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Motivational and affective responses to exercise: issues for adherence and the role of causality orientations

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MOTIVATIONAL AND AFFECTIVE RESPONSES TO EXERCISE: ISSUES FOR ADHERENCE AND THE ROLE OF CAUSALITY ORIENTATIONS

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SUMMARY

This series of studies set out to investigate the effect of self-determination and the individual differences that are present in motivational orientation on exercise behaviour and the affective and motivational responses to exercise. Deci and Ryan's (1985a) self-determination theory (SDT) and its sub-theories, cognitive evaluation theory (CET) and causality orientations theory (COT) were used as the theoretical basis. The purpose of the research was to provide an indication of the exercise environment that will encourage the most positive responses and may promote the adoption and maintenance of regular exercise in individuals with different motivational orientations. The first study examined the effect of increased self-determination on the affective and motivational responses to acute exercise. Results showed that increased self-determination made no difference to the affective response or to intrinsic motivation following exercise, although individuals chose to exercise at a higher intensity when given freedom of choice. Additional analyses showed that pre-exercise levels of affect influenced the response to exercise, as did individual differences with respect to motivational orientation. These individual differences were explained in terms of causality orientations and became the focus of the remainder of the thesis. Study two addressed the measurement of causality orientations specific to exercise. A measurement tool to assess causality orientations specific for exercise (the ECOS) was developed and was shown to be factorially valid and reliable and support was found for its concurrent validity. The third study was an intervention using the ECOS to investigate the interaction between causality orientations and the exercise environment on exercise behaviour. Psychological responses to regular exercise were measured at the situational and contextual level. Comparisons were made between individuals whose exercise environment was either supportive or not supportive of their predominant causality orientation and a control group. It was concluded that providing a matched exercise environment did not influence exercise behaviour. All individuals achieved and maintained the same levels of exercise. However, differences did emerge in psychological responses. Situationally, being autonomy oriented or in an autonomy supportive environment provided the most positive affective and motivational responses. Contextually, levels of autonomy, self-determined regulation and intrinsic motivation increased irrespective of causality orientation or exercise environment. Limitations of the research were discussed. Conclusions and future research based on an integration of the results of all three studies are presented with reference to SDT and COT along with the applied implications of the research with respect to exercise promotion.

CHAPTER 1

Introduction

Rationale for the programme of research

It has frequently been cited in the literature that regular exercise of a moderate intensity is beneficial in reducing a number of risk factors for disease such as obesity and hypertension (Blair *et al.*, 1989) as well as benefiting mental health (Seraganian, 1993). However, despite this knowledge, numbers participating in health related exercise are low (Allied Dunbar National Fitness Survey, 1992). Furthermore, adherence to exercise programmes is poor and it is widely cited that 50% of individuals drop out of exercise programmes within six months (Dishman, 1987). Research into factors which are related to participation in exercise and predict maintenance of exercise is widespread (see Robison and Rogers, 1994; Buckworth, 2000 and Marcus *et al.*, 2000 for reviews), yet no magic prescription has been found. Biddle and Nigg (2000) commented that knowledge and understanding about how people might be motivated to adopt and maintain exercise can only be furthered by research grounded in theory.

One factor reported as being important to long term adherence to exercise is intrinsic motivation (Boothby *et al.*, 1981; Dishman, 1987; Frederick and Ryan, 1993; Wankel, 1993; Ingledew *et al.*, 1998; Ryan *et al.*, 1997; Biddle, 1999). The development and importance of intrinsic motivation is the focus of Deci and Ryan's (1985a) self-determination theory. Through three sub-theories, self-determination theory describes the conditions conducive for developing intrinsic motivation (cognitive evaluation theory and organismic integration theory) and the individual differences that exist with respect to motivation (causality orientations theory). One of the main components of intrinsic motivation is self-determination (the freedom of choice), the others being perceived competence and relatedness. Markland and Hardy (1997) reported that research on intrinsic motivation to exercise has mainly focused on the effects of perceived competence even though self-determination plays a fundamental role in intrinsic motivation. Therefore, research into self-determination is warranted and as a theory has begun to receive attention in predicting, explaining and understanding behaviour (Biddle and Nigg, 2000).

Feelings of well-being are also intimated as being likely to influence long-term participation in exercise (Dishman, 1987; King *et al.*, 1988; Wankel, 1993). It is likely that the affective response generated by specific exercise sessions will play a role in the enjoyment gained from exercise and will influence the perception of the exercise as a whole. If this affective response is positive then this may prove beneficial for future participation in exercise.

The purpose of this programme of research is to investigate the effect of self-determination and the individual differences that are present with respect to the desire for self-determination on the affective and motivational responses to both acute and chronic exercise.

Structure of the thesis

The thesis is structured as three empirical studies with the second and third studies arising out of conclusions drawn from the first. Chapter two provides a literature review on the affective responses to acute exercise. Specifically, issues of the measurement of affect and the duration and intensity required of an exercise session to maximise affective responses are discussed. This is followed by an overview of self-determination theory and cognitive evaluation theory and the relevance of intrinsic motivation to the thesis. This review leads on to the rationale for the first empirical study.

The first study (Chapter three) is a lab based quasi-experimental study that compares the affective and motivational responses to a preferred intensity and a prescribed intensity exercise session. On the basis of self-determination theory (Deci and Ryan, 1985a) it is hypothesised that the preferred intensity exercise session will result in the most positive affective and motivational benefits.

Chapter four introduces the causality orientations theory (Deci and Ryan, 1985a) and details the results of an additional analysis of the data from study one that takes into account the proposals of this theory. Specifically, it compares the affective and motivational responses of those individuals who expressed a preference for the preferred intensity exercise session with those who favoured the prescribed intensity

exercise session. Its conclusions highlight the need for a valid measure of exercise specific causality orientations.

The second empirical study is presented in Chapter five. This describes the development of an instrument to measure causality orientations specific to exercise (the Exercise Causality Orientations Scale) including a detailed rationale for its development. The psychometric properties of the scale are tested using structural equation modelling and an assessment of its concurrent validity is presented. The chapter concludes with suggestions for how the instrument should be used from a theoretical and applied perspective.

Chapter six presents the third empirical study. This is a six month, field based, intervention study designed to investigate the interaction of causality orientations and the exercise environment on the adoption and maintenance of an exercise programme. It is proposed that in the short term adherence to exercise would be greater in those individuals whose exercise environment is matched to their predominant causality orientation. Situational and contextual psychological responses to the intervention are also assessed.

A general summary and final conclusions are given in chapter seven. A discussion of the theoretical and applied implications of the programme of research is presented along with proposals for where research should be directed in the future.

The first two empirical studies have formed the basis of discrete scientific papers that have been accepted for publication in peer-reviewed journals. The published paper resulting from each study is indicated at the foot of each respective title page.

CHAPTER 2

Affective responses to acute exercise and self-determination theory

Measurement of affect

Definitions

Within the literature pertaining to affective responses to exercise there has been inconsistency in defining the concepts of affect, mood, emotion and feelings such that they are regularly used interchangeably and not distinguished from each other (Ekkekakis and Petruzzello, 1999; Biddle, 2000a; Hanin, 2000; Landers and Arent, 2000; Vallerand and Blanchard, 2000). Although there are important distinctions between them, it is likely that the exercise environment will induce changes in them all.

Bateson *et al.* (1992) suggest that emotions are the immediate result of the individual's reaction to a specific event. More specifically, an emotion results from the appraisal of a situation or event (Biddle, 2000b; Lazarus, 2000; Vallerand and Blanchard, 2000). It is further suggested that the appraisal relates to the goals or values that are important to the individual (Frijda, 1988; Ekkekakis and Petruzzello, 1999; Lazarus, 2000). In contrast, moods lack a relationship to an object and have no distinct focus (Lazarus, 2000; Vallerand and Blanchard, 2000). The term feeling states has been defined as a reaction, appraisal or response to a specific experience (Gauvin and Spence, 1998) and as reflecting the subjective experience of emotion and mood (Vallerand and Blanchard, 2000). Therefore, feeling states seems to have the same cognitive basis as emotions. Emotions are thought to be of short duration, although they may last longer if the stimulus persists, while moods are longer lasting. Oatley and Jenkins (1996) proposed that emotions, moods and feelings differ on a temporal basis. They suggested that emotions last minutes to hours, feelings last minutes, hours and days, and moods may last days, weeks and even months. These different time patterns are typically disregarded when the different terms are used in research (Hanin, 2000). This temporal patterning would support the suggestion that mood follows from an emotion (Frijda, 1992; Morris, 1992). It has also been suggested that an individual's mood prior to an event will influence the appraisal of that situation and therefore affect the emotional response that results (Davidson, 1994).

Affect has been characterised as a more general term encompassing emotion, feelings and mood (Oatley and Jenkins, 1996; Ekkekakis and Petruzzello, 1999) as well as values, preferences and attitudes (Gohm and Clore, 2000). Affective state or response has been used to summarise all resultant emotions, moods and feelings at a particular time or to a particular event. However, mood has also been discussed as being the representation of overall affective state (McNair *et al.*, 1971; Morris, 1992; Feldman, 1995; Biddle, 2000a,b).

Within this thesis, the specific feelings or emotions arising from exercise will be discussed in terms of feeling states. The appraisal of, or response to, the specific exercise session that is being captured within the resultant feeling states is what individuals remember about the experience and is what may provide one source of motivation for future participation. Additionally, the term affective response will be used to describe the overall summary of feeling states (and emotions) resulting specifically from the exercise experience.

Measurement Scales

One of the most important factors to be considered when investigating affective change is the measurement scale used. The measurement of emotion, mood and affect has been approached in two ways. The first is to define an affective core of emotions and moods and to measure their intensity. This approach may conceal the wider impact of exercise on affective state (Van Landuyt *et al.*, 2000). The other is to combine these specific emotions and moods into a set of affective dimensions (typically a positive and negative subscale) based on their shared properties. This approach may result in the important psychological meaning and description inherent in emotion laden words being obscured or lost (Lazarus, 2000). As Gauvin and Spence (1998) have shown, a whole host of affect scales have been developed and used in physical activity research which all have their merits and limitations. In recognising the limitations of previous scales it is now regarded as important for a measurement tool to have two essential properties. Firstly, it must be multidimensional. McAuley and Courneya (1994) state that a multidimensional approach to measurement is essential to achieve an accurate understanding of the affective responses generated by exercise. There is widespread support for the belief that mood and affect vary along at least two dimensions classified as positive and negative affect (Watson *et al.*, 1988; McAuley and Courneya, 1994;

Frederick *et al.*, 1996), although these two dimensions are not orthogonal, they share some common variance (Tellegen *et al.*, 2000). Research in the exercise setting using multidimensional scales has provided support for affective responses varying in both a positive and negative manner (Lox and Rudolph, 1994; McAuley and Courneya, 1994; Tate and Petruzzello, 1995; Rudolph and Butki, 1998). Secondly, the scale must be exercise specific. Given that emotions and feelings result specifically from an appraisal of a particular stimulus then the affect scale should contain those emotions and feelings that will result specifically from an appraisal of the exercise experience. A further rationale for the need for exercise specificity is that the scale can be more sensitive towards detecting meaningful exercise-induced change (Gauvin and Rejeski, 1993).

Two scales which satisfy these criteria and warrant discussion are the Subjective Exercise Experiences Scale (SEES; McAuley and Courneya, 1994) and the Exercise-Induced Feeling Inventory (EFI; Gauvin and Rejeski, 1993). These two scales approach the measurement of affective responses in the two different ways as highlighted previously. The SEES has as its subscales positive well-being (PWB), psychological distress (PD) and fatigue which are deemed to measure the global subjective responses elicited by the exercise environment (McAuley and Courneya, 1994). PWB and PD are theorised to be equivalent to positive affect and negative affect, while the fatigue subscale was included to measure subjective interpretations of physical effort. The SEES has been described as a comprehensive measure of exercise induced subjective states (Lox and Rudolph, 1994). Gauvin and Rejeski (1993), meanwhile, have reported that exercise produces several distinct feeling states which can be defined as: revitalisation, positive engagement, tranquillity and physical exhaustion which together constitute the EFI. These subscales represent more specific feeling states than the general responses assessed by the SEES. By taking the view that exercise produces distinct feeling states, Gauvin and Rejeski are effectively ruling out other emotions that may result from exercise. Both scales report adequate psychometric properties and have been used successfully in the literature to highlight exercise induced changes in affective state.

Gauvin and Spence (1998) examined the properties of these two scales and concluded that despite their limitations, the two scales are useful for understanding the nature of the affective effects of exercise. However, Ekkekakis and Petruzzello (1999) provide a

scrutiny of the conceptual foundations of the two scales. They conclude that both scales have serious flaws. The EFI suffers from a lack of simple structure and its content is limited by failing to assess negative affective responses. The SEES is criticised on the basis of its conceptual assumptions, specifically, the PWB and PD subscales are negatively correlated ($r = -0.52$) when they are presented as two orthogonal and bipolar dimensions. A further consideration regarding the measurement of affective response is whether the scale is assessing emotion (or feelings) or mood. Smith and Crabbe (2000) suggest self-report questionnaires would appear to be assessing mood rather than emotion. Their rationale is that the time it takes to complete the scale is more consistent with the measurement of mood rather than emotion which is generated instantly. Vallerand and Blanchard (2000) also state that the EFI and SEES are actually measuring exercise-specific mood as they are not directed at specific objectives. However, if a person is asked how they feel at a particular point in time in relation to exercise it is likely that there is some cognition or appraisal taking place before a response is given. This would suggest that the scale does measure emotion or feeling states.

Gauvin and Spence (1998) concluded that measurement efforts should begin to assess more general affect before focusing on the specific elements, that both positive and negative affect should be addressed and that there should be a clear theoretical foundation for the tool. From the scales that are available and have been validated in the exercise setting, the multidimensional and exercise specific nature of the SEES would seem to make it one of the better examples of a measurement tool for affective responses to exercise. However, in using this scale its conceptual limitation is recognised.

Measurement of affect during and post-exercise

The literature is fraught with inconsistencies of when affective responses are measured following exercise. This has led to uncertainty about when affective changes occur after exercise. Ekkekakis and Petruzzello (1999) conclude that improved affectivity has consistently been shown shortly after exercise over a variety of measurement scales. Improved affective responses have been recorded immediately post-exercise (Lox and Rudolph, 1994; McAuley and Courneya, 1994; Tate and Petruzzello, 1995; Rudolph and Kim, 1996; Van Landuyt *et al.*, 2000) and five minutes post-exercise (Parfitt *et al.*,

1994; Parfitt and Eston, 1995; Tate and Petruzzello, 1995; Parfitt *et al.*, 1996). However, in other cases affect has not improved until 15 to 30 minutes post-exercise (Steptoe *et al.*, 1993; Tuson *et al.*, 1995; Petruzzello *et al.*, 1997; Rudolph and Butki, 1998; Treasure and Newbery, 1998).

The assessment of affective state during exercise has been regarded as a difficult process (McAuley and Courneya, 1994) and in consequence much research has opted against measuring it. The ignorance of measuring in-task affect disregards the dynamic nature of affective change (Van Landuyt *et al.*, 2000). With the development of the Feeling Scale (FS; Rejeski *et al.*, 1987), EFI and SEES these problems seem to have been circumvented and studies can investigate affective responses during exercise more accurately. This has provided more detailed, although inconsistent, information about affective responses during exercise. FS responses have been shown to be less positive during exercise than immediately post-exercise (Parfitt *et al.*, 1994; Parfitt *et al.*, 1996). The positive feeling states of revitalisation and positive engagement have been shown to increase during exercise (Treasure and Newbery, 1998). Levels of perceived activation have increased during exercise although FS responses have not changed (Van Landuyt *et al.*, 2000). It has also been shown that exercisers felt the greatest levels of positive and negative affect during exercise (Tate and Petruzzello, 1995). These inconsistencies in the literature are exacerbated when the activity level of participants is taken into account because high and low active individuals have been shown to have a different pattern of affective responses (e.g., Parfitt and Eston, 1995; Eston *et al.*, 1998).

Pre-exercise levels of affect.

The importance of taking into account the effect of pre-exercise levels of affect on the response to exercise has recently emerged (Rejeski *et al.*, 1995; Tuson *et al.*, 1995; Gauvin *et al.*, 1997). It has been suggested that the different affective responses to exercise and the small effect sizes being recorded may be caused by differences in baseline levels of affect before investigations begin (Rejeski *et al.*, 1995). The neglect of baseline levels may have led to exercise effects being masked. Additionally, prior mood state or emotions may influence the cognitive appraisal of the exercise experience (Lazarus, 2000). Gauvin *et al.* (1997) and Rejeski *et al.* (1995) reported that only those individuals with low levels of positive feeling states pre-exercise showed any improvement with exercise. Their investigations led them to suggest that it is more

accurate to state that 'acute exercise positively influences only *some* of the people *some* of the time'(Gauvin *et al.*, 1997, p.520) and not the more common assumption that acute exercise always has a positive influence on psychological state. As a consequence, when conducting research in this area care should be taken to record pre-exercise levels of affect, and to ensure that it is a true representation of the individual's baseline.

In conclusion, it is important when affective responses to exercise are measured that it is clear what facet of mood state, emotion or affective state is being measured. The measurement tool should be appropriate and have a sound theoretical background. Finally, measures should be taken pre-exercise, during exercise and post-exercise to obtain the full extent of the affective response to exercise.

Affective responses to exercise

Many reviews have been written in an attempt to elucidate the association between exercise and psychological well-being (McDonald and Hodgdon, 1991; Tuson and Sinyor, 1993; McAuley, 1994; Biddle, 1995; Berger, 1996; Yeung, 1996; Scully *et al.*, 1998; Ekkekakis and Petruzzello, 1999; Biddle, 2000b). These reviews all share the common conclusion that there is a positive relationship between psychological well-being and exercise. However, caution has been advised regarding the extent of the association. This is not due to a lack of evidence, but due to concern about the quality of the evidence (Biddle, 2000a). It has been acknowledged in each of the review papers that methodological issues plague much of this research. In addition, although evidence indicates a positive relationship, the optimum intensity or duration required of an exercise bout to maximise the affective response is unclear. Conclusions are generally hard to reach due to the diversity of the literature examining the effect of exercise at different intensities for differing durations and in individuals with differing fitness or activity levels. Additionally, few studies are designed which compare affective responses to two or more intensities.

Methodological issues within the literature

Biddle (2000a) alludes to methodological limitations within the literature that may confound the true effect of exercise on psychological well-being. Yeung (1996) provides a more detailed analysis of these limitations from the perspective of both

internal validity (e.g., lack of control groups) and external validity (e.g., small sample sizes, non-randomisation to group). Ekkekakis and Petruzzello (1999) further state that the greatest problem is the lack of theoretical grounding within research. An additional methodological issue, preventing direct comparisons between studies, is the classification of intensity. Intensity has been classified using different methods including absolute levels (i.e., fixed workloads or heart rates) as well as relative levels (percentages of maximum heart rate, heart rate reserve and oxygen consumption). Intensity has also been regulated by perceptions of effort using Ratings of Perceived Exertion (RPE; Borg, 1970) in both estimation and production protocols.

Optimum Intensity

Many theories abound as to the optimal exercise intensity to maximise affective benefits. The prevailing hypothesis is that there is a dose-response relationship between exercise intensity and affective benefits. Kirkcaldy and Shephard (1990) proposed that there is a threshold level of exercise intensity that must be exceeded in order for affective improvement to be realised, while exercise at high doses are associated with detrimental effects. This implies that exercise of moderate intensity is optimal. Berger (1996) also concluded that up to a certain intensity exercise produces improvements in affective state but once past this 'optimum', exercise can prove damaging to psychological well-being.

Ekkekakis and Petruzzello (1999) reviewed the literature surrounding the dose-response issue and concluded that there is only limited support for the relationship. This was due to a small number of relevant studies and a lack of consistency in their findings. A main feature of the dose-response relationship is that a reduction in affective state occurs at high intensities. Studies which have compared affective responses at increasing intensities have shown, in general, that as intensity increases affect becomes less positive (Hardy and Rejeski, 1989; Acevado *et al.*, 1994; Parfitt *et al.*, 1994; Parfitt and Eston, 1995; Parfitt *et al.*, 1996; Boutcher *et al.*, 1997). However, research which has compared the effects of high intensity exercise on affective changes pre-exercise to post-exercise have found mixed results. Some studies have found decrements in affective state post-exercise following exercise (Steptoe and Bolton, 1988; Steptoe and Cox, 1988; Tuson *et al.*, 1995), whilst several others have shown improvements in affective state following high intensity exercise (Steptoe *et al.*, 1993; Petruzzello and

Landers, 1994; Rejeski *et al.*, 1995; Tate and Petruzzello, 1995; Kennedy and Newton, 1997; Zervas *et al.*, 1997). Therefore, it cannot be concluded that exercise of high intensity is detrimental to affective state. One point to note is that the majority of participants in these studies were classified as moderate to highly fit and so these results may not generalise to sedentary, low fit, individuals. However, what these results do show is that by prescribing high intensity exercise there is a risk that affective state may be negatively altered, although this may only be temporary.

A second premise of the dose-response relationship is that moderate intensity exercise will prove to have a beneficial effect on affective state. In this case the literature is more clear and research has used a mix of low active and highly active populations. As well as the previous studies which showed affective responses to be more positive at lower intensities, studies which have compared pre- and post-exercise affective state after moderate intensity have either shown some affective improvement (Moses *et al.*, 1989; Ekkekakis and Zervas, 1993; Steptoe *et al.*, 1993; Zervas *et al*, 1993; Tate and Petruzzello, 1995; Kennedy and Newton, 1997; Watt and Spinks, 1997; Treasure and Newbery, 1998; Van Landuyt *et al.*, 2000) or no change in affective state (Tuson *et al.*, 1995; Gauvin *et al.*, 1997). Therefore, exercising at moderate intensity has not been connected with any decrements in mood state, in fact the majority show affective improvements.

The following conclusions have been reached from reviews of mood state and intensity of exercise. Yeung (1996) tentatively concluded that moderate intensity exercise would seem optimal for obtaining greatest psychological benefits. Biddle (2000a) concludes that, from the available knowledge, the promotion of moderate intensity aerobic activity seems pertinent to the enhancement of psychological well-being. Whilst it cannot be definitively concluded that moderate intensity exercise is best, it seems the most sensible prescription likely to produce affective benefits in the majority of people without the risk of causing increased negative affectivity.

