and professionals in related fields ☐

I understand that I have the right to withdraw from this study **at any time** without needing to give a reason and without negative consequences. ☐

Please ask any further questions you have about this research project at any time.
Please print your name, sign and date below if you give your consent to participate in this study according to the conditions stated above.

Participant	**Researcher**
Print name:	Print name:
Sign:	Sign:
Date:	Date:

ID code: (office use only)……

So that we can contact you with to arrange times for you to come into Sportex please fill out your contact details below (these details will be kept separate from your questionnaire and your details will remain confidential and will NOT be passed on to any other parties)

Name: ……
Email address: ……
Telephone number (mobile number is preferable): ……

Questionnaires
Survey Monkey

Section 1: General questions

Age: _____ years Sex: male female (please circle)

Exercise Participation (minutes per week of light, moderate, vigorous activity):

_____
_____
_____

Questionnaire 1: Please complete prior to beginning each condition

HOW DO YOU FEEL RIGHT NOW?

Instructions: Below is a collection of statements about what you are experiencing **right now**. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	Not at all true			**Somewhat true**			**Very True**
	0	1	2	3	4	5	6
1. I am finding it difficult to stay focused on what's happening in the present.	0	1	2	3	4	5	6
2. I am rushing through activities without being really attentive to them.	0	1	2	3	4	5	6
3. I am doing the task in hand automatically, without being aware of what I'm doing.	0	1	2	3	4	5	6
4. I am finding myself preoccupied with the future or the past.	0	1	2	3	4	5	6
5. I am finding myself doing the task in hand without paying attention.	0	1	2	3	4	5	6

Please read the following words and mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way **right now**, as in this moment in time, using the scale 1-5.

	Very slightly or not at all	**A little**	**Moderately**	**Quite a bit**	**Extremely**
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5

Each of the following words describes feelings or mood. Please use the rating scale next to each word to describe your feelings at this moment. Work rapidly, but please mark all the words. Your first reaction is best. This should take only a minute or two. Please respond using the scale provided:

	Definitely Do Not Feel	Cannot Feel Decide	Definitely Slightly Feel
	1	2	3	4
1. Active	1	2	3	4
2. Placid	1	2	3	4
3. Sleepy	1	2	3	4
4. Jittery	1	2	3	4
5. Energetic	1	2	3	4
6. Intense	1	2	3	4
7. Calm	1	2	3	4
8. Tired	1	2	3	4
9. Vigorous	1	2	3	4
10. At rest	1	2	3	4

11. Drowsy	1	2	3	4
12. Fearful	1	2	3	4
13. Lively	1	2	3	4
14. Still	1	2	3	4
15. Wide-awake	1	2	3	4
16. Clutched up	1	2	3	4
17. Quiet	1	2	3	4
18. Full of Pep	1	2	3	4
19. Tense	1	2	3	4
20. Wakeful	1	2	3	4

Comments: Is there any additional information that you think may be useful for this study? (Please feel free to use an extra sheet of paper)

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Thank you very much for your participation!

Questionnaire 3: (Asked at minute 7 of each condition)

Instructions: Below is a collection of statements about what you are experiencing right now. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	Not at all true			**Somewhat true**		**Very True**	
	0	1	2	3	4	5	6
1. I am finding it difficult to stay focused on what's happening in the present.	0	1	2	3	4	5	6
2. I am rushing through activities without being really attentive to them.	0	1	2	3	4	5	6
3. I am doing the task in hand automatically, without being aware of what I'm doing	0	1	2	3	4	5	6
4. I am finding myself preoccupied with the future or the past.	0	1	2	3	4	5	6
5. I am finding myself doing the task in hand without paying attention.	0	1	2	3	4	5	6

Please indicate using the scale provided how you feel **right now**, at this moment in time. Please circle the closest response to how you feel:

Very Good		**Good**		**Fairly Good**	**Neutral**	**Fairly Bad**		**Bad**		**Very Bad**
+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5

Please indicate using the scale provided how you are feeling **right now** at this moment in time. Please circle the closest response to how you feel:

Low Arousal				**High Arousal**	
1	2	3	4	5	6

Questionnaire 4: Please complete immediately once you have completed the task.

Instructions: Below is a collection of statements about what you are experiencing **right now**. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	Not at all true			**Somewhat true**		**Very True**	
	0	1	2	3	4	5	6
1. I am finding it difficult to stay focused on what's happening in the present.	0	1	2	3	4	5	6
2. I am rushing through activities without being really attentive to them.	0	1	2	3	4	5	6
3. I am doing the task in hand automatically, without being aware of what I'm doing	0	1	2	3	4	5	6
4. I am finding myself preoccupied with the future or the past.	0	1	2	3	4	5	6
5. I am finding myself doing the task in hand without paying attention.	0	1	2	3	4	5	6

Please indicate using the scale provided how you feel **right now**, at this moment in time. Please circle the closest response to how you feel:

Very Good		**Good**		**Fairly Good**	**Neutral**	**Fairly Bad**		**Bad**	**Very Bad**	
+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5

Please indicate using the scale provided how you are feeling **right now** at this moment in time. Please circle the closest response to how you feel:

Low Arousal				**High Arousal**	
1	2	3	4	5	6

Please read the following words and mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way **right now**, as in this moment in time, using the scale 1-5.

	Very slightly or not at all	**A little**	**Moderately**	**Quite a bit**	**Extremely**
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5

Each of the following words describes feelings or mood. Please use the rating scale next to each word to describe your feelings at this moment. Work rapidly, but please mark all the words. Your first reaction is best. This should take only a minute or two. Please respond using the scale provided:

	Definitely Do Not Feel	Cannot Decide		Definitely Slightly Feel
	1	2	3	4
1. Active	1	2	3	4
2. Placid	1	2	3	4
3. Sleepy	1	2	3	4
4. Jittery	1	2	3	4
5. Energetic	1	2	3	4
6. Intense	1	2	3	4
7. Calm	1	2	3	4
8. Tired	1	2	3	4
9. Vigorous	1	2	3	4
10. At rest	1	2	3	4
11. Drowsy	1	2	3	4
12. Fearful	1	2	3	4

13. Lively	1	2	3	4
14. Still	1	2	3	4
15. Wide-awake	1	2	3	4
16. Clutched up	1	2	3	4
17. Quiet	1	2	3	4
18. Full of Pep	1	2	3	4
19. Tense	1	2	3	4
20. Wakeful	1	2	3	4

What do you believe was the purpose of this study?

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Comments: Is there any additional information that you think may be useful for this study? (Please feel free to use an extra sheet of paper)

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Thank you very much for your participation!