Optimum Duration

The other important characteristic of the dose-response relationship is the duration of the exercise bout. As with exercise intensity, there is no clear consensus for the optimum exercise duration. Berger (1996) claims exercise must be 20 to 30 minutes in

duration but this has not been substantiated in the literature. Treasure and Newbery (1998) found improvements in affective state after only 15 minutes. Of the few studies that have compared affective responses to multiple durations, they have found no evidence for a dose-response relationship. Rudolph and Butki (1998) reported that exercise of 10, 15 and 20 minutes at RPE 13 all produced increases in positive affect and decreases in negative affect. However, Rejeski *et al.* (1995), found no pre- to post-exercise differences in affective state after 10, 25 or 40 minutes of exercise at 70% of HRR. This latter result may have been different had the exercise been conducted at a moderate rather than a high intensity. Due to the lack of concrete evidence, stipulating an ideal duration is impossible, although it may be that a minimum of 10-20 minutes is necessary to produce psychological improvements.

High versus low active individuals

The relationship between exercise intensity and affect is further clouded when the activity, or fitness status, of individuals is taken into account. When the affective responses of self-reported highly active individuals (those exercising three or more times per week) and low active individuals (those exercising twice or less per week) are compared, differences between the two groups have emerged. Research has shown that highly active or highly fit individuals report more positive affect than low active or moderately fit participants at high intensity (Steptoe and Bolton, 1988; Parfitt *et al.*, 1994; Boutcher *et al.*, 1997; Petruzzello *et al.*, 1997). Highly active individuals show similar values on the feeling scale (FS; Rejeski *et al.*, 1987) at moderate and high intensities, while low active individuals show more negative responses at high intensity compared to moderate intensity (Parfitt and Eston, 1995). Differences have also emerged in affective responses recorded during exercise. Boutcher *et al.* (1997) have shown that trained individuals report greater levels of positive affect and negative affect during exercise compared to the untrained. Petruzzello *et al.* (1997) found that during exercise the low active show decreases in overall affect but the highly active show increases. This is contrary to the findings of Eston *et al.* (1998) who reported that it was the highly active which demonstrated reduced feeling state during exercise. Overall, it seems that those individuals who participate in exercise regularly become more accustomed to the feelings associated with exercise and feel comfortable with exercise at a higher intensity.

Mechanisms for exercise induced affective change

Despite the knowledge that there is an association between affective changes and exercise there is very little evidence for why and how these changes occur. There are a number of potential mechanisms that have been proposed to account for the acute effect of exercise on affective responses. These encompass physiological and psychological explanations. The affective benefits from exercise have been explained in physiological terms to be a result of increased endorphins in the brain (the endorphin hypothesis; see Hoffmann, 1997), increased neurotransmitters in the brain, specifically norepinephrine (the monoamine hypothesis; see Dishman, 1997) and/or increased core body temperature (the thermogenic hypothesis; see Koltyn, 1997). However, there is poor empirical support for these theories (see Boutcher, 1993; Morgan and O'Connor, 1988; Tuson and Sinyor, 1993). For example, these theories would seem to suggest that there is a linear relationship such that as exercise intensity increases (and so circulating monoamines and body temperature increase) affective responses should become more positive. However, as it has been shown, affective responses to high intensity exercise are not always positive. Alternatively, it may be that there is a curvilinear relationship and that at a certain intensity (and temperature or level of circulating monoamines) a plateau occurs in affective response which may lead to a negative affective response if intensity continues to increase. Furthermore, there may be a threshold effect whereby the affective response of low active individuals is affected by relatively lower body temperature or level of monoamines compared to highly active individuals. These suggestions could be investigated quite easily, but research to date has not been directed to this area.

Psychologically, the affective benefits from exercise have been explained as a time-out from stressful aspects of life (the distraction hypothesis; Bahrke and Morgan, 1978) and/or a sense of mastery or accomplishment gained from exercise which leads to increases in self-esteem, self-efficacy and perceived control (the mastery hypothesis). Again, there is little direct evidence to support these theories. However, the mastery hypothesis does seem to have the potential to explain why highly active individuals can feel positive at high intensities. To gain a sense of achievement highly active individuals may need to exercise at higher intensities.

It is likely that there is no one explanation for the affective benefits with exercise and that the physiological and psychological mechanisms combine together. Boutcher (1993) suggests that the mechanism most likely to account for the affective benefits is dependent on exercise experience. For those just beginning to exercise and who have not yet adapted physiologically the psychological mechanisms will play a greater role. With continued exercise experience both the physiological and psychological mechanisms will feature. Finally, in the final habituation (or maintenance) phase, the physiological explanations, along with behavioural conditioning, will be prominent. Biddle (2000b) suggests this theory is attractive because if takes into account the context and experience of exercise when suggesting an underpinning mechanism. The opponent process theory (Solomon, 1980) also attempts to integrate the physiological and psychological theories. This theory posits that during the first experience of exercise the initial response (a process) is negative and large. This is followed, post-exercise, by an opposite reaction (b process) of positivity or relief, which is short lived. With continued experience of exercise, habituation or tolerance occurs whereby the initial response becomes less negative and shorter and the post-exercise response is more positive and prolonged. Petruzzello *et al.* (1997) provided partial support for this theory in the context of exercise.

Future research should move towards establishing why the affective changes occur, through direct testing of these mechanisms. However, this is not the focus of this research.

Preferred Intensity

The discussion so far has centred around the effect of prescribed intensity exercise on affective state. More recently, studies have begun to investigate the effect of preferred or self-selected intensity exercise on psychological affect. In fact, it has been expressed that exercising at a preferred intensity may be more appropriate when trying to establish the potential psychological benefits of exercise (Rudolph and Kim, 1996) and that individual preferences for exercise intensity may elucidate the dose-response relationship (Morgan, 1997). Ekkekakis and Petruzzello (1999) recommend the study of preferred versus prescribed exercise doses. They have been critical of those who have tried to establish an optimum intensity and duration of exercise because it ignores the effect of individual differences, making generalisations practically impossible.

Biddle (2000a) is also aware that individual preferences for exercise need to be taken into account and that neglect of this factor may mask the true effect of exercise on affect. Steptoe *et al.* (1993) suggested that the characteristics of participants will play a role in the effect of different exercise intensities on psychological affect. This proposal is given support by the variation found in the intensity and quality of affective response reported by different individuals to an identical stimulus. Van Landuyt *et al.* (2000) further suggest these individual preferences will interact with the physical and social environment, the attributes of the exercise environment and psychological state to influence how an individual will respond to an exercise stimulus. It would seem obvious that by allowing individuals to select their own preferred intensity that these characteristics will then be taken into account and may result in more positive affective responses.

Zervas *et al.* (1993) first utilised the preferred intensity protocol and despite some methodological limitations within the design of their study, the results were very interesting. They reported that the self-selected group exhibited the highest peak heart rate while also manifesting the most positive mood responses. Dishman *et al.* (1994) and Eston *et al.* (1998) have used a preferred intensity protocol to compare the preferred intensities of high and low-active men and its effects on affective state. They both found that high and low-active participants chose to exercise at an average of 55-60% VO_{2peak}. However, the high active men increased their workrate over the 20 minute bout while the low active men chose to exercise at the same intensity throughout. With regard to affective response, Dishman *et al.* reported that state anxiety only decreased in the high-active group. Eston *et al.* investigated affective responses using the Feeling Scale. They found that both the high and low active participants showed more positive feeling states post-exercise than pre-exercise. During exercise, the low-active group showed stable, positive, feeling states during exercise while the high-active showed reduced feeling states at 15 and 20 minutes, although they still remained in the positive range. From these two studies, it was shown that regardless of activity status, individuals choose to exercise at moderate intensity. Until affective responses to preferred and prescribed intensity exercise are compared within a single study, there can be no support for the proposition that preferred intensity is more beneficial. Therefore, the first question that this thesis will investigate is the difference in affective responses to a prescribed and preferred intensity exercise session.

To summarise, it has been tentatively suggested that for maximum psychological benefits from acute bouts of exercise these bouts should last for twenty minutes and be of moderate intensity. This is especially important for sedentary or irregular exercisers who have been shown to tolerate and actually feel positive at moderate intensities (Parfitt *et al.*, 1994). Speculation has begun on the use of self-selected exercise intensities. This protocol may prove to result in greater psychological benefits than the traditional prescribed intensity regimen. It has been shown that measuring an individual's pre-exercise psychological state is important to gauge how effective the regimen of exercise will be in improving affective state. Finally, an overall picture of the affective responses to exercise can only be generated by measuring affective state before, during and after exercise.

It is generally agreed that emotions and feeling states have a motivational consequence (Biddle, 2000b; Lazarus, 2000; Vallerand and Blanchard, 2000; Van Landuyt *et al.*, 2000). They prompt an action that is related to the particular emotion experienced (Carver *et al.*, 2000). Thus, the affective response generated by exercise will probably play a role in whether individuals decide to participate in exercise again. Individuals are likely to participate in activities that make them feel good and avoid those that do not (Wankel, 1993). For this reason, it is important to decipher the optimum intensity and duration of an exercise bout that will produce the most positive affective response and minimise any negative feelings. The experience of any negative feelings during or after exercise may be detrimental to future participation in exercise.

Self-Determination Theory

Ekkekakis and Petruzzello (1999) criticise the dose-response assumptions regarding exercise intensity and affective responses on the basis that they are not grounded in a theory of emotion, arousal or motivation and have neither an inductive nor deductive foundation. This cannot be said about the self-selected or preferred exercise intensity approach to maximising affective response. Self-determination theory (SDT; Deci and Ryan, 1985a) provides a clear theoretical basis on which to base the proposals of the preferred intensity approach.

SDT distinguishes between two forms of motivation, intrinsic and extrinsic. Intrinsic motivation is defined as involvement in an activity for its own sake, for the inherent rewards of interest, enjoyment, excitement, satisfaction and challenge (Deci and Ryan, 1985a). Extrinsic motivation refers to behaviour that is engaged in to gain an external reward, or to satisfy an external force. Deci and Ryan (1987) state that motivation can be classified as extrinsic when the satisfaction of engaging in a behaviour results from the outcome rather than in the behaviour itself.

Intrinsic motivation is based on three innate needs, the need for competence, self-determination and relatedness. The extent to which these three psychological needs are met catalyses or causes the expression of intrinsic motivation (Deci and Ryan, 1985a). This relationship has been demonstrated in situations that have been structured to support competence (e.g., Vallerand and Reid, 1984) or self-determination (e.g., Reeve and Deci, 1996) and in a cross-sectional study (Kowal and Fortier, 2000). Perceived competence refers to an individual's perceptions of their abilities and in being able to use those abilities to produce the desired response and is similar to the concept of self-efficacy (Bandura, 1977). Perceived competence is enhanced from obtaining positive feedback either from an external source or from the individual's own perception of having successfully mastered an activity. Self-determination (also known as a sense of autonomy) refers to having the freedom to decide or choose whether to begin a particular behaviour as opposed to having an external pressure be the determinant of ones actions. The perception of choice is paramount. Self-determination has been discussed in attributional terms through locus of causality (Heider, 1958; DeCharms 1968). Locus of causality is concerned with what controls the initiation of behaviour. When it is perceived to be internal then behaviour is initiated autonomously by the individual and reflects a high level of self-determination. When it is perceived to be external then behaviour is believed to be controlled by an external source and reflects low levels of self-determination. Finally, relatedness refers to a sense of belongingness and feeling connected to a group or individual.

SDT comprises of three sub-theories. The first of these is Cognitive Evaluation Theory (CET) which specifies how certain social factors relevant to the initiation and regulation of behaviour can affect intrinsic motivation through the processes of self-determination and perceived competence. It states that events that support autonomy (promote self-

determination) and competence will promote intrinsic motivation. It has been suggested that feelings of competence will only influence intrinsic motivation if they occur within the context of self-determination (Deci and Ryan, 1985a). Markland (1999) examined the separate and interactive effects of self-determination and perceived competence on intrinsic motivation (operationalised as interest/enjoyment) and concluded that self-determination did moderate the effect of perceived competence on intrinsic motivation. Under conditions of high self-determination, levels of intrinsic motivation were the same irrespective of level of perceived competence, but when self-determination was low there was a positive relationship between perceived competence and. Nevertheless, intrinsic motivation was highest under conditions of high self-determination. This suggests that fostering an atmosphere of self-determination maybe more important than nurturing perceived competence. However, Biddle (1999) suggests that in order to feel autonomous an individual must first feel competent in being able to produce a response.

CET recognises that events or situations can have three aspects. These are the informational, controlling and amotivating aspects and are referred to as the situations functional significance. The informational aspect provides the individual with competence enhancing feedback within a context of self-determination which will promote intrinsic motivation. The controlling aspect induces feelings of pressure to behave in a particular way undermining self-determination and intrinsic motivation. Finally, the amotivating aspect results in feelings of incompetence by signifying that the individual cannot obtain the desired outcome undermining intrinsic motivation. As well as operating through external means, these three aspects can also operate intrapersonally such that internally informational events will promote self-determination and intrinsic motivation and internally controlling events will undermine self-determination and intrinsic motivation.

Within a particular situation it is not the objective characteristics of the situation that will influence intrinsic motivation, it is the individual's perception of the salience of each of the three aspects that will influence his/her self-determination, perceived competence and ultimately intrinsic motivation.

The second sub-theory of SDT is Organismic Integration Theory (OIT). This emerged from the recognition that extrinsically motivated behaviours can vary in its degree of self-determination and that classifying behaviour as either intrinsically or extrinsically motivating is misleading. OIT addresses the way in which initially externally regulated (non self-determined) behaviours are transformed into intrinsically regulated (completely self-determined) behaviours through the process of internalisation. The concept of a behavioural regulation continuum or as it is also known a self-determination continuum was developed out of the OIT. There are four forms of extrinsic motivation which lie along a continuum and are characterised by differing levels of self-determination as a result of the degree of internalisation achieved. The first of these is external regulation which is the classic form of extrinsic motivation. Behaviour is undertaken to satisfy an external demand or to obtain external rewards. The next step along the continuum leads to introjected regulation in which the control of behaviour is internalised and applied as pressure from within the individual. Further along the continuum is identified regulation, a more self-determined form of behavioural regulation. In this case behaviour is undertaken because of the importance the individual attaches to the outcome and is performed out of choice. In this case, behaviour is not fully self-determined as it is the importance of the outcome that motivates the behaviour and not the behaviour itself. Fully self-determined behaviour occurs when regulation is integrated. Behaviour is undertaken willingly as an expression of personal values. Integrated regulation is similar to intrinsic motivation in that they are both self-determined forms of regulation and share similar motivational qualities (Deci *et al.*, 1994). It is important to note however, that integrated regulation is not quite the epitome of intrinsic motivation (engagement in the activity out of sheer interest) because value is placed on the outcome and not on the process.

Deci and Ryan (1985a) state that the process of internalisation will only occur within an autonomy supportive environment and that the innate need for competent self-determination motivates the internalisation process. This leads to a circular argument which may be a problem for OIT. The concept of self-determination is the outcome of the process for which it motivates.

The final sub-theory of SDT is the Causality Orientations Theory (COT), the least explored of the three sub-theories. COT describes the individual differences that are

present in the interpretation of the functional significance of a situation and how this interpretation will influence the initiation and regulation of behaviour. COT argues that not everyone is motivated by intrinsic rewards. Some individuals will seek out controlling situations and look for control in order to regulate their behaviour, even though this will mitigate against the development of intrinsic motivation (Deci and Ryan,1985a). Causality orientations theory suggests that these personality based causality orientations are of importance in how a situation is interpreted and not just the actual characteristics of the situation. The same situation can be interpreted as informational by one person and controlling by another. Despite the individual's orientation being instrumental in deciding what features are attended to and the way that they are interpreted (Deci and Ryan, 1985a), the actual context and characteristics of the situation will still be taken into account and will interact with the orientation leading to an interpretation of the situation.

Deci and Ryan (1985a, 1985b) described three causality orientations which they named: autonomy, control and impersonal. Underlying the autonomy orientation is the experience of choice. Individuals regard the characteristics of an event as sources of information to regulate their own chosen behaviour. Individuals strive to be self-determining (the perception of having choice) and seek out opportunities to do so. This is shown by behaviour being governed by integrated and intrinsic regulation. Behaviour is organised through the pursuit of self-selected goals and interests, any extrinsic rewards are experienced as evidence of competence rather than as a controlling influence. Behaviour emanating from the control orientation is regulated by controls imposed either by others, within ourselves (by applying self-pressure such as guilt) or by the environment (reward contingencies). It is regulated by a pressure to perform and individuals find themselves doing things because 'they are told to', 'they should', 'they have to' or 'they must'. The sense of self-determination is missing and the resultant behaviour is determined by extrinsic regulation or introjected regulation. When control oriented, individuals rely on controlling influences such as extrinsic rewards and surveillance to motivate them. Finally, the impersonal orientation is based on the individual feeling that there is an independence between behaviour and outcomes. They feel unable to regulate their behaviour to be able to achieve desired outcomes and events are interpreted as being amotivating. Behaviour is not intentional and the sources of control may be largely unknown to the individual leading to a sense of

personal helplessness and incompetence. Deci and Ryan (1985a; 1985b) state that individuals should not be categorised as having one orientation or another because each individual will have a certain level of each.

SDT would suggest that the adoption of a routine where individuals are allowed to self-select their exercise regimen and their exercise intensity will facilitate an environment conducive to fostering intrinsic motivation. The perception of choice and lack of external control which will be encouraged should stimulate an atmosphere of self-determination. Additionally, it is likely that when individuals choose their preferred exercise regimen and exercise intensity they will do so within the confines of their own ability. This should ensure that they are able to complete the exercise, providing positive feedback and increases in perceptions of competence. The traditional routine of exercise prescription and specified exercise intensities puts control of the exercise session in the hands of someone else. This may undermine self-determination and increase the likelihood of individuals not being able to attain the standards set, decreasing their perceived competence.

Providing the conditions to promote intrinsic motivation and the actual experience of being intrinsically motivated towards exercising is not only motivationally enhancing, but is recognised to be important in producing a positive psychological state. Deci and Ryan (2000) have shown that the satisfaction of the three innate needs of competence, autonomy and relatedness is directly linked to psychological well-being. Sheldon *et al.* (1996) have shown that daily fluctuations in the satisfaction of autonomy and competence have predicted fluctuations in well-being. Similar relationships have been found between need satisfaction and self-esteem, general health and general well-being (Ilardi *et al.*, 1993; Kasser and Ryan, 1999). Self-determination is known to lead to enhanced functioning (Deci, 1980; Ryan, 1995). As a result, intrinsic motivation and self-determined forms of extrinsic motivation should lead to the most positive consequences. These consequences have been categorised into affective, behavioural and cognitive benefits and are hypothesised to be most positive following more self-determined forms of motivation (Vallerand, 1997). It has also been suggested that removing an individual's freedom to choose their type of exercise and seriousness of exercise may induce negative psychological consequences (Fahlberg, 1995). Within an exercise context, Briere *et al.* (1995) and Li (1999) have shown that positive affect,

enjoyment, interest and satisfaction are related more positively to more self-determined forms of motivation than those representing less self-determined motivation. Vallerand and Rousseau (2001) reviewed studies that investigated the relationship between levels of self-determination and emotion in sport and exercise. They concluded that increased levels of self-determination (intrinsic motivation and identified regulation) leads to positive affect while less self-determined motivation (external regulation) leads to less positive affect and even negative affect. The effect of perceived competence on psychological affect can be inferred from the self-efficacy literature. Perceptions of self-efficacy, during and after exercise, have regularly been shown to result in a positive affective response (Bandura, 1986; McAuley, 1991; McAuley and Courneya, 1992; Bozoian *et al.*, 1994; Rudolph and Butki, 1998; McAuley *et al.*, 1999). This relationship between self-efficacy and positive mood has been more strongly endorsed when exercise is performed at a level that is perceived as being individually optimal (Vallerand and Blanchard, 2000). Overall intrinsic motivation, or as it is commonly operationalised enjoyment, also seems important to the generation of a positive psychological state. Whether enjoyment is viewed as a positive affective state (Wankel, 1993) in its own right, or as an optimal psychological condition which leads to a positive affective state (Kimiecik and Harris, 1996), the experience of enjoyment has been intimated as being important to optimising the psychological benefits of exercise (Wankel, 1993; Berger, 1996).

SDT, and more specifically its proposals concerning the development of intrinsic motivation, is being used as the framework for this thesis because of the recognised importance of intrinsic motivation to continued participation in exercise. Research has highlighted that although there needs to be an extrinsic trigger for initial exercise adoption (e.g., concern over body image, health or fitness) for exercise involvement to be maintained in the long term it is crucial for intrinsic motivation to be developed (Boothby *et al.*, 1981; Dishman, 1987; Frederick and Ryan, 1993; Wankel, 1993; Ingledew *et al.*, 1998; Ryan *et al.*, 1997; Biddle, 1999). However, this research is mainly cross-sectional in nature and does not fully explore the causal relationship between exercise adherence and the need for intrinsic motivation. Mullan *et al.* (1997) suggest that a combination of both intrinsic and extrinsic motivation maybe required for exercise adherence. They concluded that for those who participate for purely extrinsic reasons consistency of exercise behaviour is unlikely. However, for many the intrinsic

motives of interest and enjoyment are not enough for maintenance and some extrinsic input is also required. In fact, Mullan and Markland (1997) found that those in the action and maintenance stages of behaviour change reported both identified and intrinsic regulations for exercise. Those in the action stage could not be distinguished from those in the maintenance stage in their degree of intrinsic regulation. Furthermore, results from Ingledew *et al.* (1998) found that individuals report both intrinsic and extrinsic motives while in the maintenance phase of exercise. This supports the importance of both intrinsic and extrinsic motives. Despite this, intrinsic motivation is still seen as important to long term exercise participation. However, it is debatable whether an individual can ever feel truly intrinsically motivated within an exercise environment. This is particularly evident when individuals begin an exercise programme. Deci and Ryan (1985a) state that individuals can only demonstrate intrinsic motivation in those situations that are inherently interesting. It is unlikely that when individuals begin to exercise they will view the experience as interesting. Indeed, it is unlikely that interest in exercise will ever be the sole motivation for participation. Therefore, instead of focusing on intrinsic motivation per se it is more appropriate to move individuals along the self-determination continuum from external regulation to identified regulation.

In summary, SDT predicts that when an environment is perceived as being autonomy supportive and providing competence relevant information more self-determined forms of behavioural regulation will be fostered ultimately leading to the development of intrinsic motivation. Furthermore, research has shown that this self-determined motivation is related to more positive cognitive, behavioural and affective outcomes. Given this theoretical perspective, the purpose of the first study was to compare the effects of a twenty minute bout of prescribed intensity exercise (unsupportive of self-determination condition) and preferred intensity exercise (supportive of self-determination) on affective responses during and after exercise. It also sought to investigate their effects on intrinsic motivation (operationalised as interest/enjoyment). Furthermore, the effect of pre-exercise affective state on the response to exercise was explored.

CHAPTER 3

STUDY 1

The effect of prescribed and preferred intensity exercise on psychological affect and the influence of baseline measures of affect.[1]

[1] This study formed the basis of an empirical study published in the Journal of Health Psychology: Parfitt, G., Rose, E.A. and Markland, D. (2000). The effect of prescribed and preferred intensity exercise on psychological affect and the influence of baseline measures of affect. *Journal of Health Psychology*, **5**, 231-240.

Introduction

Although, there has been a tendency in the last decade to view physical activity as a universal panacea (Yeung, 1996), numbers involved in health related physical activity are low (Allied Dunbar National Fitness Survey, 1992). A consideration of the acute psychological responses associated with specific exercise protocols has been suggested as an appropriate strategy to advance our knowledge and understanding of factors associated with exercise adherence (Steptoe and Bolton, 1988).

Oman and McAuley (1993) suggest that intrinsic motivation is an important determinant of exercise maintenance. According to Deci and Ryan (1985a), intrinsic motivation will be enhanced if the individual has an internal perceived locus of causality which is associated with high levels of self-determination. Choice over one's actions will foster this self-determination and the internal perceived locus of causality. However, perceived choice is often absent in the exercise domain. For example, one aspect of an exercise programme that may be perceived to be highly controlling and involves an external perceived locus of causality is being told to exercise at a specific intensity. The individual may perceive greater control over the exercise session if allowed to choose the intensity of work and may gain more enjoyment out of exercising. Wankel (1993) states that enjoyment is a crucial element for both promoting exercise adherence and improving psychological well-being. Sallis *et al.* (1986) reported that an inverse association existed between exercise intensity and the adoption and maintenance of exercise programmes. By allowing the individual to self-select their exercise intensity this negative effect may be alleviated and this added choice may have a positive effect on exercise adherence, as shown by Thompson and Wankel (1980).

Feelings of well-being experienced during exercise may play a major role in the enjoyment of exercise and subsequent exercise participation. The effect of exercise of a preferred intensity on psychological affect has been studied by Dishman *et al.* (1994) and Eston *et al.* (1998) in both low- and high-active individuals. Dishman *et al.* reported that state anxiety decreased from pre-test to post-test only in the high-active group. Eston *et al.*, using the Feeling Scale (Rejeski *et al.*, 1987) to measure affect,

found that during exercise, whilst the affective responses of the low-active participants remained stable, those of the high-active participants became more negative. However, after exercise both groups displayed significantly more positive affect. This result was similar to that shown by Parfitt and Leung (1997). These studies showed that when allowed to choose a preferred work rate on a cycle individuals exercised at an intensity corresponding to 55-60% $VO_{2\,max}$ which is equivalent to Ratings of Perceived Exertion (RPE: Borg, 1970) of 12-15.

A comparison of the affect scores obtained from the studies of Parfitt and Leung (1997) and Eston *et al.* (1998) would suggest that affect is more positive after exercising at a preferred exercise intensity (Eston *et al.*, 1998) compared to a prescribed exercise intensity (Parfitt and Leung, 1997). However, given that different populations were used, one British and one Chinese, and different exercise protocols, the above interpretation requires confirmation.

A further methodological consideration is that these studies used the Feeling Scale (Rejeski *et al.*, 1989) to measure affect. This is a unidimensional scale with positive and negative affect situated at opposite ends of the same continuum. This scale has been criticized as being too simplistic. Watson and Tellegen (1985) reported that as affect can be both positive and negative a scale must measure both dimensions. A multidimensional scale which assesses the subjective feelings associated with the exercise experience is necessary to achieve an accurate understanding of the psychological responses to exercise (McAuley and Courneya, 1994). The Subjective Exercise Experiences Scale (SEES: McAuley and Courneya, 1994) assesses both positive and negative affect and fatigue specific to exercise. This scale has been used in many studies to measure affective responses to exercise (for example, Lox and Rudolph, 1994; McAuley and Courneya, 1994; Rudolph and Kim, 1996). These studies support the theory that exercise has a differential influence on positive and negative affect.

Two studies which have employed a different multidimensional affect scale are Rejeski *et al.* (1995) and Gauvin *et al.* (1997). Both studies used the Exercise-Induced Feeling

Inventory (EFI: Gauvin and Rejeski, 1993) to study the impact of prescribed intensity exercise on feeling states. Using this scale, these studies reported contrasting results to the general consensus from studies which investigated affective responses to exercise. Rejeski *et al.* (1995) reported that exercise (of 10, 25 and 40 minutes) enhanced revitalization only in those individuals who reported low to moderate revitalization on the pre-test. Gauvin *et al.* (1997) concluded that there was no widespread mood enhancement effects of acute exercise at 30, 50 and 70% HRR. Their results again revealed however, that baseline feeling states affected the response to exercise. Individuals with very low levels of positive engagement, revitalization and tranquility displayed increases in these during exercise, whereas those who were already high in these attributes displayed a decrease. Therefore, they concluded that 'acute exercise positively influences only *some* of the people, *some* of the time' (Gauvin *et al.* 1997; p520). The equivocal nature of these results may be attributed to the statistical analysis used, which allowed for individual differences to be considered rather than just considering group responses. Additionally, Gauvin *et al.* used a completely sedentary population, while most previous research has been conducted on individuals with exercise experience.

The objective of the present study was to compare the effects of prescribed and preferred intensity exercise on affect and interest/enjoyment. It will further investigate the effect of pre-exercise affective state on the response to preferred and prescribed intensity exercise. The following hypotheses were proposed. Firstly, positive well-being (PWB) will be higher while psychological distress (PD) and fatigue will be lower in the preferred, compared to the prescribed, intensity exercise condition. Secondly, levels of interest/enjoyment and choice (subscales from the Intrinsic Motivation Inventory, McAuley *et al.*, 1989; McAuley *et al.*, 1991) will be higher following the preferred exercise session than after the prescribed condition. Finally, those subjects low in PWB prior to exercise will show greater increases in PWB than those who are high in PWB at this time. Similarly, those high in PD and fatigue prior to exercise will show greater decreases in PD and fatigue than those low in PD and fatigue at this time.

Methods

Participants

Twenty six (12 Male and 14 female) healthy undergraduates aged between 18 and 30 volunteered to participate in the study (male mean age 21.25, $s = 3.62$ years; female mean age 19.93, $s = 1.27$ years). Descriptive statistics of the sample are shown in Table 1. It can be seen that individuals reported a mean activity level of 3.17, $s = 1.46$ exercise sessions per week. All participants gave their informed consent.

Instruments

Subjective Exercise Experiences Scale. The Subjective Exercise Experiences Scale (SEES; Appendix 1A, p185) developed by McAuley and Courneya (1994) was employed to measure psychological affect before, during and after exercise. It comprises three subscales: positive well-being (PWB), psychological distress (PD) and fatigue. It was scored using a 7-point Likert-type scale with verbal anchors of 'not at all' (1), 'moderately so' (4) and 'very much so' (7). The instructions to participants were similar to those used by McAuley and Courneya with the substitution of 'before exercise' or 'during exercise' with 'after exercise' at the appropriate time of administering the scale. This allowed affect to be measured before, during and after exercise. The scale has been found to have factorial, convergent and discriminant validity (McAuley and Courneya, 1994). Lox and Rudolph (1994) also found support for its factorial and external validity and internal consistency.

Intrinsic Motivation Inventory. The 21 item Intrinsic Motivation Inventory (IMI: McAuley *et al.*, 1989; McAuley *et al.*, 1991; Appendix 1B, p186) was administered after each exercise session. The IMI comprises five subscales labelled interest/enjoyment, effort/importance, pressure/tension, perceived competence and perceived choice. The inventory was modified to be specific to the exercise mode used in the study. It was assessed using a 7-point Likert-type scale with verbal anchors reading 'strongly disagree' (1) and 'strongly agree' (7). The instructions given to participants followed those used by McAuley *et al.* (1991). The subscales have adequate internal consistency and good construct validity, however there is concern over the reliability of the choice subscale (McAuley *et al.*, 1991).

Ratings of Perceived Exertion. General, whole body ratings of perceived exertion (RPE) were assessed using the Borg 6-20 Category Scale (Borg, 1970; Appendix 1C, p187). Participants were given instruction as to its use and were given time to practice during the familiarisation session in line with standard recommendations (Noble and Robertson, 1996).

Procedure

The study employed a within subjects cross-over design. Participants completed a familiarisation session and both a preferred and a prescribed intensity exercise session with half completing the preferred intensity exercise session first and the other half the prescribed intensity exercise. The initial visit to the laboratory was the familiarization session. On arrival, participants completed an informed consent form (Appendix 2A, p204), which explained the procedures of the experiment, a self-report activity history questionnaire and a health questionnaire (Appendix 1D, p188). The participants' age, height, mass, body mass index and resting heart rate were measured at this point. Body fat percentage was estimated by bioelectrical impedance analysis (Body Stat 1500, Bodystat Ltd, Isle of Man). Participants then completed a period of familiarization with the equipment. A motorized treadmill (Powerjog 'G', Sport Engineering Ltd, England) was used in all exercise sessions. Participants were given instruction on its use and given time to become accustomed to the feeling of the treadmill at different speeds and to practice increasing and decreasing the speed using the control pad. The RPE and SEES scales were then shown and participants were instructed on how to use them. They then completed a submaximal VO_2 exercise test to gain a measure of estimated maximal oxygen uptake (estimated $VO_{2\,max}$).

Submaximal VO_2 Exercise Test. The pre-test SEES questionnaire was completed before the procedures for the submaximal exercise test were explained. A heart rate monitor (Cateye PL-6000, Cateye Company Ltd, Japan) and respiratory mouthpiece were then fitted to the participant. The receiver of the heart rate monitor was held by the investigator at all times to ensure that the read-out was not visible to the participant. After a 4 minute warm up at walking pace, the participant ran for 4 minutes at two intensities to elicit heart rates of approximately 130 and 160 beats per minute. Oxygen

uptake was measured continually using on-line gas analysis (Biokinetics, Bangor, UK) and the reading at 4 minutes was noted. Heart rate was measured every minute and the steady state reading at 4 minutes was noted. RPE was recorded at the end of each stage by participants pointing to a rating on the scale held out to them. Once the test was finished, participants were given time to warm down for a duration of their own choosing and then asked to complete the post-test SEES questionnaire. Heart rate and oxygen uptake values from the two treadmill runs were placed in a prediction equation (American College of Sports Medicine [ACSM], 1995) to compute the individuals' estimated $VO_{2\,max}$ (see Table 1) and the running speed equivalent to 65% of $VO_{2\,max}$ required for the prescribed exercise session. This intensity was chosen because it generally equates with a comfortable running speed and elicits an aerobic training effect (ACSM, 1995). On the second visit, 7 days later, participants were randomly assigned to either the preferred or prescribed intensity exercise condition.

Prescribed Intensity Exercise Session. Participants completed the pre-test SEES, were fitted with the heart rate monitor and then exercised for 20 minutes at 65% $VO_{2\,max}$ with heart rate, RPE and the SEES measured in the last 45 seconds of each 5 minute period. The SEES was administered by the investigator who read out the items. Participants called out the corresponding number from a Likert-type scale on the wall in front of them. The SEES items were randomized each time to avoid order effects. Once the exercise session was finished, participants completed a warm down of a duration of their own choosing and then sat quietly in a chair for 5 minutes before completing the post-exercise SEES. After the session was completed, participants were asked a series of open-ended questions (Appendix 4A, p233). These investigated if they had felt comfortable at the prescribed intensity, how they had felt during the exercise and if there were any times during which they had felt particularly good or bad.

Preferred Intensity Exercise Session. Participants were instructed to exercise continuously at their own preferred work rate for 20 minutes. Participants were given instructions to: 'select an intensity that you prefer that can be sustained for 20 minutes and that you would feel happy to do regularly'. These instructions were modified from the study by Dishman *et al.* (1994) because the investigators felt that their instructions

would be too controlling to the individual and this element of choice was required in the study. The participants were also told that they could change the intensity after 5, 10 and 15 minutes if they so wished. Following completion of the pre-test SEES and an exploratory phase on the treadmill where the participants found their preferred exercise intensity, they exercised for 20 minutes. As with the prescribed session RPE, heart rate and SEES were measured in the last 45 seconds of each 5 minute period. Additionally, participants were asked if they would like to change the intensity. If change was desired, participants increased or decreased their speed until the desired intensity was found. They carried on at that speed for the next 5 minutes when the procedure was repeated. On completion of the 20 minute exercise bout, participants warmed down for as long as they wanted and then sat quietly for 5 minutes before completing the post-exercise SEES. Again, participants were asked a series of open ended questions (Appendix 4A, p233) to investigate if they had felt able to regulate their own intensity and how they had felt during the exercise.

At the end of the third exercise session (either preferred or prescribed), a further set of questions were asked (Appendix 4A, p233). These determined if participants had felt any different during the two sessions, which exercise session they had preferred and why. Further questions inquired about exercise in general. These asked which method of exercise would encourage the participant to continue exercising, being in control of their intensity or being prescribed an intensity. After these questions, participants were debriefed as to the purpose of the study and thanked for their participation.

Results

Due to the number of analyses being completed, and risk of type I error, results with alphas above 0.01 were interpreted with caution. Greenhouse-Geisser epsilon corrections were used when the sphericity assumption was violated and Tukey post-hoc tests were used to identify where any significant differences lay.

From the descriptive data of participants who volunteered for the study (see Table 1) it can be seen that the participants had a mean age of 20.54, s = 2.66 years. The sample was composed of aerobically fit individuals. Participants' estimated $VO_{2\,max}$ was high

(mean value 51.52, s = 9.02 $ml.kg^{-1}.min^{-1}$) corresponding to the 95th percentile (ACSM, 1995).

Table 1. Mean descriptive characteristics of participants.

Variable	Mean	SD
Age (years)	20.50	2.60
No. of times participants exercised per week	3.17	1.46
Height (m)	1.73	0.09
Mass (kg)	70.20	11.30
Bodyfat (%)	18.10	7.80
Body Mass Index	23.20	2.80
$VO_{2\,max}$ ($ml.kg^{-1}.min^{-1}$)	51.00	9.00

Estimated percentage $VO_{2\,max}$ (est. $\%VO_{2\,max}$)

A two factor mixed model analysis of variance (Time X Condition) revealed a significant main effect for time ($F_{1.5, 36.58} = 12.21$, $\varepsilon = 0.501$, $P < 0.01$) and condition ($F_{1, 24} = 13.48$, $P < 0.001$). Tukey post hoc analysis revealed that the exercise intensity at 10, 15 and 20 minutes was significantly greater than that at 5 minutes and the participants exercised at a higher est. $\%VO_{2\,max}$ in the preferred exercise intensity condition. A condition by time interaction ($F_{1.52, 36.58} = 12.71$, $\varepsilon = 0.508$, $P < 0.01$) was found and post hoc analysis revealed that there was a significant difference between the two conditions at 10, 15 and 20 minutes but not at 5 minutes. Participants chose to increase their work rate in the preferred condition but maintained a stable work rate across time in the prescribed condition (see Figure 1).

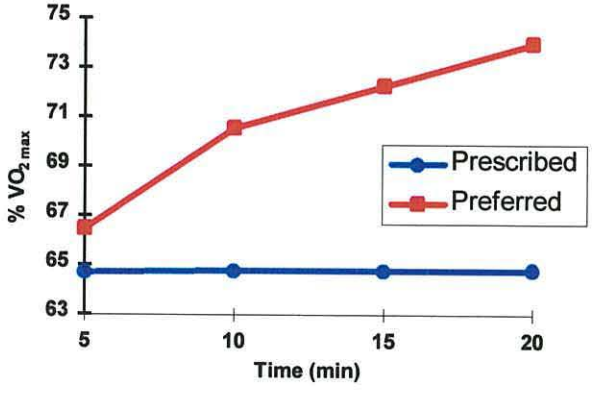

Figure 1. Workrate during the preferred and prescribed

Ratings of Perceived Exertion (RPE)

A two factor mixed model ANOVA (Time X Condition) revealed a significant main effect for time ($F_{1.68, 40.39} = 37.29$, $\varepsilon = 0.561$, $P < 0.01$). RPE at 10, 15 and 20 minutes were significantly higher than at 5 minutes and RPE at 20 minutes were greater than that at 10 minutes. No other significant differences were observed.

Subjective Exercise Experiences Scale (SEES)

A two factor mixed model ANCOVA (Time X Condition) was conducted on each subscale with the pre-test measure of each subscale being used as the covariate. Results showed no significant main effects or interactions for the PWB, PD or Fatigue subscales. Means and standard deviations of the pre- and post-exercise values for the three subscales are shown in Table 2.

Table 2. Means and standard deviations of the SEES subscales pre and post-exercise

	Pre-exercise		Post-exercise	
SEES	Mean	SD	Mean	SD
Positive Well Being				
Prescribed	17.12	4.52	19.64	3.40
Preferred	18.28	3.97	20.56	4.02
Psychological Distress				
Prescribed	8.56	4.64	5.84	2.63
Preferred	8.52	4.56	6.12	3.05
Fatigue				
Prescribed	12.80	5.52	10.08	3.99
Preferred	12.92	5.36	10.52	3.55

Intrinsic Motivation Inventory (IMI)

A MANOVA revealed a significant main effect for condition ($F_{5,50} = 11.93$, $P < 0.01$). The post hoc tests revealed a significant difference in the choice subscale with greater choice being felt in the preferred condition. There were no significant differences in the other subscales. Means and standard deviations for each of the subscales are shown in Table 3.

Table 3. Means and standard deviations of the IMI subscales for the prescribed and preferred intensity exercise conditions.

	Prescribed		Preferred	
IMI (post-exercise)	Mean	SD	Mean	SD
Interest-enjoyment	34.57	7.08	35.11	7.99
Pressure-tension	7.79	3.47	7.17	3.02
Perceived Choice	9.79	5.81	18.79**	2.32
Effort-importance	18.11	5.30	19.61	5.57
Perceived Competence	14.43	2.81	14.07	3.15

** Significant at $P < 0.01$

The Influence of Pre-test Levels of PWB, PD and Fatigue

To investigate the effect of pre-test levels of the SEES subscales on scores throughout both exercise sessions and after exercise, the sample was split into a high and low pre-exercise affect group for each of the three subscales by taking the median pre-exercise value for each subscale and for each condition. Participants below this value were classified as having a low pre-exercise affect and those above were classified as having a high pre-exercise affect. Those who scored at the median value were omitted from the analysis. This accounted for four participants in the PWB analysis and six participants in the PD analysis. There were no omissions from the fatigue analysis. In all analyses, a three factor mixed model ANOVA (Time X Group X Condition) was conducted.

Est. $\%VO_{2\,max}$. The time by condition interaction remained ($P < 0.01$). Additionally, a condition by group interaction ($F_{1,40} = 6.27$, $P < 0.02$) was reported for PWB. The post-hoc test revealed that the group with high PWB pre-exercise exercised at a significantly greater work load in the preferred condition compared to the prescribed, while the group with low PWB prior to exercise exercised at a similar intensity in both conditions.

RPE. As shown previously, a main effect for time still existed for all 3 subscales ($P < 0.01$). There were no other significant effects.

Subjective Exercise Experiences Scale

PWB. The analysis revealed significant main effects for time ($F_{3.58, 143.36} = 4.01$, $\varepsilon = 0.896$, $P < 0.01$) and group ($F_{1, 40} = 7.14$, $P < 0.02$) and a significant time by group by condition interaction ($F_{3.58, 143.36} = 2.51$, $\varepsilon = .894$, $P < 0.05$). The post-hoc analysis indicated that in the prescribed condition those participants with low PWB prior to exercise increased in PWB from 5 minutes (15.2) to 15 minutes (17.9). In comparison, at 5 minutes in the preferred condition, their values were significantly higher (17.7) and remained stable across time. For those high in PWB prior to exercise, values were stable across time in the prescribed condition (between 19.4 and 20.1), but in comparison, significantly increased in the preferred condition, from 15 to 20 minutes (21.0 to 23.1). See Figure 2.

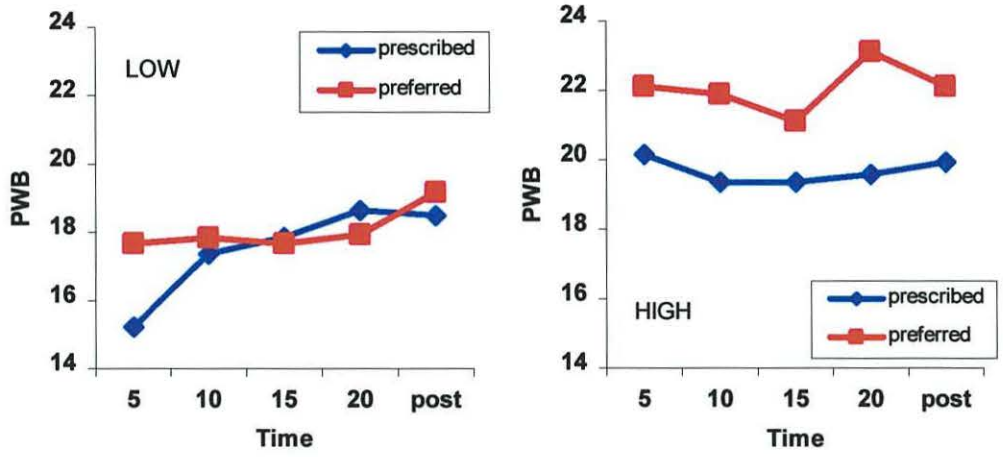

Figure 2. Changes in Positive Well-Being (PWB) in the preferred and prescribed intensity exercise sessions in those participants with low PWB pre-exercise (A) and those with high PWB pre-exercise (B).

PD. The analysis revealed significant main effects for time ($F_{2.34, 100.45} = 2.90$, $\varepsilon = 0.584$, $P < 0.05$) and group ($F_{1, 43} = 21.22$, $P < 0.01$). These main effects are reflected in a time by group interaction ($F_{2.34, 100.45} = 4.37$, $\varepsilon = 0.584$, $P < 0.01$). Post hoc analysis found that, for those participants with high PD pre-exercise, there was a significant decrease in PD from 5 minutes (9.4) to 20 minutes (7.4) and 5 minutes to post-exercise (7.0) while for those participants with low PD pre-exercise, PD values remained stable (5.4 to 4.8). See Figure 3.

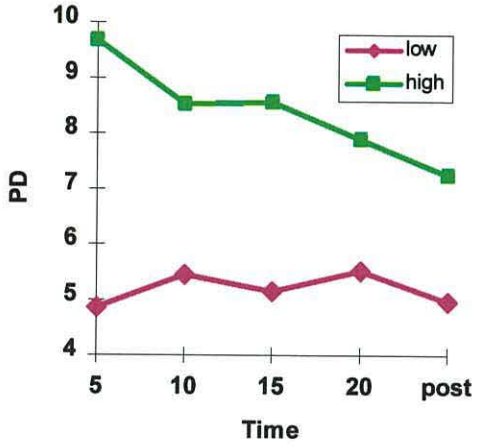

Figure 3. Changes in Psychological Distress (PD) in those participants with low and high levels of pre-exercise PD.

Fatigue. The analysis revealed a time by group interaction ($F_{2.76, 110.56} = 6.06$, $\varepsilon = 0.691$, $P < 0.01$). Post hoc analysis indicated that at 5 minutes and 10 minutes those with low fatigue pre-exercise had significantly lower fatigue (8.2 and 8.2) than those with high fatigue pre-exercise (11.9 and 10.9), but at 15 minutes there was no difference between the groups due to an increase in the scores of the low fatigue group (9.7). Those with high fatigue pre-exercise reported a significant decrease in fatigue from 5 minutes (11.9) to 20 minutes (10.0) while those with low fatigue pre-exercise, although showing a rising trend, did not show a significant change (8.2 to 9.8). See Figure 4.

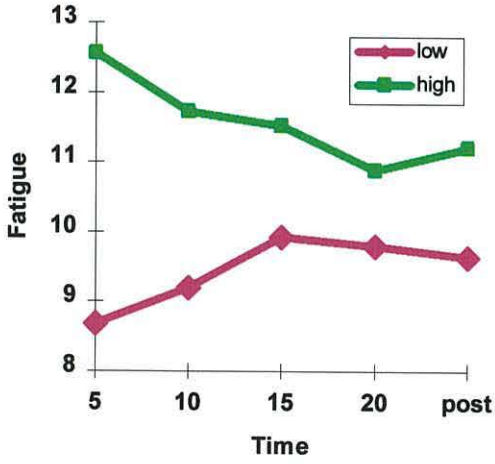

Figure 4. Changes in Fatigue in those participants with low and high levels of Fatigue pre-exercise.

Discussion

The purpose of this study was to investigate the differences in psychological affect and interest/enjoyment between a prescribed intensity and a preferred intensity exercise session and to evaluate the effect of pre-exercise affective state on the response to exercise. The results indicate that participants chose to exercise significantly harder in the preferred condition (71% $VO_{2\,max.}$). The interaction of time by condition supports previous research which indicated that, when left to choose their own intensity, individuals' work rate increased over the duration of the exercise. This apparent warm-up strategy has been shown by Eston *et al.* (1998) in both high- and low-active subjects. In the present study, although metabolic work rates differed between the prescribed and preferred exercise sessions, there were no differences in RPE. However, as expected, RPE increased over time. Therefore, individuals perceived that they were exercising at the same level in both conditions. This may indicate a potential positive perception of the preferred exercise session as they are working harder but are reporting similar RPEs. It is possible that the use of an estimated $VO_{2\,max}$ protocol in the current study, may have resulted in an underestimation of the prescribed exercise intensity. This is supported by the relatively low RPEs (9-12), in comparison to those recorded in the studies of Dishman *et al.* and Eston *et al.* (12-15).

The results for the affective data do not support the proposed hypotheses. During both exercise sessions, participants remained relatively high in PWB (18.9) and low in PD (6.9) and fatigue (9.9; scales range from 4 to 28). These results do not support previous literature which shows an increase in positive affect with exercise (see Yeung, 1996 for a review). Although there was no difference in PWB, PD or fatigue between prescribed and preferred conditions, it is important to note that participants reported similar levels of affect while exercising at a higher intensity in the preferred intensity condition. It may be that when allowed to choose, individuals naturally select an intensity which results in relatively high levels of PWB and low levels of PD and fatigue. For the PD subscale, the results may reflect a floor effect with individuals low in PD not being able to report any lower values, thus masking any exercise effects.

Rejeski *et al.* (1995) and Gauvin *et al.* (1997) reported that baseline affect is important in understanding the effects of exercise on psychological responses. Although these results should be interpreted with caution ($P < 0.05$), it is notable that during exercise only participants low in PWB prior to exercise showed a significant increase. However, this only applied to the prescribed exercise condition. In the preferred exercise condition, participants low in PWB pre-exercise showed a relatively more positive state at 5 minutes. PWB remained stable in participants with high PWB prior to exercise in the prescribed condition, but these participants also recorded higher PWB values in the preferred condition. The results from the prescribed exercise condition partially support those of Gauvin *et al.* (1997), although contrary to the findings from the present study, Gauvin *et al.* also found decrements in PWB in participants with high pre-exercise levels. This was not observed in this study. Interestingly, the group who were high in PWB prior to exercise exercised at a greater intensity in the preferred exercise condition. Therefore, they may have exercised harder simply to maintain their high levels of PWB.

In this study, participants high in PD and fatigue prior to exercise showed the expected decrease over time, while participants low in PD and fatigue remained stable. This was irrespective of exercise condition. These results do lend support to the study of Gauvin *et al.* (1997). They found that those with very low levels of physical exhaustion reported an increase during the exercise session. Although this study indicated a rising trend in fatigue from 5 to 20 minutes in participants with low levels of fatigue prior to exercise, it was not significant.

One factor which may confound the results was the relative fitness of this population compared to that of Gauvin *et al.* The participants in Gauvin *et al.*'s (1997) study were relatively sedentary and recorded fitness levels which would locate them between the 5th and 30th percentile (ACSM, 1995). The fitness levels of the participants in this study were significantly higher placing them between the 90th and 97th percentile (ACSM, 1995).

From these results it can tentatively be inferred that pre-exercise levels of PWB, PD and fatigue are important in determining the influence exercise can have on psychological affect. It may be that it is only in those individuals who show below average levels of positive affect and/or above average levels of negative affect who will feel any psychological improvements with exercise. However, it should be emphasized that, although those high in PWB and low in PD and fatigue prior to exercise did not gain significant improvements with exercise, they did have the most favorable profiles with higher levels of PWB and lower levels of PD and fatigue.

Finally, the results from the interest/enjoyment subscale of the IMI did not support the original experimental hypothesis. Participants demonstrated similar, high, levels of interest/enjoyment for both exercise sessions (33.3 for preferred and 32.3 for prescribed - scale ranges from 7 to 49). In retrospect, this is perhaps not that surprising as the population were active and fit. However, there was a significant difference in the choice subscale as predicted. Greater choice was experienced in the preferred condition highlighting that the manipulation of choice was successful. The element of choice in the preferred condition was intended to facilitate greater feelings of self-determination. Feelings of self-determination were reported following the preferred exercise session. For most of the participants who stated a preference for the preferred exercise, the reason was due to the perception of greater control. On answering the question, 'Do you have a reason for your preference?' quotes included, '*because I know I've got control over it*', '*I just felt more happy knowing that I had set it (the intensity) and I had control over the speed*' and '*you are in control of what you want to do*'.

The manipulation of choice in the study was restricted to exercise intensity. This could be a limitation because in the real world having choice over physical activity would include having choice over the mode of exercise too. However, in order to be able to regulate and monitor the actual exercise intensity validly and evaluate affective state, a laboratory study was necessary. It is recognized that in conducting the study in this manner external validity has been compromised. Due to the voluntary nature of participant recruitment, the sample obtained for the study were aerobically fit. Therefore, the conclusions obtained may not generalize to the less fit, sedentary

individual. To address these limitations, further research should replicate this study in a field setting with a more sedentary population.

In conclusion, this investigation revealed that on a treadmill individuals chose to exercise at an average intensity of 71% $VO_{2\,max}$. There were no differences in levels of PWB, PD and fatigue between a prescribed intensity and a preferred intensity exercise session, despite participants exercising at a significantly higher intensity in the preferred condition. Participants exhibited relatively high levels of PWB and low levels of PD and fatigue in both conditions. Participants reported greater perceptions of choice in the preferred condition. It was further shown that pre-exercise values of PWB, PD and fatigue are important in determining the affective responses to 20 minutes of exercise in the aerobically fit, although there is some evidence to suggest that exercise condition affects this relationship for PWB.

From a health promotion perspective, when choosing a preferred work rate on a treadmill, individuals chose to exercise at an intensity which provides general health and fitness benefits. In both conditions, participants exhibited relatively high levels of PWB and low levels of PD and fatigue as well as showing high levels of interest/enjoyment. However, in the preferred condition they gave an indication of feeling more self-determined. CET suggests that this greater feeling of self-determination is accompanied by increased intrinsic motivation for exercise, which may lead to greater adherence to a preferred exercise regimen. This is clearly of importance from a health promotion perspective and would not be facilitated by the traditional prescribed exercise programme.

In addition to these recommendations, the results of this study suggest that further research should investigate what prompts individuals to choose a specific intensity of exercise. Do individuals select an intensity which results in high levels of positive affect and low levels of negative affect? Furthermore, the influence of pre-exercise affect on the response to exercise is an important area for research and from this study it can be seen that controlling for factors such as aerobic fitness is necessary.

CHAPTER 4

The effect of causality orientations on the affective and motivational responses to acute exercise.

Introduction

When the previous study was designed it was anticipated that participants would show a preference for the preferred intensity condition because of an individual's innate need to demonstrate self-determination (Deci and Ryan, 1985a). However, at the end of the study when participants were asked which of the two conditions they had preferred, some stated a preference for the preferred intensity condition while others had favoured the prescribed intensity condition. This finding can be explained by Deci and Ryan's (1985a) causality orientations theory (one of the least explored areas of the overarching self-determination theory). It argues that not everyone is motivated by intrinsic rewards, some individuals will seek out controlling situations and look for control in order to regulate their behaviour. This will mitigate against the development of intrinsic motivation (Deci and Ryan, 1985a, p159). If this is the case, then the affective and motivational benefits that can be accrued from the prescribed and preferred intensity conditions may differ depending on the individual's motivational orientation.

According to Deci and Ryan (1985a) every situation or event can be interpreted as being informational, controlling or amotivating and this interpretation will affect the motivational consequences (increased or decreased intrinsic motivation) for, and resultant affective responses and behaviour of, the individual. They explain that those situations construed as informational will result in a promotion of intrinsic motivation by being autonomy supportive and providing competence information. Controlling events will promote extrinsic motivation by imparting pressure to achieve specific outcomes and by conferring the feeling that behaviour is being controlled by an external source. Finally, amotivating events lead to a type of learned helplessness where individuals feel that they cannot achieve a desired outcome. Causality orientations theory suggests that these personality based causality orientations are of importance in how a situation is interpreted and not just the actual characteristics of the situation. The same situation can be interpreted as informational by one person and controlling by another. Despite the individual's orientation being instrumental in deciding what features are attended to and the way that they are interpreted (Deci and Ryan, 1985a),

the actual context and characteristics of the situation will still be taken into account and will interact with the orientation leading to an interpretation of the situation.

Deci and Ryan (1985a, 1985b) described three causality orientations which they named: autonomy, control and impersonal. Underlying the autonomy orientation is the experience of choice. Individuals regard the characteristics of an event as sources of information to regulate their own chosen behaviour. Individuals strive to be self-determining (the perception of having choice) and seek out opportunities to do so. This is shown by behaviour being governed by integrated regulation and intrinsic motivation. Integrated regulation is characterised by involvement in an activity because the outcome is personally important and valued. Intrinsic motivation is typified by an involvement in an activity because of its interest and the enjoyment to be gained out of it (Deci and Ryan, 1985a). Behaviour is organised through the pursuit of self-selected goals and interests, any extrinsic rewards are experienced as evidence of competence rather than as a controlling influence. Behaviour emanating from the control orientation is regulated by controls imposed either by others, within ourselves (by applying self-pressure such as guilt) or by the environment (reward contingencies). It is regulated by a pressure to perform and individuals find themselves doing things because 'they are told to', 'they should', 'they have to' or 'they must'. The sense of self-determination is missing and the resultant behaviour is determined by extrinsic regulation (external pressures and the avoidance of negative consequences) or introjected regulation (pressure imposed by the self). When control oriented, individuals rely on controlling influences such as extrinsic rewards and surveillance to motivate them. Finally, the impersonal orientation is based on the individual feeling that there is an independence between behaviour and outcomes. They feel unable to regulate their behaviour to be able to achieve desired outcomes and events are interpreted as being amotivating. Behaviour is not intentional and the sources of control may be largely unknown to the individual leading to a sense of personal helplessness and incompetence.

Vallerand (1997) outlines a motivational hierarchy where he describes three levels at which motivation operates, the global (personality) level, contextual (life domain) level and the situational level. At each level of the hierarchy he states that motivation leads to cognitive, affective and behavioural outcomes. These outcomes are affected differently depending on the type of motivation. He concludes that the most positive outcomes appear to result from self-determined forms of motivation, although he

acknowledges that most research has been carried out at the contextual level with little available evidence from the situational. It may be that at the situational level, the most positive outcomes appear when the exercise situation is matched to the motivational orientation of the individual.

In light of the preceding discussion of causality orientations theory, the data from study one were reanalysed to investigate the effect of causality orientations on the affective and motivational responses reported in the prescribed and preferred intensity exercise conditions. The two conditions would seem to have characteristics that would appeal differently to control oriented and autonomy oriented individuals. The prescribed exercise condition removes the choice from the individual and is pressurising each participant to exercise at a specific intensity dictated by an external source. This situation should be suited to a control oriented person who seeks out opportunities to be controlled. The preferred condition offers the individual choice over their exercise intensity and should increase the individual's sense of self-determination. This situation is appealing to the autonomy oriented individual who desires an informational environment which does not seek to control.

The following hypotheses were proposed:

a) In the prescribed condition, the control oriented group will report greater positive well-being (PWB) and lower psychological distress (PD) compared to the autonomous group.
b) In the preferred condition the autonomy oriented group will report higher PWB and lower PD compared to the control oriented group.
c) Interest/enjoyment will be greater for the autonomy oriented individuals in the preferred condition while for the control oriented group interest/enjoyment will be higher in the prescribed condition.

Methods

Participants were classified as being autonomy or control oriented based on their response to the question, 'Which of the exercise sessions did you prefer and why?'. Those who reported a preference for the preferred condition were classified as autonomy oriented. Those who chose the prescribed condition were classified as control oriented. Only those participants who made a definite choice were included in the analysis. This resulted in there being 8 participants in both the autonomy (4 male

and 4 female) and control oriented (3 male and 5 female) groups. The groups did not differ on measures of age, gender, height, weight, body fat percentage, body mass index, resting heart rate or estimated VO_{2max} (see Table 4). Ten participants stated that they did not have a preference and were not included in the analysis.

Statistical analysis

A three factor mixed model analysis of variance (Time X Group X Condition) was conducted on the estimated % VO_{2max} and RPE data. A three factor mixed model ANCOVA (Time X Group X Condition) was conducted on each sub-scale of the SEES with the pre-test measure of each sub-scale being used as the covariate. Finally, the motivation data was analysed using a two factor mixed model (Group X Condition) MANOVA and was followed up by univariate ANOVA's. Greenhouse-Geisser epsilon corrections were applied when sphericity was violated. Tukey post-hoc tests were used to identify where any significant differences lay.

Results

Table 4. Mean descriptive characteristics of the autonomy and control oriented groups (standard deviations are in parentheses).

Variable	Autonomy Oriented group	Control Oriented group
Age	22.00	19.38
	(4.28)	(0.74)
Height (m)	1.74	1.74
	(0.11)	(0.10)
Mass (kg)	72.56	66.38
	(13.29)	(11.33)
Bodyfat (%)	18.43	17.31
	(7.40)	(4.39)
Body Mass Index	23.67	21.78
	(2.24)	(2.27)
$VO_{2\,max}$ ($ml.kg^{-1}.min^{-1}$)	53.60	50.81
	(10.70)	(8.95)

Estimated $\%VO_{2max}$

There were significant main effects for time ($F_{1.17, 16.34} = 4.821$, $\varepsilon = 0.389$, $P < 0.01$), group ($F_{1, 14} = 7.044$, $P < 0.02$) and condition ($F_{1, 14} = 9.672$, $P < 0.01$). These main effects were reflected in a condition by time interaction ($F_{1.14, 16.0} = 5.996$, $\varepsilon = 0.381$, $P < 0.01$) and a condition by group interaction ($F_{1, 14} = 20.999$, $P < 0.01$). Post hoc analysis revealed that at 15 and 20 minutes individuals exercised significantly harder in the preferred intensity condition than the prescribed intensity condition. More importantly,

in the preferred intensity condition the autonomy oriented group were exercising significantly harder than the control oriented group (74% and 63% respectively).

RPE

There was a significant main effect for time ($F_{1.70, 23.86} = 30.434$, $\varepsilon = 0.568$, $P < 0.001$). RPE was significantly greater at 15 and 20 minutes than at 5 minutes. Further, a condition by group interaction ($F_{1, 14} = 17.069$, $P < 0.001$), revealed that the autonomy oriented group recorded significantly higher RPE than the control oriented group in the preferred intensity condition.

Subjective Exercise Experiences Scale

PWB. There were no significant main effects or interactions.

Fatigue. There was a group main effect ($F_{1, 13} = 8.73$, $P < 0.02$) indicating that the control oriented group had significantly higher levels of fatigue (13.5) than the autonomy oriented group (8.5). There was also a time by group by condition interaction ($F_{4, 56} = 3.16$, $P < 0.04$). Post hoc analysis revealed that in the prescribed condition the control oriented group reported a significant increase in fatigue from 5 to 10 minutes (12.0 to 13.8) with levels remaining high, while the autonomy oriented group reported a decrease in fatigue (9.5 to 8.5) with levels remaining low. In the preferred condition the control oriented group showed a significant decrease in fatigue from 15 to 20 minutes (14.5 to 12.8), to come back in line with the level of fatigue shown by the autonomy oriented group which remained stable over time (10.5).

PD. Analysis of the PD sub-scale also found a time by group by condition interaction ($F_{2.69, 37.61} = 3.43$, $\varepsilon = 0.67$, $P < 0.04$). Post hoc analysis revealed that in the prescribed condition there was a significant increase in PD from 5 to 10 minutes in the control oriented group (6.5 to 8.1), while PD did not change significantly (7.4 to 6.4) in the autonomy oriented group (see Figure 1). From 20 minutes to post-exercise, PD decreased significantly in the autonomy oriented group (6.9 to 4.9) but did not change significantly in the control oriented group (8.9 to 7.9).

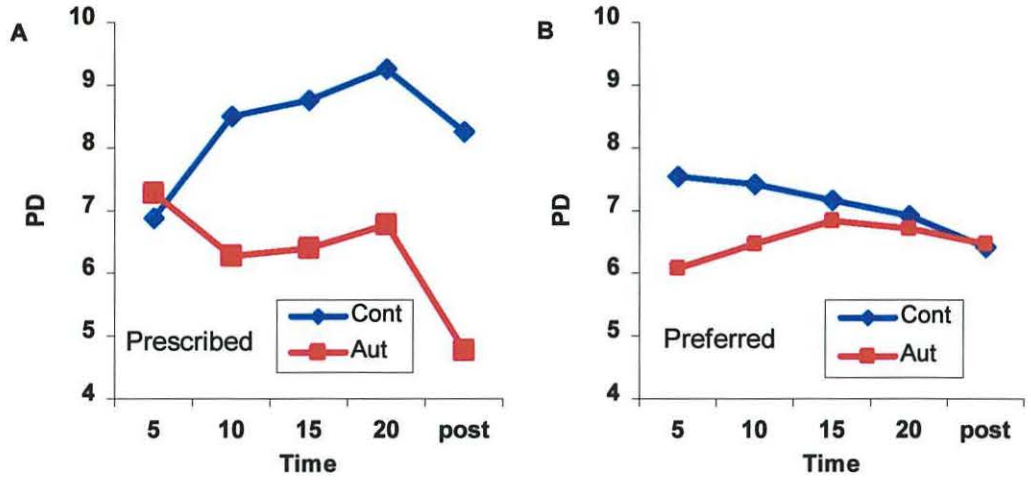

Figure 5. Levels of Psychological Distress (PD) in the control and autonomy oriented groups during the prescribed (A) and preferred (B) intensity exercise sessions.

Intrinsic Motivation Inventory

The MANOVA found a significant main effect for condition ($F_{5, 24} = 5.057$, $P < 0.01$). The univariate ANOVA's revealed a significant condition main effect only in the choice subscale ($F_{1, 14} = 34.845$, $P < 0.001$). Participants perceived they had greater choice in the preferred condition. Interestingly, there was a clear trend towards a group by condition interaction for interest/enjoyment ($P = 0.1$). The autonomy oriented group showed greater interest/enjoyment after the preferred condition while the control oriented group showed more after the prescribed condition. This interaction may have been significant given a larger sample.

Discussion

The purpose of the additional analysis was to investigate the differences in affective and motivational responses to the preferred and prescribed exercise conditions in those individuals classified as autonomy or control oriented.

Before discussing the results, it should be reiterated that this analysis was conducted retrospectively to highlight the potential individual differences surrounding the area of preferred and prescribed exercise regimens in order that they can be followed up in future research. As a consequence, there are some limitations that are acknowledged and should be taken into account. The main limitation is the method used to classify the participants into the two causality orientations. The question used as the basis to group the individuals has not been validated and cannot be thought of as a valid and reliable measure of causality orientations for exercise. Furthermore, it can only categorise

individuals as being either control or autonomy oriented. Deci and Ryan (1985b) have stated that individuals possess a certain level of each of the three orientations (the impersonal orientation was not considered here) and it is misleading to classify individuals as being wholly autonomy, control or impersonally oriented. It is more likely that individuals are 'predominantly' control, autonomy or impersonal in their orientation. This may have resulted in some individuals being misclassified as having one orientation or the other when they actually have high levels of both. This would affect the results. It was hoped that this situation was kept to a minimum by only including those individuals who were clear in their preference for one exercise session over the other but this can not be known for certain. Another limitation is low participant numbers. With there being only eight participants in each group the power of the analysis is low making statistical significance hard to achieve. This may have resulted in some exercise affects being masked.

The exercise intensity results indicate that during the preferred intensity exercise session the autonomy oriented group chose to exercise at a significantly greater percentage of estimated VO_{2max} (74%) than the control oriented group (63%). This was accompanied, as would be expected, by the autonomy oriented group reporting higher RPE values. Contrary to what was anticipated the PWB data did not reveal any significant affective differences between the two groups in either the prescribed or preferred exercise conditions. For PD, the three factor interaction indicated that in the prescribed condition the control oriented group felt a significant increase in PD from 5 to 10 minutes, which did not occur in the autonomy oriented group. Additionally, from 20 minutes to post-exercise, the autonomy oriented group showed a decrease in PD. This would be expected given previous research which has shown decreased PD following exercise in high active individuals (Petruzzello *et al.*, 1997). This effect did not occur in the control oriented group. As this is the first study that has compared affective responses in autonomy and control oriented individuals any reasons for the differences can only be speculative. It may be that the control oriented group were distressed that they may not be able to exercise at the intensity prescribed for the required duration. The prescribed intensity turned out to be greater than that which the control oriented individuals chose to exercise at in the preferred intensity session (although not significantly). The fatigue data revealed that overall the control oriented group felt significantly greater levels of fatigue than the autonomy oriented group. This result is the opposite to what would have been expected since the autonomy oriented group were

exercising at a higher intensity than the control oriented group. The three factor interaction showed that in the prescribed intensity condition, the autonomy oriented group reported a decrease in fatigue from 5 to 10 minutes, with levels remaining low. As they were exercising at a lower intensity than they preferred to, this would be expected. However, the control oriented group reported an increase in fatigue from 5 to 10 minutes, with levels remaining high. In the preferred intensity condition, the control oriented group showed a significant decrease in fatigue 15 to 20 minutes.

Therefore, it seems as though the motivational orientation of the individual influences the intensity at which individuals choose to exercise and also affects the PD and fatigue responses elicited by exercise in different exercise environments. Results seem to suggest that the prescribed intensity condition was detrimental to the affective response of the control oriented individuals but not to autonomy oriented individuals. Being autonomy oriented perhaps protected the individual from this negative influence.

The analysis of the subscales of the IMI produced a significant main effect for exercise condition. As shown in Chapter three, individuals perceived they had greater choice in the preferred exercise condition compared to the prescribed. Although there were no significant results from the follow-up tests for the other sub-scales, that of interest/enjoyment was in the expected direction. There was a trend towards the autonomy oriented group showing more interest/enjoyment for the preferred condition and the control oriented group showing more for the prescribed condition. Both groups are showing greater interest/enjoyment when in the environment which matches their causality orientation. Self-determination theory would suggest that control oriented individuals should not experience intrinsic motivation because they have low levels of self-determination. These results (although not significant) suggest that in a controlling environment individuals can show high levels of interest/enjoyment (an indicator of intrinsic motivation). These results warrant further investigation.

Although limited, these results begin to show that an individual's predominant causality orientation and the environment in which they exercise may be important in the determination of preferred exercise intensity and the affective and motivational responses that result from acute exercise in a fit population.

Further research should examine the link between causality orientations and the affective and motivational responses to exercise more accurately and in a population of sedentary individuals. The first step in doing this is to develop a valid and reliable measure of causality orientations, specific to exercise, that will elicit a measure of each of the three orientations.

CHAPTER 5

The development and initial validation of the exercise causality orientations scale[2]

[2] This study formed the basis of an empirical study accepted for publication in the Journal of Sports Sciences: Rose, E.A., Markland, D. & Parfitt, G. (2001). The development and initial validation of the exercise causality orientations scale. *Journal of Sports Sciences,* **19**, 445-462.

Introduction

Chapter four highlighted that an individual's causality orientation may be important to establish the motivational and affective consequences of exercising in certain environments. This may also have consequences for long term participation in exercise. Research has shown that individuals find adhering to an exercise programme troublesome with reports of up to 50 per cent of individuals dropping out of exercise within six months of beginning (Dishman, 1988). If an exercise environment can be provided that suits the individual's motivational orientation this may enhance the immediate motivational and affective consequences of the exercise session and help initiate participation in exercise while ultimately influencing participation in the long term. Researchers who have investigated motivation to exercise have concluded that for exercise involvement to be maintained in the long term, it is crucial that intrinsic motivation is developed (Boothby *et al.*, 1981; Wankel, 1985; Dishman, 1987; Frederick and Ryan, 1993; Wankel, 1993; Biddle, 1999). However, causality orientations theory argues that not everyone is motivated by intrinsic rewards. Some individuals will seek out controlling situations and look for control in order to regulate their behaviour, although this will mitigate against the development of intrinsic motivation (Deci and Ryan,1985a, p159). If individuals differ in their preferred motivational orientation then in the short term it may be important to foster an exercise environment which supports their orientation in order to initiate participation. However, to encourage long term participation, it may be important (especially in control oriented individuals) to foster an environment which promotes intrinsic motivation.

Before the effect of causality orientations on long term exercise participation can be investigated a valid and reliable measure of causality orientations specific to exercise is required (as highlighted in Chapter four). Deci and Ryan (1985b) devised and provided support for the validity and reliability of the General Causality Orientations Scale (GCOS). The scale was designed as a global measure to give an indication of the enduring general motivational orientation that exists across all aspects of life. It comprises twelve scenarios addressing different situations, including interpersonal relationships, the work environment and socialising, which are followed by three responses that correspond to each causality orientation. The individual rates how much each response is characteristic of them in that situation and a measure of the strength of

each orientation is obtained. Although the orientations have been classified as three distinct types, Deci and Ryan (1985b) recognised that it is not realistic to classify individuals on the basis of one orientation, each individual possesses a certain degree of each. They discuss the causality orientations concept as a move towards a dimensional view of personality where individuals are described by the interaction of two or more dimensions rather than a categorical approach where individuals are characterised as a particular type. However, it is likely that an individual will have a predominant orientation and within this thesis when an individual is described as being autonomy or control oriented, it is meant that autonomy or control is their predominant orientation. Correlations between the three subscales of the GCOS showed the autonomy orientation to be negatively related to the impersonal orientation and unrelated to the control orientation. The control orientation was found to be positively related to the impersonal orientation. Koestner and Zuckerman (1994) pointed out that the GCOS is an unusual scale, the correlational patterning of the orientations show that they are only weakly related, yet their theoretical underpinning would imply a strong negative relationship between the subscales, especially between control and autonomy. Thus, the autonomy and control orientations can be described as orthogonal, which implies that an individual's level on the autonomy orientation cannot be used to indicate his/her level on the control orientation.

In developing the GCOS, Deci and Ryan (1985b) recognised that the three orientations will differ in strength within different life contexts and that context specific scales for assessing orientations are necessary to be able to predict behaviour in those domains more accurately. They have also validated the Causality Orientations at Work Scale (Deci and Ryan, 1985a). Research investigating the effects of different situations on intrinsic and extrinsic motivation has also emphasised the need for domain specific scales. Scales now exist for measuring motivation in education (Vallerand *et al.*, 1992), work (Amabile *et al.*, 1994), leisure (Weissinger and Bandalos, 1995), exercise (Mullan *et al.*, 1997; Li, 1999) and sport (Pelletier *et al.*, 1995). In his motivational hierarchy, Vallerand (1997) implied there is a top-down effect of global motivation to contextual motivation such that the general motivational orientation will be channelled toward specific fields of activity. It also stipulates a bottom-up effect whereby contextual motivation orientations will influence general motivational orientations. Therefore, an individual's general (global) causality orientation will play some role in defining

contextual orientation. This relationship was shown by Williams *et al.* (1996). They reported that a patient's global level of autonomous motivation (from the autonomy subscale of GCOS) prior to their study was a significant predictor of their contextual autonomous motivation (reasons for participating in the programme) 10 weeks into their weight loss programme. Vallerand also recognised that people's orientations are likely to vary somewhat from one context to another and that to predict and explain contextual motivation more precisely it needs to be assessed at the contextual level using suitable measures. Both Vallerand (1997) and Ryan (1995) emphasised the critical need for domain specific research, particularly for its applied significance.

The exercise habits of an individual may be influenced by their causality orientations. Within this context, exercise is defined as 'planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness' (Caspersen *et al.*, 1985a) and is thought of as subset of physical activity. To promote the greatest psychological benefits and enjoyment from exercise and provide the most motivationally adaptive environment to promote adherence requires an exploration into the interaction of personality characteristics, environmental conditions and preferences of the individual. By assessing the individual's exercise specific causality orientations, the exercise environment most likely to fulfil these requirements may be established. For example, an individual with a predominantly autonomy orientation may prefer exercising in a setting that allows choice over activities and exercise intensities, offers information on competence and allows for personal goal-setting. However, a predominantly control oriented individual may prefer an environment where the exercise regimen is prescribed or controlled by someone else, where there is opportunity for external rewards to be gained and where progress is continually monitored. It is recognised that more self-determined forms of behavioural regulation are associated with long term participation in exercise (Mullan *et al.*, 1997). Therefore, over time, control oriented individuals should be encouraged to adopt more autonomous regulation. However, to initiate participation, taking into account the predominant orientation (control, autonomous or impersonal) may prove beneficial. In order to identify the individual's preference and to address this question, an exercise specific measure of causality orientations is required.

The causality orientations are an indication of an individual's predisposition to interpret events in a particular manner and for this interpretation to influence how individuals initiate and regulate their behaviour. Therefore, scales to measure causality orientations differ conceptually from those that measure behavioural regulation (e.g., Behavioural Regulation in Exercise Questionnaire, BREQ, Mullan *et al.*, 1997) and perceived locus of causality (e.g., Locus of Causality for Exercise Scale, LCE, Markland and Hardy, 1997). The BREQ provides a precise account of the different forms of motivation specific to exercise which lie along the self-determination continuum. The LCE is concerned with the perceived source of initiation of behaviour. There is no existing tool which measures the causality orientations concept specifically in the exercise context.

The purpose of this chapter is to describe the development and initial validation of a scale designed to assess the strength of an individual's exercise specific causality orientations. The analysis of the data was conducted in two stages and so the chapter is split into two parts. Part one details the development of the Exercise Causality Orientations Scale (ECOS) and describes the psychometric properties of the scale. Part two examines the concurrent validity of the scale by comparing its subscales to other constructs which were highlighted by Deci and Ryan (1985a) as being conceptually related to the causality orientations. Hypotheses for these relationships will be stated in part two.

Methods

Development of the scale

The format adopted for the General Causality Orientations Scale (Deci and Ryan, 1985b) was used as the template for the scale. A series of scenarios were written (using the same design as the GCOS) that addressed aspects of the exercise experience, including preferences for a new exercise programme, reasons for exercising and monitoring progress. Each scenario was followed by three responses, one corresponding to each causality orientation. These responses captured the defining features of each orientation as described by Deci and Ryan (1985a, 1985b) as they would relate to the situation described in the scenario. Each response was rated on a seven point Likert-type scale anchored by the labels, 'very unlikely' (1) through 'moderately likely' (4) to 'very likely' (7). Individuals indicated the extent to which

each response was characteristic of them in that situation. An example of one scenario is:

You are asked to keep a record of all the weekly exercise you have completed in an exercise diary. You are likely to view the diary:
As a way to measure your progress and to feel proud of your achievements. (Autonomy)
As a way of pressurising yourself to exercise. (Control)
As a reminder of how incapable you are at fulfilling the task. (Impersonal)

The attention to monitoring progress and feeling proud suggests a high level of intrinsic motivation and an enjoyment of the exercise for its own sake. Viewing the diary as a source of pressure suggests a need to be controlled. Finally, the pervasive sense of being incapable suggests a worry about not being in control of outcomes.

An initial pool of 19 scenarios and 57 items were written. This preliminary set of items (Appendix 3A, p207) were administered to 258 undergraduate students, 95 males and 131 females (32 did not report gender), mean age 20.85, $s = 5.29$ years. Bivariate correlations and an exploratory factor analysis with varimax rotation were conducted on the responses (Appendix 3B, p210). From these analyses, 12 scenarios were retained whose items showed the greatest number of significant correlations with items reflecting the same orientation and whose items loaded on the factor for which they had been written, i.e., the autonomy items loaded on the autonomy factor. In six of the scenarios, the control item had to be reworded to give it a more controlling emphasis and in one scenario the impersonal item was changed to emphasise the unintentional nature of behaviour. The revised 12 scenario version (Appendix 3C, p220) was administered to a further sample of 125 undergraduate students, 63 males and 62 females, mean age 20.27, $s = 4.95$ years. Following the same correlational analysis and exploratory factor analysis (Appendix 3D, p222) a further three scenarios were eliminated as their items did not correlate well with items reflecting the same orientation from the other scenarios.

Completed version. The completed Exercise Causality Orientations Scale (ECOS) comprised nine scenarios and 27 items (Appendix 3E, p227). From the pilot studies,

three of the scenarios still required one item to be reworded to make the emphasis more controlling. The stem of one scenario was rewritten to make the situation sound more hypothetical by trying to get respondents to think of themselves in that situation despite never having been in it.

Participants

The nine scenario ECOS was administered to nine samples of working adults comprising University staff ($n = 167$) and employees of eight private companies ($n = 427$). Two large companies were approached to take part but they refused. Therefore, smaller companies were contacted to take part until sufficient completed questionnaires were returned. The effective sample (after listwise deletion for missing values) comprised 222 men and 329 women (12 did not report gender) aged between 16 and 66 years (mean 35.78, $s = 11.31$). The original sample comprised 592 individuals, the response rate was 42%. Table 5 shows the differences between males and females in mean scores on each of the subscales of the ECOS. It can be seen that the males scored significantly lower on the control subscale than females. A modification of the Leisure Time Physical Activity Scale (LTPA; Appendix 1E, p190) devised by Godin and Shephard (1985) was used to measure physical activity habits. Individuals reported how often in a typical seven day period they exercised 1) strenuously, 2) moderately and 3) mildly, for longer than 15 minutes. Participants reported varying physical activity habits from sedentary (not exercising regularly) to highly active (exercising three or more times per week). Correlations between the LTPA and each subscale of the ECOS found activity level to be significantly positively related to the autonomy subscale ($r = 0.179$, $P < 0.001$) and negatively related to the impersonal subscale ($r = -0.201$, $P < 0.001$). Out of those sent to University staff, 98 agreed to participate in a two month retest. Completed questionnaires were received from 66 participants.

Table 5. Mean differences between males and females for each causality orientation (standard deviations are given in parentheses).

	Autonomy	Control	Impersonal
Males	44.48	31.81*	24.20
	(9.11)	(8.29)	(8.02)
Females	44.25	36.47	25.76
	(8.99)	(8.16)	(8.28)

* = significant difference between males and females at $P < 0.001$.

Procedure

Consent was obtained from each company and University department to approach staff. Participants were then given a pack (either by a contact within each company or department or by mail) that explained the purpose of the research and contained the ECOS, the LTPA, a questionnaire asking for details of age and gender and certain questionnaires to be used in the validation of the ECOS (these instruments will be described in the statistical analysis section where the rationales for the scales used will be presented). It was explicitly stated that participation was entirely voluntary. Completed questionnaires were returned by mail either directly to the investigator or to a contact within the company who forwarded them on. Those questionnaires distributed to the University staff asked if participants would consider completing the ECOS again in two months. Upon receipt of completed questionnaires participants were debriefed (in the form of a letter) and thanked for their participation.

Statistical Analysis

As indicated earlier, the analysis of the data is split into two parts. In part 1, the psychometric properties of the ECOS are examined using structural equation modelling. In the second, the concurrent validity of the scale is established by correlational analysis between its subscales and other constructs believed to be conceptually related to the causality orientations.

Part 1. This design lends itself to statistical investigation by multi-trait multi-method (MTMM) analysis. MTMM analysis is used to determine the true relationship among traits when the effects of method variance (an artefact of measurement) and random error are present (Schmitt and Stults, 1986). The simple rationale is that traits can be

measured by different methods but the magnitude of that trait should not change depending on which measurement instrument is used (Wothke, 1996). In this analysis each of the nine scenarios are classed as methods and the three orientations (autonomy, control and impersonal) were considered traits.

Traditionally, the convergent, discriminant and construct validity of the MTMM correlation matrix along with any method effects have been evaluated using Campbell and Fiske's (1959) guidelines. These state that correlations between different measures of the same trait should be substantial (convergent validities). Discriminant validity is demonstrated by these convergent validities being higher than correlations among different methods of measuring different traits (heterotrait heteromethod correlations) and correlations among different traits assessed by the same method (heterotrait monomoethod correlations). Finally, the pattern of correlations among the traits should be the same for different methods. However, several limitations have been levelled at this approach. Specifically, there is no standard by which to evaluate the degree to which criteria are met, correlations based on observed variables are used to draw conclusions about underlying trait and method factors and it does not separate out method effects from random error, which is desirable. These criticisms have meant that a more sophisticated approach to evaluating MTMM models is necessary (Marsh and Bailey, 1991). More recently, confirmatory factor analysis (CFA) has become the most popular and widely advocated method of analysing the MTMM matrix (Marsh and Bailey, 1991; Kenny and Kashy, 1992). In this study the data underwent confirmatory factor analysis using LISREL 8.30 (Jöreskog and Sörbom, 1999).

The variance-covariance matrix (Appendix 3F, p229) was computed using PRELIS 2.3 (Joreskog and Sorbom, 1999) and maximum likelihood (ML) estimation was used. This estimation procedure is the most commonly used in structural equation modelling and has as its main assumption that the data be normally distributed. Prior analyses indicated that the data showed departure from multivariate normality. Normalised Mardia coefficients were: 35.413, $P < 0.0001$ (skewness) and 21.777, $P <$ 0.0001(kurtosis). When the normality assumption is violated, Bentler and Chou (1987) and Chou and Bentler (1995) have concluded that the estimates obtained from maximum likelihood estimation are acceptable and unbiased, however, problems with the χ^2 distribution and the standard errors have been observed. To overcome these

problems the scaled test statistic of Satorra and Bentler (SCALED χ^2; 1988, 1994) was used to modify the standard test statistics to make them more approximately χ^2 distributed. Chou *et al.* (1991) and Hu *et al.* (1992) reported that this statistic performed better than the standard tests when assumptions are violated.

Marsh (1988, 1989) and Marsh and Grayson (1995) recommend that for MTMM data four models should be compared and evaluated in relation to each other and a priori predictions. The four models specified were those with:

1) Correlated traits correlated methods (CTCM) - the complete model.
2) Correlated traits (CT).
3) Correlated traits uncorrelated methods (CTUM).
4) Correlated traits correlated uniquenesses (CTCU) - the recommended model.

As their names suggest, the CTCM model is the full model and allows the three traits to intercorrelate and the nine methods to intercorrelate (see Figure 6). It provides an unambiguous interpretation of convergent validity, discriminant validity and method effects when the trait factor loadings, method factor loadings and trait correlations are evaluated. The CT and CTUM models are nested within the CTCM. The CT model does not posit method factors and allows only the traits to correlate (see Figure 7). When compared to the other CFA models it provides an indication of the size of any method effects. The CTUM model specifies method factors but does not allow them to correlate, allows only the traits are correlated (see Figure 8). When compared to the CTCM model, this model provides a test of whether the method effects are correlated. The CTCU model is not nested within the CTCM model. In this model the three traits are correlated and method effects are inferred from the correlated uniquenesses among the three items based on the same method (see Figure 9). It assumes that the method effects associated with each different method are uncorrelated. When compared to the CTUM model, it provides a test of whether method effects are unidimensional or multidimensional.

Marsh and Bailey (1991) and Kenny and Kashy (1992) have observed that due to estimation and identification problems, in most cases the CTCM model rarely arrives at a unique and proper solution and the estimates obtained have suspect precision. They cite the CTCU model as the preferred model. It has been shown to result in proper solutions for all sizes of matrices and sample sizes. Marsh *et al.* (1992) have stated that

in order to achieve interpretable results the CTCM model needs to be simplified. Therefore, this study places most emphasis on the CTCU model. Analysis of the data showed that these identification and estimation problems occurred for the CTCM and CTUM models and solutions could not be generated. Subsequently, only the fit of the CT and CTCU models could be compared. For a full discussion of MTMM techniques and the four models see Marsh and Grayson (1995).

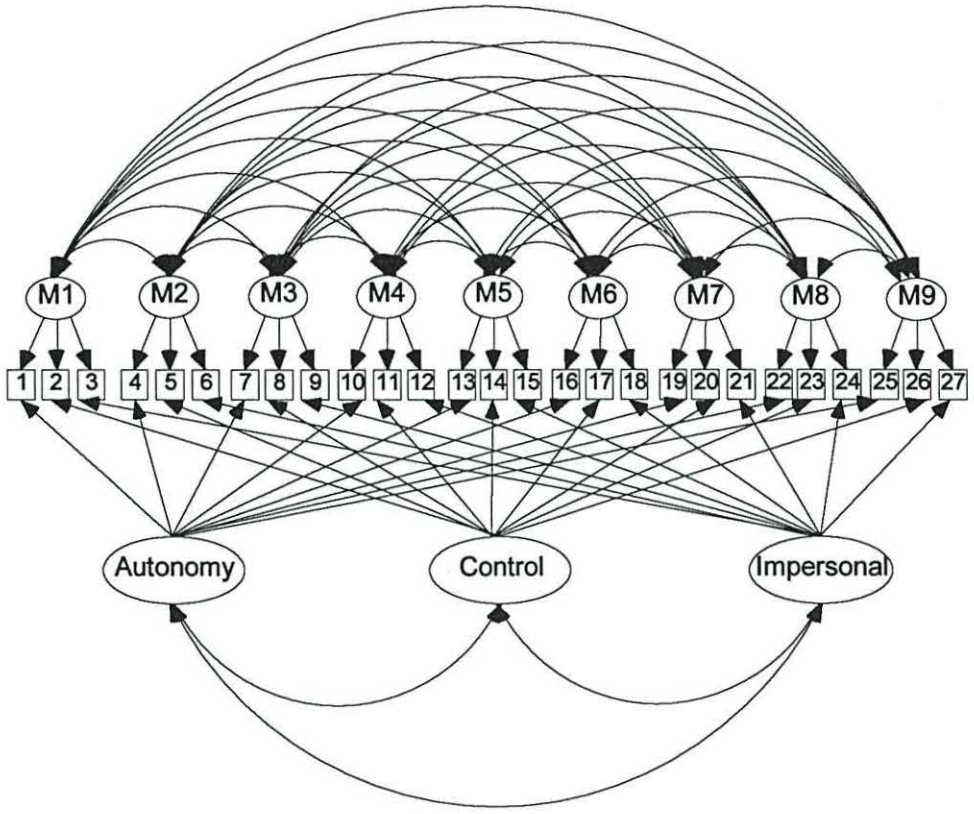

Figure 6. The correlated traits correlated methods model (CTCM)

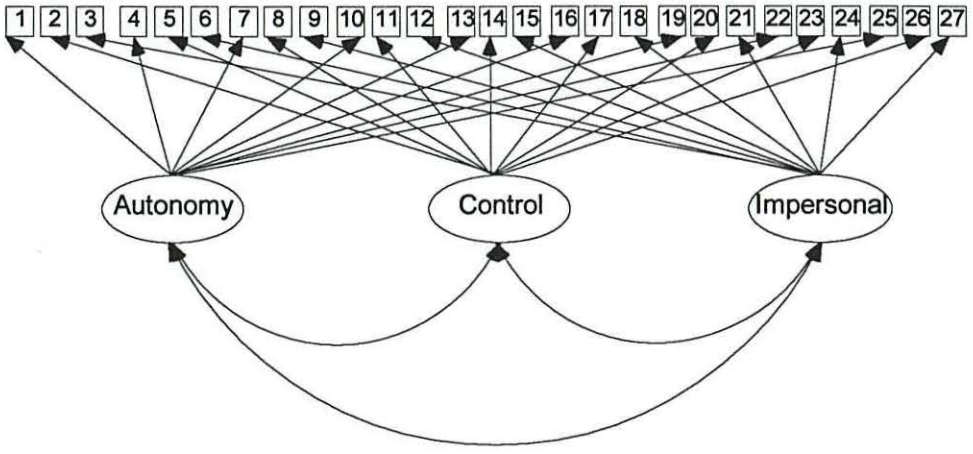

Figure 7. The correlated traits model (CT)

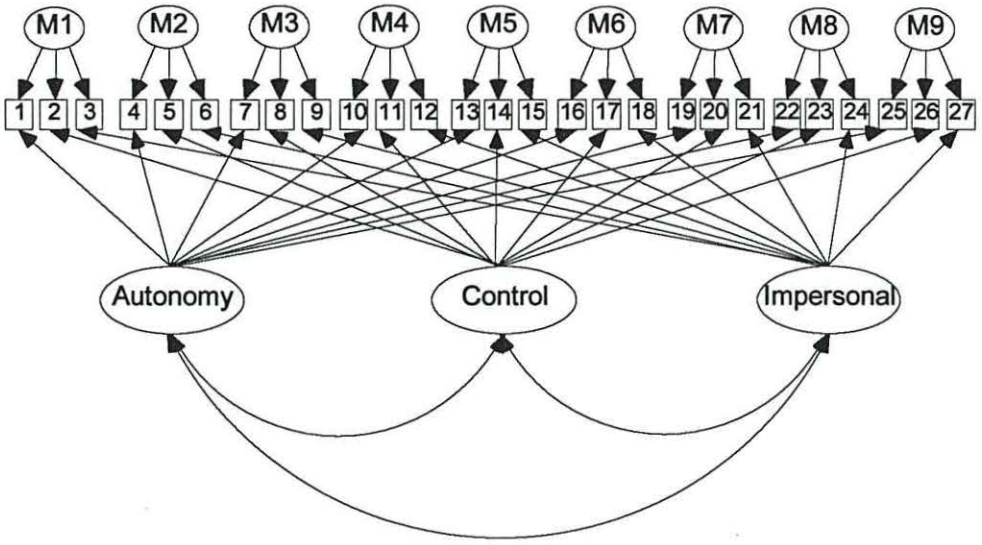

Figure 8. The correlated traits uncorrelated methods model (CTUM)

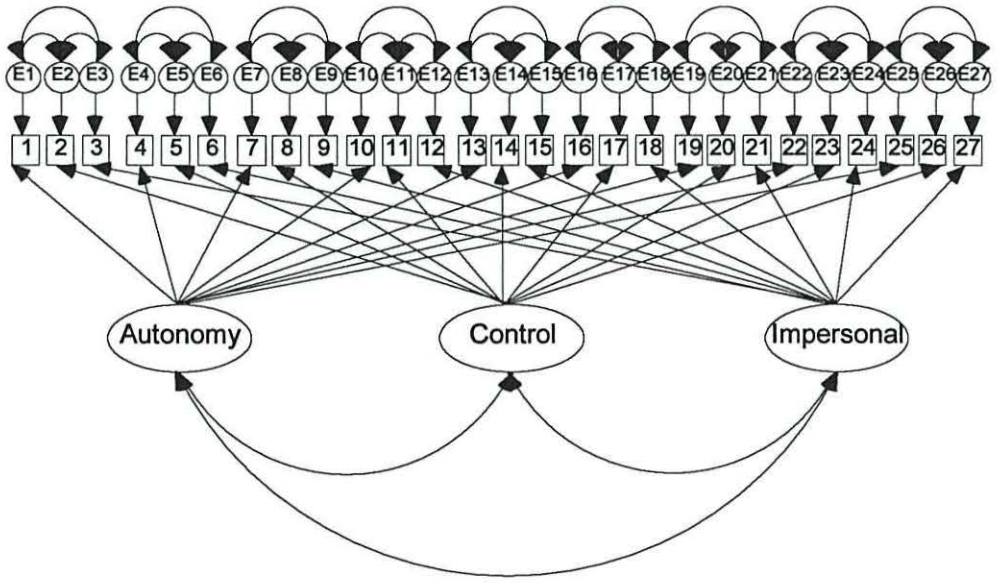

Figure 9. The correlated traits correlated uniquenesses model (CTCU)

As recommended by Hoyle (1995) and Hoyle and Panter (1995) a variety of fit indices from different classes were used to evaluate goodness of fit. These were: SCALED χ^2 (Satorra and Bentler, 1988; 1994), the Comparative Fit Index (CFI; Bentler, 1990), the Non-Normed Fit Index (NNFI; Tucker and Lewis, 1973), the Incremental Fit Index (IFI; Bollen, 1989), the Root Mean Square Error of Approximation (RMSEA; Steiger,

1990) and Standardised Root Mean Square Residual (SRMR; Bentler, 1995). For CFI, NNFI and IFI, minimum values of 0.90 have generally been regarded as indicating an acceptable fit (Bentler and Bonett, 1980). However, more recently Hu and Bentler (1999) proposed the criteria for evaluation of fit should be close to 0.95 for CFI, IFI and NNFI, close to .06 for RMSEA and close to 0.08 for SRMR. The 90% confidence intervals for RMSEA were also examined. The RMSEA value should not be significant, the significance test examines the probability that the RMSEA value is larger than 0.05. Hu and Bentler (1999) also recommend that fit indices should be evaluated in combination to provide a superior assessment of model fit. When used in combination the criteria are: 0.95 for NNFI, CFI and IFI with SRMR < 0.09 and RMSEA < 0.06 with SRMR < 0.09. The Parsimony Normed Fit Index (PNFI; James *et al.*, 1982) and Consistent Akaike Information Criterion (CAIC, Cudeck and Browne, 1983) were used to compare the fit of competing models.

For detailed assessment of fit the completely standardised parameter estimates and residuals were examined for direction and magnitude. Finally, in order to gain the best fitting model the modification indices of the CTCU were evaluated to find which, if any, scenarios had any ambiguous items so the scenarios could be removed from the analysis. The internal consistency of the three subscales of the ECOS was investigated using Cronbach's alpha, while the retest reliability was examined using intraclass correlations with 95% confidence intervals.

Part 2. Pearson's correlational analysis was used to explore the concurrent validity of the Exercise Causality Orientations Scale (ECOS) by comparing its subscales to the following constructs highlighted by Deci and Ryan (1985a) to be conceptually related to the causality orientations. Due to the number of correlations being conducted there was an increased risk of Type I error. The table of critical r's developed by Wallace and Snedecor (1931; In Shavelson, 1988) was used to evaluate the significance of the resulting r value based on the number of a priori comparisons to be made (20) and the degrees of freedom (286 or 292).

General Causality Orientations. The General Causality Orientations Scale (GCOS: Appendix 1F, p191). developed by Deci and Ryan (1985b) described earlier was used to give a measure of global causality orientations. The scale has been found to have

acceptable internal consistency and test-retest reliability and its construct validity has been supported (Deci and Ryan, 1985b). In this study, Cronbach's alphas for each subscale were: 0.69 (autonomy), 0.59 (control) and 0.77 (impersonal).

Hypotheses. Vallerand (1997) suggests that this global personality orientation will play some role in defining orientations in different contexts. Therefore, there will be significant correlations between the subscales of the GCOS and the corresponding ones of the ECOS. Additionally, because Deci and Ryan (1985b) found the impersonal orientation to be negatively related to the autonomy orientation and positively related to the control orientation it is expected that the same pattern of correlations will emerge across the two instruments.

Behavioural Regulation In Exercise. The Behavioural Regulation In Exercise Questionnaire (BREQ; Appendix 1G, p193) developed by Mullan *et al.* (1997) established levels of self-determination for exercise. It comprises four subscales; extrinsic regulation (EXT), introjected regulation (IJ), identified regulation (ID) and intrinsic regulation (IM), which range from non self-determined regulation (EXT) to complete self-determination (IM). It was scored using a four point Likert-type scale with verbal anchors reading, 'not true for me' (0) through 'sometimes true for me' (2) to 'very true for me' (4). Separate subscale scores and a relative autonomy index (RAI; Ryan and Connell, 1989) were computed. The RAI is a single score which gives an indication of levels of self-determination, the higher the RAI the greater the level of self-determination. It was determined by applying a weighting of -2, -1, +1 and +2 to EXT, IJ, ID and IM respectively, and then summing the products. Acceptable reliability and discriminant validity were found for the subscales as well as overall factorial validity of the scale (Mullan *et al.*, 1997). In this study, Cronbach's alphas for the four subscales were: 0.76 (EXT), 0.75 (IJ), 0.85 (ID) and 0.94 (IM).

Hypotheses. The autonomy orientation is characterised by high levels of self-determination and will therefore be positively correlated with identified and intrinsic regulation. The control orientation undermines the development of self-determination and will be positively correlated with external and introjected regulation. The impersonal orientation is the antithesis of self-determination and will be positively related to external regulation and negatively related to intrinsic regulation. Finally, the autonomy orientation will be positively correlated with RAI and the control and impersonal orientations will be negatively correlated.

Locus of Causality for Exercise. The Locus of Causality for Exercise Scale (LCE; Appendix 1H, p194) developed by Markland and Hardy (1997) measured perceived locus of causality for exercise. It was scored using a seven point Likert-type scale with verbal anchors of 'strongly agree' (1) and 'strongly disagree' (7). High scores indicate a more internal perceived locus of causality. Support for the scale's factorial and construct validity have been found (Markland and Hardy, 1997; Markland, 1999). In this study, Cronbach's alpha was found to be 0.74.

Hypotheses. Although not synonymous with self-determination, locus of causality and self-determination are very similar. Locus of causality is concerned with the source of initiation of behaviour whereas self-determination is regarded as being principally concerned with the perception of choice. However, high levels of self-determination are equated with an internal perceived locus of causality and low levels are indicative of an external perceived locus of causality. Therefore, the autonomy orientation will show a positive correlation with LCE while the control and impersonal orientations will show negative correlations.

Self-Consciousness. The Revised Self-Consciousness Scale (SCS-R; Appendix 1I, p195) devised by Scheier and Carver (1985) measured self-consciousness. It comprises three subscales; private self-consciousness (refers to the awareness of aspects of yourself hidden from others, e.g., beliefs, values and feelings), public self-consciousness (the tendency to see yourself as others do) and social anxiety (concern over how people view you and by anxiety about being evaluated by others). It was scored using a four point Likert-type scale with anchors 'not at all like me' (0), 'a little like me' (1), 'somewhat like me' (2) and 'a lot like me' (3). The psychometric properties of the revised scale are comparable to those of the original (Scheier and Carver, 1985). In this study, Cronbach's alphas for the three subscales were: 0.76 (private), 0.83 (public) and 0.79 (social anxiety).

Hypotheses. Public self-consciousness will be correlated with the control orientation because the search for a controlling environment may involve comparing yourself to others and being sensitive to what others think of you (Deci and Ryan, 1985b). Private self-consciousness will correlate positively with the autonomy orientation because behaviour is initiated and regulated with respect for personally valued outcomes and feelings. Finally, social anxiety will show a positive correlation

with the impersonal orientation because the experience of a new situation, the concern over how people will view you and the evaluation anxiety experienced is indicative of the impersonal orientation. Social anxiety derives in part from public self-conscious because to be anxious about how people view you, you need to be focused on your public self. Therefore, social anxiety will also be positively related to the control orientation.

Social Desirability. The 13-item short form of the Marlowe-Crowne Social Desirability Scale (Crowne and Marlowe, 1960; Appendix 1J, p196) validated by Reynolds (1982) measured social desirability (the extent to which the responses given to questionnaires are affected by individuals responding in a socially desirable manner). Participants responded either true or false to a series of statements concerning personal attitudes, a score of one is attributed to the socially desirable response and zero is given to the non-socially desirable response. Validity and reliability of the short form of the scale is comparable to the standard form (Reynolds, 1982).

Hypotheses. In this instance the autonomy orientation could be suggested as being the most attractive and socially desirable response set. Ideally, there will be no correlation between social desirability and any of the orientations.

Part 1: Psychometric Properties

Results and Discussion

As indicated previously, the CTCM and the CTUM models could not be computed due to identification problems, leaving comparisons to be made only between the CTCU and CT models. The fit indices for the CT and CTCU models are shown in Table 6. It can be seen that neither model showed a good fit to the data but the CTCU model showed a better fit than the CT model. Additionally, it is reported to be a more natural and heuristic representation of MTMM data than the other models (Marsh and Bailey, 1991). The improved fit of the CTCU model shows that the method effects are multidimensional and do not form a single latent method factor. However, the fit of the CTCU model was far from acceptable. The SCALED χ^2 value was significant showing that the observed and implied models were different. The incremental fit indices, CFI, NNFI and IFI indicated that when compared to the null model the fit of the CTCU model was poor. On a more positive note, the RMSEA showed that the model was approximating the data at an acceptable level (< 0.06) with the confidence intervals

Table 6. Fit indices for the Correlated Traits (CT) model and the Correlated Traits Correlated Uniquenesses (CTCU) model.

Model	SCALED χ^2	Unadjusted χ^2	df	CFI	NNFI	IFI	SRMR	RMSEA	90% CI for RMSEA
CT	1146.10**	1361.58**	321	0.84	0.82	0.84	0.09	0.07**	0.06; 0.07
CTCU	829.92**	952.65**	294	0.89	0.87	0.89	0.08	0.06*	0.05; 0.06

SCALED χ^2 = Satorra Bentler SCALED test statistic; df = degrees of freedom; CFI = Comparative fit index; NNFI = Non-normed fit index; SRMR = Standardised root mean square residual, RMSEA = Root mean square error of approximation; 90% CI for RMSEA = 90% Confidence interval for RMSEA; ** = significant at $P < 0.001$; * = significant at $P < 0.01$.

being small. However, the value was significantly greater than 0.05. The SRMR showed that the average of the residuals were at an acceptable level.

Examination of the modification indices of the CTCU model found four scenarios to have a large number of modification indices. These scenarios were removed one at a time and each time the CTCU model was respecified. This process was repeated until four CTCU models were specified and could be compared. This process did not involve freeing up parameters, it simply reduced the number of items indicating each latent variable. The fit indices of these models are shown in Table 7.

The fit of the CTCU model improved with each scenario that was removed. The 6 scenario and the 7 scenario models produced the most acceptable fits with the 6 scenario model showing a slightly better fit. For both models the incremental fit indices of CFI (7 scenario = 0.96; 6 scenario = 0.97) and IFI (7 scenario = 0.96; 6 scenario = 0.97) indicated that the model was a good fit with both values being above the accepted cut off criterion of close to 0.95. The NNFI values of 0.91 (7 scenario) and 0.92 (6 scenario) were not so encouraging. However, Marsh *et al.* (1996) and Yadama and Pandey (1995) have advised caution when considering NNFI. They observed that in simulation studies NNFI has shown large sampling fluctuations and large within cell standard deviations. Yadama and Pandey (1995) reported that NNFI, CFI and IFI are all positively associated with sample size but, while IFI and CFI are relatively stable, NNFI shows wide variation between different sample sizes. Hu and Bentler (1995) however, suggested that this problem may not be so great when using ML estimation. Bentler (1992) stated a preference for CFI over NNFI suggesting it was a better measure of model fit and that indices should not mix model parsimony and criteria of fit into a single index. These factors may account for the discrepancy between NNFI and the other indices and the values of CFI and IFI should be taken to reflect the true fit of the model. The RMSEA values (6 and 7 scenario = 0.05) again indicated an acceptable fit with the values being less than the 0.06 criterion and non-significant showing that the RMSEA values were not significantly greater than 0.05.

Table 7. Fit indices for each CTCU model following scenario deletion.

Model	SCALED χ^2	Unadjusted χ^2	df	CFI	NNFI	IFI	SRMR	RMSEA	90% CI for RMSEA
CTCU (9 scenarios)	829.92**	952.65**	294	0.89	0.87	0.89	0.08	0.06*	0.05; 0.06
CTCU (8 scenarios)	561.85**	645.31**	225	0.93	0.90	0.93	0.07	0.05	0.05; 0.06
CTCU (7 scenarios)	387.35**	445.14**	165	0.96	0.91	0.96	0.06	0.05	0.04; 0.06
CTCU (6 scenarios)	251.67**	298.00**	114	0.97	0.92	0.97	0.06	0.05	0.04; 0.05

The numbers in brackets are the number of scenarios left in the analysis.

SCALED χ^2 = Satorra Bentler SCALED test statistic; df = degrees of freedom; CFI = Comparative fit index; NNFI = Non-normed fit index; SRMR = Standardised root mean square residual, RMSEA = Root mean square error of approximation; 90% CI for RMSEA = 90% Confidence interval for RMSEA; ** = significant at $P < 0.001$; * = significant at $P < 0.01$.

When taken in combination, these values of RMSEA and those of SRMR (6 and 7 scenario = 0.06) are below the 0.05 and 0.06 criteria respectively as are those of SRMR (0.09) combined with CFI and IFI (cut off criterion 0.95) giving increased confidence in the goodness of fit of the model. In comparing the 7 and 6 scenario models the Parsimony Normed Fit Index (PNFI) and Consistent Akaike Information Criterion (CAIC) values showed that the 7 scenario model (along with the 8 scenario model) gave the greatest PNFI value (0.63 compared to 0.61) while the 6 scenario model gave the lowest CAIC value (669.47 compared to 871.11). This suggests that based on parsimony the 7 scenario model may be the better fitting model.

Table 8 shows the parameter estimates, uniquenesses and trait factor correlations used to evaluate the detailed assessment of fit of the 6 and 7 scenario models. The parameter estimates for both models were adequate (above 0.3) and significant with small standard errors showing that the model has good convergent validity. Each correlated uniqueness represents the correlation between traits sharing the same method once the trait effects are removed. If they are small and non-significant then method effects are insubstantial. As can be seen, the majority of the uniquenesses were significant and large indicating the presence of multidimensional method effects. It could be expected that this model would show method effects because the scenario on which each trait is based is the same. The trait-factor correlations show that the autonomy and control traits are unrelated, autonomy and impersonal traits have a negative relationship (7 scenario = -0.53, 6 scenario = -0.61) and the impersonal and control traits have a positive relationship (7 scenario = 0.55, 6 scenario = 0.52). These results limit the discriminant validity of the scale. However, given that we cannot classify individuals as having one orientation and that they will have a certain level of each it was to be expected that the subscales would be related. Marsh and Bailey (1991) reported that the CTCU model may have a tendency to demonstrate stronger convergent validity but weaker discriminant validity with the CTCU model being a conservative test of discriminant validity.

Table 8. Standardised parameter estimates for the 6 and 7 scenario models, standard errors are shown in parentheses.

Method	Trait	Parameter Estimates (SE)		Uniquenesses (SE)					
		6 scenario	7 scenario	6 Scenario			7 Scenario		
1	Aut	0.39 (0.05)	0.38 (0.04)	0.85* (0.04)			0.85* (0.04)		
	Cont	0.29 (0.05)	0.30 (0.05)	-0.15* (0.04)	0.92* (0.04)		-0.14* (0.04)	0.91* (0.04)	
	Imp	0.38 (0.06)	0.44 (0.05)	0.00 (0.04)	0.06 (0.04)	0.86* (0.05)	0.01 (0.04)	0.04 (0.04)	0.81* (0.05)
2	Aut	0.46 (0.05)	0.45 (0.05)	0.79* (0.05)			0.80* (0.05)		
	Cont	0.31 (0.05)	0.35 (0.05)	0.21* (0.04)	0.90* (0.05)		0.20* (0.04)	0.88* (0.04)	
	Imp	0.42 (0.05)	0.40 (0.05)	-0.04 (0.04)	0.06 (0.04)	0.82* (0.06)	-0.06 (0.04)	0.05 (0.04)	0.84* (0.06)
3	Aut	0.65 (0.05)	0.63 (0.05)	0.58* (0.06)			0.60* (0.06)		
	Cont	0.63 (0.05)	0.61 (0.05)	0.02 (0.04)	0.60* (0.06)		0.01 (0.03)	0.63* (0.06)	
	Imp	0.53 (0.05)	0.51 (0.04)	-0.01 (0.04)	-0.12* (0.04)	0.72* (0.05)	-0.05 (0.04)	-0.10* (0.04)	0.74* (0.05)
4	Aut	0.67 (0.04)	0.66 (0.04)	0.56* (0.06)			0.57* (0.05)		
	Cont	0.38 (0.05)	0.38 (0.05)	-0.13* (0.04)	0.85* (0.06)		-0.13* (0.03)	0.86* (0.06)	
	Imp	0.50 (0.05)	0.46 (0.05)	-0.10* (0.04)	-0.18* (0.04)	0.75* (0.07)	-0.12* (0.04)	-0.19* (0.04)	0.79* (0.07)
5	Aut	0.62 (0.04)	0.60 (0.04)	0.62* (0.06)			0.64* (0.06)		
	Cont	0.45 (0.05)	0.43 (0.05)	-0.08* (0.04)	0.80* (0.06)		-0.07* (0.04)	0.81* (0.05)	
	Imp	0.52 (0.05)	0.46 (0.05)	-0.21* (0.05)	-0.05 (0.04)	0.73* (0.07)	-0.24* (0.05)	-0.04 (0.04)	0.79* (0.07)
6	Aut	0.38 (0.06)	0.43 (0.05)	0.85* (0.06)			0.82* (0.06)		
	Cont	0.46 (0.05)	0.50 (0.05)	-0.01 (0.04)	0.79* (0.05)		0.01 (0.04)	0.75* (0.05)	
	Imp	0.42 (0.06)	0.49 (0.05)	0.03 (0.04)	0.10* (0.04)	0.82* (0.06)	0.04 (0.04)	0.06 (0.04)	0.76* (0.06)
7	Aut		0.41 (0.06)				0.83* (0.06)		
	Cont		0.52 (0.05)				-0.14* (0.04)	0.73* (0.05)	
	Imp		0.59 (0.04)				-0.02 (-0.04)	0.13* (0.04)	0.65* (0.05)

All parameter estimates are significant. LISREL 8.3 does not give standard errors and *t* values for the completely standardised solution. The standard errors presented are rescaled by dividing the completely standardised parameter estimates by their *t* values derived from the unstandardised solution (Marsh, 1993).

Table 8 continued

Trait-Factor Correlations						
	6 Scenario			7 Scenario		
	Autonomy	Control	Impersonal	Autonomy	Control	Impersonal
Autonomy	1.00			1.00		
Control	-0.07 (0.08)	1.00		0.01 (0.08)	1.00	
Impersonal	-0.61* (0.06)	0.52* (0.08)	1.00	-0.53* (0.06)	0.55* (0.07)	1.00

Aut = Autonomy; Cont = Control; Imp = Impersonal; * = $P < 0.05$.

Internal Consistency

The nonstandardised Cronbach's alpha values for the 7 scenario CTCU model were: autonomy 0.70, control 0.65 and impersonal 0.68. Those for the 6 scenario CTCU model were: autonomy 0.69, control 0.59 and impersonal 0.63. The standardised values were only marginally higher. These results showed that the reliabilities of both models are reasonable and as expected, those of the 7 scenario model were higher due to there being more indicator items.

Temporal Stability

The intraclass correlations and 95% confidence intervals assessing two month test-retest reliability for the 7 scenario CTCU model were: autonomy 0.73 (0.59 - 0.82), control 0.77 (0.65 - 0.85) and impersonal 0.71 (0.57 - 0.81). Those for the 6 scenario CTCU model were: autonomy 0.71 (0.56 - 0.81), control 0.76 (0.64 - 0.85) and impersonal 0.69 (0.54 - 0.80), all were significant at $P < 0.001$ showing that the ECOS scores are relatively stable over time.

In conclusion, the model to be accepted and proposed as the best fitting solution is the scale with seven scenarios. This is preferred over the six scenario version for a variety of reasons. There are virtually no differences in their fit statistics and on the basis of model parsimony the seven scenario solution is superior. The subscale reliabilities are greater in the seven scenario solution (especially the control subscale) and can all be described as acceptable. Finally, and more importantly, retaining more scenarios for the final scale improves the content validity of the scale. The following section will examine the concurrent validity in more detail.

Part 2: Validity assessment

Methods

Participants

Two packs containing different validation questionnaires were circulated to different companies. The pack which contained the LCE, Social Desirability Scale and GCOS was distributed to staff of the University and one company. These were completed by 121 men and 167 women (1 did not report gender) mean age 37.28, $s = 11.15$ years. Response rate was 30%. The other pack which contained the BREQ and SCS-R was

completed by 117 men and 177 women (11 did not report gender) mean age 34.90, s = 11.39 years. Response rate was 45%.

Results and Discussion

The pattern of results between each of the subscales of the ECOS and those of the validation questionnaires are shown in Table 9. Due to the number of correlations being conducted, the resulting r values were adjusted based on Wallace and Snedecor's (1931) recommendations. It can be seen that all correlations were in the low to moderate range. Amongst those correlations that were significant, all but one were significant at $P < 0.001$.

General Causality Orientations

As hypothesised, the autonomy subscale of the GCOS showed a significant positive correlation with the autonomy subscale of the ECOS (r = 0.40). The control subscale of the GCOS showed significant positive correlations with the control (r = 0.27) and impersonal (r = 0.34) subscales of the ECOS. Finally, the impersonal subscale of the GCOS showed significant positive correlations with the ECOS impersonal (r = 0.47) and control (r = 0.32) subscales. These results showed that, as expected, the same orientation subscales of the GCOS and ECOS were significantly correlated. This may indicate the reciprocal relationship between global and contextual orientations as discussed by Vallerand (1997). As stated earlier, both the ECOS and the GCOS autonomy and impersonal subscales were negatively related, the autonomy and control subscales were unrelated and the control and impersonal subscales were positively related. On the whole, across the two instruments this pattern of results also emerged which begins to support the content validity of the ECOS. Although the GCOS control subscale showed a stronger correlation with the ECOS impersonal subscale than with control, and similarly, the ECOS control subscale showed a stronger correlation with the GCOS impersonal than control subscales, Fisher's z transformations showed that these correlations were not significantly different from one another. Nevertheless, the pattern of these correlations are not entirely in line with expectations.

Table 9. Adjusted Correlations between the subscales of the ECOS and the validation questionnaires.

	Autonomy	Control	Impersonal
General Causality Orientations Scale:			
Autonomy	0.40**	0.18	-0.21
Control	0.07	0.27*	0.34**
Impersonal	-0.13	0.32**	0.47**
Locus of Causality for Exercise	0.21	-0.18	-0.31**
Behavioural Regulation In Exercise Questionnaire:			
External Regulation	-0.08	0.28**	0.26**
Introjected Regulation	0.21	0.22	-0.01
Identified Regulation	0.50**	0.06	-0.26**
Intrinsic Regulation	0.42**	-0.02	-0.29**
RAI	0.41**	-0.14	-0.35**
Self-Consciousness Scale:			
Private Self-conscious	0.13	0.11	-0.01
Public Self-conscious	0.02	0.29**	0.10
Social Anxiety	-0.17	0.14	0.21
Social Desirability	0.09	-0.13	-0.12

Correlations were adjusted using the table of critical r's (Wallace and Snedecor, 1931).
** = significant at $P < 0.001$; * = significant at $P < 0.05$. $n = 289$ for LCE, SDS & GCOS, $n = 294$ for BREQ and SCS-R.

Behavioural Regulation for Exercise

The correlations between the BREQ subscales and the ECOS subscales were all in the anticipated direction. The autonomy subscale showed a positive correlation with identified regulation (r = 0.50) and intrinsic regulation (r = 0.42). These results indicate that there is a link between the autonomy orientation and engaging in exercise because of the importance of achieving an outcome and out of interest and enjoyment. The control subscale was positively related to external regulation (r = 0.28) but not to introjected regulation, as had been expected. These results showed that there is a

relationship between the control orientation and engaging in exercise because of external pressure (from someone else) to do so, but not necessarily from internal pressure (from within the self). Finally, the impersonal subscale was positively related to external regulation (r = 0.26) and negatively related to identified regulation (r = -0.26) and intrinsic regulation (r = -0.29). This pattern of results indicates an association between the impersonal orientation and engaging in exercise because of external pressure and not because of its value, benefits or out of enjoyment. This is indicative of the belief that outcomes cannot be attained by initiating a certain behaviour. Before a correlation between RAI and the ECOS could be computed, it was first necessary to establish that there was a simplex pattern between the subscales of the BREQ such that those subscales closer on the self-determination continuum displayed a greater positive correlation than those further apart (Ryan and Connell, 1989). This pattern was found. As expected, results of the RAI and ECOS correlations found the autonomy subscale to have a positive relationship (r = 0.41) with RAI and the impersonal subscale to have a negative relationship (r = -0.35). These results show that the autonomy orientation is linked with high levels of self-determination and the impersonal orientation is linked with low levels. The control orientation was not significantly correlated with RAI.

Locus of Causality for Exercise

Unexpectedly, there were no significant correlations between the autonomy and control subscales and the LCE, but the impersonal orientation did show a significant negative correlation (r = -0.31). This indicated that a higher level on the impersonal subscale was related to a less internal perceived locus of causality. This supports Deci and Ryan's (1985b) contention that the impersonal orientation is not supportive of self-determination. However, it did not support the hypotheses that the autonomy orientation would be associated with a more internal perceived locus of causality and the control orientation would be associated with a less internal perceived locus of causality.

Self-consciousness

The only significant relationship was between the control subscale and public self-consciousness (r = 0.29). This showed that there was a link between having a high level of the control orientation and being more likely to compare yourself to others. The lack

of a relationship between the impersonal orientation and social anxiety may indicate that being involved in exercise is not something that causes anxiety.

Social Desirability

As expected, there were no significant correlations between social desirability and each of the causality orientations.

Overall, results were in the predicted direction and provide good support for the concurrent validity of the ECOS. These results show agreement with the characteristics of an autonomy, control and impersonally oriented individual outlined by Deci and Ryan (1985a).

General Discussion

The aims of this research were to develop a psychometrically acceptable measure of causality orientations specific to the exercise context and to demonstrate its concurrent validity by examining its relationships with other related concepts. A measurement tool was constructed and redefined until a scale that had acceptable psychometric properties was found. The final scale consisted of seven scenarios, each depicting some aspect of the exercise experience, which were followed by three items relating to how a person with a predominance of each causality orientation (autonomy, control and impersonal) would react in that situation. On completing the scale each individual has a score on each of the three orientations and their pattern of causality orientations for exercise can be identified.

This study has shown the ECOS to have good factorial validity. All but one of the fit indices reached a level recommended by Hu and Bentler (1999) as demonstrating a good fit and when they were evaluated in combination provided further evidence of a good fit. The removal of scenarios to refine the scale and improve its fit did not involve post-hoc freeing of parameters leaving the integrity of the original model intact. This technique is regarded as a legitimate process in measurement development (Hofmann, 1995). It has been used previously by Markland and Ingledew (1997) to refine a measurement instrument. The ECOS was found to have good convergent validity shown by the size and significance of the factor loadings and acceptable

discriminant validity. It was also shown to be internally consistent and to have good retest reliability.

The theoretical grounding of the ECOS suggests that the control and autonomy orientations and autonomy and impersonal orientations should be negatively related, while the control and impersonal subscales should be positively related. The results of the subscale intercorrelations upheld all but one of these relationships. The results for the ECOS were similar in direction and magnitude to those for the general scale providing support for the content validity of the scale. Therefore, as Koestner and Zuckerman (1994) implied about the general scale, the autonomy and control orientations of the ECOS can be described as orthogonal. If an individual displays a large score on the autonomy subscale it cannot be inferred that they will necessarily have a low score on the control subscale. Alternatively, the control and impersonal subscales show a moderate positive relationship and as such are not orthogonal.

The concurrent validity of the scale was given some support by the emergence of hypothesised relationships with constructs theoretically linked to causality orientations: the GCOS and measures of self-determination and public self-consciousness, although in some cases findings were not in line with expectations. The pattern of correlations that emerged between the ECOS and the GCOS showed that the global level of causality orientations are related to the contextual level which supports one of the proposals of the motivational hierarchy described by Vallerand (1997). The use of correlational analysis precludes a causal inference being made on whether the global motivational orientation is affecting the contextual level or whether it is the contextual level that is having an effect on the global level. It is likely, as Vallerand suggests, that there is a reciprocal relationship whereby the global level first effects the contextual, which in turn consolidates the global motivational orientation. However, Vallerand stresses that additional research is needed to fully understand the impact of contextual motivation on global motivation.

It had been expected for the control orientation to be positively related to introjected regulation. On further inspection of the ECOS items it is perhaps not surprising that this correlation was not significant. The content of the items of the ECOS are mainly focused on external control rather than internal control. The lack of significant

correlations found with the self-consciousness scale may be due to the fact that it is measuring at the global (personality) level and is not context specific for exercise.

Further research should be conducted which continues to demonstrate the construct validity of the ECOS by using other related constructs and through the prediction of behaviour. Furthermore, the psychometric properties of the ECOS should be confirmed by revalidating the scale using another sample. It is proposed that the ECOS be used in the applied setting to assess an individual's pattern of causality orientations so that an exercise environment can be matched to support their predominant causality orientation. In the short term, this may result in a situation which fosters the greatest psychological benefits and enjoyment from exercise. However, for long term adherence it is likely that control oriented individuals will need to be encouraged to use more self-determined forms of behavioural regulation. Using the ECOS as a research tool this should be the subject of future investigations.

In conclusion, this study has provided a rationale for context specific causality orientations scales and in particular a scale to measure causality orientations for the context of exercise. A factorially valid and reliable scale for measuring causality orientations for exercise has been developed which can be used both in empirical research and the applied setting. However, certain relationships were not as predicted, for example, significant relationships between GCOS control and ECOS impersonal and ECOS control with GCOS impersonal. Additionally, some expected relationships did not emerge. These included IJ and RAI with the control subscale, LCE with the autonomy and control subscales, private self-consciousness with the autonomy subscale and social anxiety with the impersonal subscale. Further investigations are required to investigate these relationships as well as establish the construct validity and predictive validity of the ECOS with respect to behaviour.

CHAPTER 6

STUDY 3

The influence of causality orientations on adherence to exercise and motivational responses to exercise during a six month exercise intervention.

Introduction

The evidence which espouses the physical and psychological benefits of participating in regular exercise is immense. However, it has been consistently shown that individuals find adhering to a programme of regular exercise troublesome (Dishman, 1988). This has prompted a wealth of research investigating factors that may enhance adherence to exercise. This research has mainly focused on the determinants of exercise participation and barriers associated with participation in exercise. There have been few interventions conducted to improve adherence to exercise.

In a review of the determinants of exercise, Buckworth (2000) found them to include levels of self-efficacy, behavioural intention, the use of self-regulatory skills (e.g., goal setting, self-reinforcement and self-monitoring), social influence, exercise enjoyment, positive affect and a moderate exercise intensity. Sallis and Hovell (1990) also report spouse support, past programme participation, health risk and peer influence as important. However, there is no single variable that appears to be the sole determinant of adherence to either prescribed or self-initiated exercise (Sallis and Hovell, 1990). This highlights the fact that it is important to take individual differences into account when considering exercise behaviour. Individuals will differ in the importance they attach to certain factors to maintain their participation in exercise. A further important consideration is that the determinants and psychological processes involved in the adoption of an exercise programme are likely to differ from those which help individuals maintain the new behaviour (Rothman, 2000). This factor has largely been ignored and may help explain why those who successfully adopt an exercise regimen fail to maintain that behaviour. Rothman (2000) suggests that individuals initiate behaviour change because they have positive perceptions of what they can achieve from it. However, the decision to adhere to that new behaviour depends on how satisfied they are with the outcomes they experience. Although he does acknowledge that little empirical evidence is available to support his hypotheses, from an exercise perspective it would seem to make sense. If individuals are not experiencing the benefits they want then they are likely to feel amotivated and drop out. Dishman *et al.* (1985) also suggests that determinants may be dynamic and their influence over exercise behaviour may differ over time, making certain interventions more or less successful at a particular time. One of the limitations of the determinants literature is that the research is almost always conducted retrospectively and there are many problems with this sort of methodology. Brawley *et al.* (1998) reported that the accuracy of retrospective data

relies on the individual's memory of why they began to exercise. This may lead to bias because psychological processes such as expectations, attributions or stereotypes may have influenced the responses. Additionally, retrospective research can only provide an indication of an association between certain factors and adherence to exercise.

Literature which has summarised the reported barriers to exercise (Wankel, 1988; Sallis and Hovell, 1990; Willis and Campbell, 1992) consistently state lack of time as one of the main obstacles to participating in exercise. However, Wankel points out that non-exercisers are unlikely to have less time to exercise than exercisers and it is more a question of priorities: what do individuals want to make time for? These researchers have also shown a lack of interest or motivation as another common barrier. This factor highlights the importance of making the exercise enjoyable and providing an exercise environment which is motivationally enhancing. They also reported the lack of easily accessible, adequate facilities and the cost associated with exercising as obstacles to exercise. These underline the importance of encouraging individuals to choose home-based exercises, find a facility which is convenient and/or to participate in activities that do not involve any cost, such as walking. Other barriers that were reported in these studies are a lack of knowledge about exercise, fatigue and the perceived discomfort associated with exercise.

In order to investigate the capacity of certain determinants to enhance adherence and to try and circumvent the reported barriers to exercise, longitudinal intervention studies with a sound theoretical rationale need to be conducted. Marcus *et al.* (2000) conclude that interventions designed to increase exercise participation have been successful. Dishman and Buckworth (1996) conducted a meta analysis to examine the ability of physical activity interventions to improve physical activity adoption and to identify factors which moderate their success. Their results suggested that the implementation of an intervention improved success rates from 50% (without intervention) to 70-88%. They identified that interventions were more likely to result in success if they had a focus on behaviour modification, were group interventions and promoted unsupervised, leisure physical activity of low intensity. Surprisingly, they reported that more success was likely when interventions were delivered through the use of the media rather than one to one contact. Marcus *et al.* (2000) added that better maintenance of physical activity appears to result from interventions which were home-based, were delivered in the community and had self-management instruction. Dishman and Buckworth (1996)

warned that the maintenance of successful participation following the conclusion of the intervention has been less promising. Marcus *et al.* (2000) also suggest that having frequent contact with participants during the maintenance phase seems important, but how regular and what the content needs to be is not known. Marcus *et al.* (1998) recognised that in order to maximise the effectiveness of interventions they should be tailored to at least some aspects of the individual or group and that a 'one size fits all' approach is not as effective. The unique characteristics of the individual should be taken into account because variables that affect adoption and maintenance of exercise are likely to differ between individuals. It is frequently acknowledged that much intervention research has been atheoretical (Biddle and Nigg, 2000; Buckworth, 2000; Marcus *et al.*, 2000). Biddle and Nigg (2000) emphasise that it is critical that exercise interventions are conducted within an appropriate theoretical framework for further insight to be gained into exercise behaviour.

One of the major factors implicated in long term participation in exercise is the development of intrinsic motivation for exercise (Dishman, 1987; McAuley *et al.*, 1991; Wankel, 1993; Ingledew *et al.*, 1998; Li, 1999; Biddle and Nigg, 2000). According to self-determination theory (Deci and Ryan, 1985a) intrinsic motivation will be developed as a result of increased perceptions of self-determination, perceived competence and relatedness (the three psychological needs). Interpersonal contexts that support the experience of these needs will promote self-regulation (Deci *et al.*, 1986). In order to develop a feeling of relatedness the individual needs to feel a sense of belonging and connectedness. This is generated by an interpersonal environment in which individuals feel others are genuinely interested in them (Ryan and Deci, 2000). Providing a structure for exercise that will offer optimal challenge and positive feedback pertaining to their ability will enhance perceptions of competence. Finally and perhaps more importantly, providing an autonomy supportive environment where the individual experiences freedom of choice and an absence of control and pressure will enhance self-determination. This autonomy supportive environment is necessary for the processes of internalisation and integration in which extrinsically motivated behaviours become increasingly internalised leading to more autonomous intrinsically motivated forms of regulation. This process is discussed within Deci and Ryan's (1985a) organismic integration theory. In short, there are several forms of behavioural regulation which are characterised by different levels of self-determination as a result of the degree of internalisation achieved. These regulations for behaviour lie along a self-determination

continuum beginning with external regulation (behaviour results from external pressure), through introjected regulation (behaviour results from pressure imposed by the self) to identified regulation (behaviour results from value that is attached to the outcome) and finally intrinsic motivation. Deci *et al.* (1994) demonstrated that internalisation and integration can be promoted by providing a meaningful rationale for a particular behaviour, by providing an autonomy supportive environment and by providing supports to promote relatedness. They do state, however, that controlling contexts can promote some internalisation but it is likely to result only in introjected regulation.

It is maintained that when exercise is first initiated it is likely that extrinsic motives are most salient but with increased participation, intrinsic motives are developed (Dishman, 1987; McAuley *et al.*, 1991; Wankel, 1993; Ingledew *et al.*, 1998; Li, 1999; Biddle and Nigg, 2000). Ingledew *et al.* (1998) demonstrated that those in the action stage of behaviour change (Prochaska and DiClemente, 1984) reported a predominance of extrinsic motives for exercise over intrinsic motives, but for those in the maintenance stage this situation was reversed and the intrinsic motives dominated. However, it should be remembered that both extrinsic and intrinsic forms of motives were in evidence and it was only the dominance of one over the other that differed. They concluded that progression from inactivity to activity is associated with higher levels of intrinsic motives but not extrinsic motives. The concomitants of intrinsic motivation, self-determination and perceived competence, have also been studied in relation to exercise maintenance. Sallis and Hovell (1990) reported self-efficacy (perceived competence) to be strongly related to exercise behaviour. The construct of autonomy or high self-determination is viewed as one of the most important factors that will influence long term participation in exercise. Biddle (1999) concludes that feelings of autonomy are important to the study of adherence to exercise and that behaviour regulated by intrinsic and identified forms of regulation is more likely to lead to maintenance of exercise. Cross-sectional data supports this conclusion. Mullan and Markland (1997) reported an association between stage of change for exercise and behavioural regulation showing that the use of identified and intrinsic regulation (more self-determined forms of regulation) distinguished those in the action and maintenance stages of change (those actively exercising) from those in prepreparation and preparation (those not exercising). However, they also suggest that extrinsic motives and external and introjected forms of behavioural regulation are often necessary to

provide the catalyst to initiate behaviour change. The construct of autonomy has also been shown to be important to long term adherence to weight loss programmes (Williams *et al.*, 1996) and to the study of intentions towards physical activity. Chatzisarantis and Biddle (1998) reported that adults who showed more self-determined motives for exercise were found to have greater intentions to be physically active which translated into higher levels of physical activity compared to those with less self-determined motives. Taken together, these results suggest that for long term success, exercise interventions should foster feelings of self-determination, perceived competence and intrinsic motivation.

The conclusions drawn regarding the influence of self-determination and intrinsic motivation do not take into account the influence of causality orientations. This is a unique individual characteristic which may play a role in the adoption and maintenance of exercise and the extent to which an intervention will promote self-determination and intrinsic motivation. Therefore, it may be pertinent to take this into account when designing exercise interventions. It has been discussed previously that causality orientations theory (Deci and Ryan, 1985a) suggests that individuals differ in their preferred motivational orientation and that this will impact on the initiation and regulation of their behaviour. It is likely that the individual's predominant causality orientation will influence the exercise environment in which the individual prefers to exercise and will affect the psychological outcomes experienced. Vallerand (1997) states that the motivation to engage in a specific activity at a specific point in time (situational motivation) will mainly be affected by motivation for exercise in general (contextual motivation) and the situational factors occurring at that moment. Thus, if an individual is predominately autonomy or control oriented for exercise in general, it is likely that they would choose a specific exercise session which is autonomous or controlling in nature in order to meet the needs of their orientation and that this experience will further confirm the autonomy or control causality orientation. Vallerand (1997) also proposes that there is a reciprocal relationship between contextual and situational motivation. This relationship is such that an individual's feelings of intrinsic motivation for exercise in general will facilitate the experience of intrinsic motivation in reaction to each specific exercise session. Additionally, repeated experience of intrinsic motivation following each exercise session will serve to strengthen intrinsic motivation for exercise in general. By assessing both contextual

intrinsic motivation for exercise in general and situational intrinsic motivation after each exercise session a test of these proposals can be performed.

In order to satisfy their orientation, those who are predominately autonomy oriented are likely to be searching for an autonomous environment in which they can demonstrate their self-determination by exercising when and how they want to and can be focused on their enjoyment of the activity. This environment is conducive to increasing intrinsic motivation. Those who are control oriented are likely to prefer a controlling environment in which there is pressure upon them to exercise, where someone else controls their exercise regimen, where they are being externally monitored and where there is a focus on external rewards. This environment is not supportive of self-determination and according to self-determination theory (Deci and Ryan, 1985a; 1987) would not be favourable for the development of intrinsic motivation. For those who are impersonally oriented, it is unlikely that they will choose to exercise and will need to be pressured to exercise and made aware of the benefits that can be obtained. Again, intrinsic motivation is unlikely to be cultivated.

Deci and Ryan (1987) stated that when behaviour is controlled by external sources it will only persist for as long as the controlling pressure is present. This implies that removal of external control will lead to termination of the behaviour. They suggest behaviour change brought about in more autonomous circumstances is more conducive to persistent change. Therefore, it is likely that placing control oriented individuals in a controlling environment will initiate behaviour change (in this case increased levels of exercise) but once the intervention is terminated levels of exercise will be reduced due to the lack of controlling influence. This implies that providing a controlling environment will only be beneficial in the short term and as research suggests, only by increasing the autonomy of control oriented individuals will maintenance of exercise be achieved. Thus, as Rothman (2000) and Marcus *et al.* (2000) suggest, some behaviour change strategies may be more important for the short term and others for the long term. The search for a situation that promotes adherence and fosters the greatest psychological benefits and enjoyment from exercise may be achieved by exploring the relationship between personality characteristics (causality orientations) and the exercise environment.

Many criticisms have been levelled at intervention studies designed to increase exercise participation especially concerning the area of measurement. These have been discussed by Kimiecik and Blissmer (1998). One of the major criticisms is that self-reported exercise behaviour is rarely validated or verified by objective measures such as increased fitness or the use of a motion sensor. This is important because of problems, such as the social desirability bias, associated with self-reported exercise measures which lead to unreliable estimates of levels of exercise (see Ainsworth *et al.*, 1994). Studies must also distinguish the type of exercise they are interested in increasing, whether it is light to moderate lifestyle activity or vigorous exercise. It has been found that there are different determinants for increasing moderate intensity exercise and vigorous intensity exercise (Sallis *et al.*, 1986). The second major criticism is that the psychological constructs that are likely to underlie any increases in exercise behaviour are not typically measured or are only measured pre- and post-intervention. Kimiciek and Blissmer (1998) suggest that the ignorance of this factor limits the potential for developing an applied psychology knowledge base. Rothman (2000) also encourages the measurement of the individual's psychological experiences of a behaviour change programme. In order to ascertain the relationship between psychological processes and behaviour change, it is pertinent to measure these constructs during the intervention to attempt to explore why exercise behaviour changes.

In order to address these issues, this study will incorporate a measurement of fitness to supplement the self-reported assessment of exercise behaviour. Exercise is being defined as 'planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness' (Caspersen *et al.*, 1985a). Moderate intensity exercise is being encouraged because of its ability to promote a positive affective state (see Chapter two) and because it is likely that for sedentary individuals this intensity will be most comfortable and achievable (hopefully resulting in increased perceptions of competence). The theoretical rationale for the study is based around the theories of self-determination and causality orientations. Therefore, the contextual psychological processes that will be pertinent to any changes in exercise behaviour and that are being measured are: levels of self-determination (operationalised using the behavioural regulation continuum), levels of causality orientations, perceived competence and levels of intrinsic motivation for exercise. It is also assumed that situational psychological processes may also be relevant. These include psychological affect, situational intrinsic motivation and activity enjoyment. A modification of the

interest/enjoyment subscale of the Intrinsic Motivation Inventory (IMI: McAuley *et al.*, 1989; McAuley *et al.*, 1991) is being used as the indicator of intrinsic motivation. It has been modified in two ways. Firstly, to relate to exercise in general and assess contextual intrinsic motivation and secondly to relate to each specific exercise session to assess situational intrinsic motivation.

The Exercise Causality Orientations Scale (ECOS) as described in Chapter 5 will be used to measure the strength of each causality orientation within the exercise context. It has been discussed that individuals should be described by the interaction of all three causality orientations rather than categorically as having one particular orientation. However, it is likely that an individual will have one orientation which is predominant over the others. Koestner and Zuckerman (1994) suggest that the causality orientations theory is better suited to the use of a typological distinction and that more can be learned by classifying individuals on the basis of their predominant orientation. They suggest it is easier to predict how individuals who are predominately autonomy oriented differ from those who are predominately control or impersonally oriented than it is to describe how someone with a low autonomy score may differ from someone with a high control score. Koestner and Zuckerman suggest that individuals can be categorised by standardising their scores on each of the three subscales. Individuals are classified as being predominantly autonomy oriented when their autonomy z-score is greater than their control and impersonal z-score. Similarly, individuals are classified as being predominantly control oriented when their control z-score is greater than their autonomy and impersonal z-score.

The characteristics of the orientations are such that those with a predominance of the autonomy orientation are more likely to be currently involved in exercise than those with a predominance of the control orientation. Unlike control oriented individuals who need to feel some sort of pressure to exercise, autonomy oriented individuals are more likely to feel able to motivate themselves and are less likely to feel the need to respond to an offer of help to get them motivated to exercise. For this reason, it was anticipated that more control oriented individuals would volunteer to take part in the study than autonomy oriented individuals. Additionally, it was thought unlikely that impersonally oriented individuals would volunteer to take part as they would not feel they could benefit from beginning to exercise.

The aim of this study was to investigate the interaction between causality orientation and the exercise environment on adherence to exercise and the motivational and affective responses to exercise over a six month period. The 12 week intervention period compared a group of control oriented individuals (group 1) who were placed in an exercise environment supportive of their predominant causality orientation (controlling environment) with a group of control oriented individuals (group 2) and autonomy oriented individuals (group 3) whose exercise environments were not supportive of their orientation (autonomous and controlling environments respectively). There was no group of autonomy oriented individuals in an autonomous environment because of the lack of autonomy oriented volunteers. The intervention groups were compared to a control group (group 4) that only received an education component and a fitness assessment. In the following 12 weeks, all participants were left to exercise on their own in an autonomous environment with no intervention. The following hypotheses were proposed.

Hypothesis 1: Exercise Behaviour

It is hypothesised that in the short term (during the first 12 weeks of the study) placing individuals in an exercise environment that supports their predominant causality orientation will result in greater levels of exercise than placing them in an environment which does not support their orientation. Specifically, the control oriented individuals placed in a controlling environment (group 1) will exercise more often each fortnight than those control oriented individuals (group 2) and autonomy oriented individuals (group 3) who are placed in an autonomous and controlling environment respectively. Furthermore, Groups 1-3 will exercise more often than the control group (group 4). In the 12 weeks following the intervention period, it is hypothesised that because the external pressure to exercise will have been removed this will adversely affect the exercise habits of the control oriented individuals but will be beneficial to those who are autonomy oriented. Specifically, at week 24 the matched control oriented individuals (group 1) will show lower levels of exercise than the mismatched control oriented individuals (group 2) and the autonomy oriented individuals (group 3).

Hypothesis 2: Situational Responses

Psychological Affect. It is hypothesised that the most positive affective responses will be generated when the individuals are in an exercise environment that is matched to their predominant orientation. Therefore, the matched control oriented individuals

(group 1) will show more positive psychological affect after each fortnightly block of exercise sessions than the control and autonomy oriented individuals who are mismatched (groups 2 and 3 respectively). Furthermore, in group 1, psychological affect will become more positive over the 12 weeks of the intervention, while in groups 2 and 3, affect will become less positive.

Situational Intrinsic Motivation. Self-determination theory (Deci and Ryan, 1985a) predicts that intrinsic motivation will only be developed in an autonomy supportive environment or those environments that are interpreted in an informational rather than a controlling manner. Therefore, group 2, who are exercising in an autonomous environment, will show greater levels of situational intrinsic motivation after each fortnightly block of exercise sessions than groups 1 and 3 who are exercising in a controlling environment. Furthermore, in group 2, situational intrinsic motivation will increase over the 12 weeks of the intervention, while in groups 1 and 3, intrinsic motivation will decrease.

Situational Perceived Competence. Perceptions of competence are increased through experiences of optimal challenge and success at performing a task (Ryan and Deci, 2000). The intensity of exercise promoted throughout the intervention was of moderate intensity in order to maximise the likelihood of gaining these success experiences. Therefore, providing individuals continue to exercise regularly, levels of situational perceived competence will increase in all participants over the 12 weeks. This should not be influenced by causality orientation.

Enjoyment. Similar to psychological affect, it is anticipated that more enjoyment will be experienced following exercise when individuals are in an environment matched to their predominant orientation. Therefore, group 1 will show greater levels of enjoyment after each fortnightly block of exercise sessions than groups 2 and 3. Additionally, in group 1, enjoyment will increase over the 12 weeks of the intervention, while in groups 2 and 3, enjoyment will decrease.

Hypothesis 3: Contextual Responses

As stated in hypothesis two, levels of autonomy will only be increased when individuals are in an autonomy supportive environment or when events are interpreted in an informational rather than controlling manner (Deci and Ryan, 1985a). Therefore, the following hypotheses were formulated based on this rationale.

Causality Orientations Specific to Exercise. Over the 24 weeks, group 2 will show increases in levels of the autonomy orientation because they are exercising in an

autonomous environment. Group 1 will show no change in their pattern of causality orientations because of the predominance of the control orientation and because they are exercising in a controlling environment. Group 3 may show no change or an increase in the autonomy orientation during the first 12 weeks depending on whether the context of the situation or their predominant orientation is most influential in the interpretation of environment. In the following 12 weeks, levels of the autonomy orientation will increase because they will be exercising in an autonomous environment.

Behavioural Regulation for Exercise. In the first 12 weeks, the mix of the control orientation and the controlling influence of the controlling environment will result in an increase in the use of less self-determined forms of behavioural regulation (external and introjected) in group 1. The autonomy support provided in the autonomous environment will result in increased use of more self-determined forms of behavioural regulation (identified and intrinsic) in group 3. In group 2, levels of the more self-determined behavioural regulations will not change. The predominance of the autonomy orientation may protect levels from decreasing but the controlling environment will not be conducive to their levels being increased. These changes in self-determined regulation will result in the Relative Autonomy Index (RAI) increasing in group 3 and decreasing in group 1 and being unchanged in group 2. In the following 12 weeks where individuals are exercising in an autonomous environment, the RAI and levels of intrinsic regulation and identified regulation will increase. Furthermore, RAI and the more self-determined forms of behavioural regulation will be greatest and levels of external regulation and introjected regulation will be lowest in the autonomy oriented individuals of group 3 and those control oriented individuals in group 2 who have had a longer exposure to an autonomous environment.

Locus of Causality. In the first 12 weeks, group 2 will have a more internal perceived locus of causality than groups 1 and 3 because of the autonomy supportive nature of the autonomous exercise environment. In the following 12 weeks when all individuals are exercising in an autonomous environment, group 1 will show a more internal perceived locus of causality. However, groups 2 and 3 will have a more internal perceived locus of causality than group 1.

Contextual Intrinsic Motivation. Similarly to situational intrinsic motivation, only the autonomous environment will promote increases in intrinsic motivation. Therefore, group 2, who are exercising in an autonomous environment, will show greater levels of contextual intrinsic motivation after the first 12 weeks than groups 1 and 3 who are exercising in a controlling environment. In the following 12 weeks when all

participants are in an autonomous environment, intrinsic motivation will increase in all participants; however, groups 2 and 3 will show greater levels than group 1.

Contextual Perceived Competence. Similarly to situational perceived competence, providing individuals continue to exercise regularly, levels of contextual perceived competence will increase in all participants over the 24 weeks. This should not be influenced by causality orientation.

Hypothesis 4: Reciprocal relationship between situational and contextual intrinsic motivation. Vallerand (1997) states that repeated experience of intrinsic motivation at the situational level will have a bottom-up effect and translate to increases in intrinsic motivation at the contextual level. Additionally, levels of contextual motivation will have a top-down effect and influence the experience of intrinsic motivation at the situational level. Therefore, it is hypothesised that situational intrinsic motivation assessed at week six will be positively correlated with contextual motivation measured at week 12. Additionally, contextual intrinsic motivation measured at week six will be positively correlated with situational intrinsic motivation measured at week 12.

Methods

Participants

Participants responded to an advert that invited volunteers to take part in a study to investigate motivation to exercise. This advert was placed in the local newspaper (on two separate occasions, three months apart), was sent to all the University departments and was placed on noticeboards in the local hospital. Those who were interested in taking part were asked to phone or e-mail the researcher to get further details. Ninety-five individuals (14 men, 81 women) responded to the adverts and were asked about their current activity habits (to ensure that all participants had been sedentary for the last year). They were told that the study was investigating two different motivational programmes and that they would be randomly allocated to one of them. They were told that they would have to attend two separate sessions, an information session and an individual consultation, each lasting an hour, and descriptions of the content of the sessions were given. It was explained that they would see the researcher for five to ten minutes every fortnight for a period of 12 weeks and after those 12 weeks they would have another consultation. Finally, they were told that after 24 weeks they would have their last consultation.

Out of the 95 who responded, 64 (10 men, 54 women) attended an information session at which time they completed an informed consent form (Appendix 2B, p205) and a health questionnaire. Participants who were concerned about any illnesses or injuries they had were asked to consult with their GP before the consultation to check that there were no contraindications to them beginning to exercise. From those 64, 57 individuals (8 men, 49 women) attended the initial consultation. Four women were omitted from the study because they were already active. Therefore, 53 self-reported healthy individuals (8 men, 45 women) with a mean age of 42.39, $s = 9.88$ years volunteered to begin the study.

Instruments

Demographic questionnaire. This comprised questions asking for details of name, contact address, marital status, occupation, whether participants had children and where they had heard about the study.

Exercise diary. Participants were provided with an exercise diary in which they were asked to record the type of exercise, the intensity of the exercise they completed (including heart rate, RPE or both), the duration of exercise and the day on which the exercise was completed.

Ratings of Perceived Exertion. General, whole body ratings of perceived exertion were assessed using the Borg 6-20 Category Scale (Borg, 1970; Appendix 1C, p187) during the submaximal exercise tests. This served as a familiarisation and practice session (as recommended by Noble and Robertson, 1996) so that participants could use RPE to record in their exercise diary the intensity of each individual exercise session they participated in.

Leisure time physical activity. Weekly activity was also assessed using a modification of the Leisure Time Physical Activity questionnaire (LTPA; Appendix 1E, p190) devised by Godin and Shephard (1985). It is split into three categories to assess strenuous, moderate and mild exercise. Individuals indicate how often in a typical seven day period they exercise for longer than 15 minutes in each category by circling the appropriate number on a Likert scale ranging from 0 to 7+ times. A total weekly exercise score was calculated by multiplying the strenuous, moderate and mild scores by 9, 5 and 3 METS respectively and summing them.

Exercise Causality Orientations Scale. The Exercise Causality Orientations Scale (ECOS; Appendix 3E, p227) was used to measure causality orientations specific for exercise. It comprises 7 scenarios which address situations likely to arise in the exercise environment. These are followed by three responses which correspond to the three subscales of the ECOS: autonomy, controlling and impersonal. Individuals indicate the extent to which each response would be characteristic of them in that particular situation on a 7 point Likert-type scale labelled 'very unlikely' (1) through, 'moderately likely' (4) to, 'very likely' (7). In order to assess levels of each orientation, the responses corresponding to each orientation were summed. The psychometric properties of the ECOS have been demonstrated in Chapter 4.

Behavioural Regulation for Exercise. The Behavioural Regulation In Exercise Questionnaire (BREQ; Appendix 1G, p193) developed by Mullan *et al.*, (1997) assessed levels of self-determination for exercise. It comprises four subscales: extrinsic regulation (EXT), introjected regulation (IJ), identified regulation (ID) and intrinsic regulation (IM), which range from non self-determined to complete self-determination. Individuals responded on a four point Likert-type scale with verbal anchors reading, 'not true for me' (0) through 'sometimes true for me' (2) to 'very true for me' (4). Instructions given to participants followed those used by Mullan *et al.* (1997). The BREQ was scored by compiling separate subscale scores and by computing the relative autonomy index (RAI). The RAI was computed by applying a weighting of -2, -1, +1 and +2 to EXT, IJ, ID and IM respectively and then summing the products. Acceptable reliability and discriminant validity were found for the subscales as well as overall factorial validity of the scale (Mullan *et al.*, 1997).

Locus of Causality for Exercise. The Locus of Causality for Exercise Scale (LCE; Appendix, 1H, p194) developed by Markland and Hardy (1997) assessed locus of causality for exercise. Participants indicated on a 7 point Likert-type scale labelled 'strongly agree' (1) and 'strongly disagree' (7), the extent to which each of three statements was characteristic of them. High scores indicate a more internal locus of causality. Support for the scales factorial validity has been found (Markland and Hardy, 1997).

Perceived Expectations Scales. This three item scale measured perceived expectations about being involved in the study (Appendix 1K, p197). Participants responded on a 7

point Likert-type scale labelled, not at all (1) and very much (7), the extent to which they believed being involved in the study would help improve their level of fitness, their health and help them to exercise regularly. These scales were used previously by Markland (1993).

Perceived Outcomes Scales. The items used in the perceived expectations scale were reworded to form the perceived outcome scales which assessed the degree to which participant's believed that being involved in the study had improved their fitness, their health and helped them to exercise regularly (Appendix 1K, p197). Again, participants responded on a 7 point Likert-type scale.

Experimenter Effects Scales. This comprised a set of 8 items which assessed participant's opinions of the researcher's delivery of the information session and consultations and of the quality of the written information given to them (Appendix 1J, p196). Participants responded on a 6 point Likert-type scale labelled, strongly disagree (1) and strongly agree (6). These items were a modification of those used by Markland (1993).

Subjective Exercise Experiences Scale. The Subjective Exercise Experiences Scale (SEES; Appendix 1A, p185) developed by McAuley and Courneya (1994) measured psychological affect. It comprises three subscales: positive well being (PWB), psychological distress (PD) and fatigue, which take into account physical, cognitive and affective states felt during exercise. Participants responded on a 7 point Likert-type scale labelled, 'not at all' (1), 'moderately so' (4) and 'very much so' (7). Instructions to participants followed those used by McAuley and Courneya with the substitution of 'before exercise' for 'after exercise' at the appropriate time of administering the scale. The scale's factorial, convergent and discriminant validity have been confirmed (McAuley and Courneya, 1994). Lox and Rudolph (1994) also found support for its factorial and external validity and internal consistency.

Intrinsic Motivation Inventory. A modification of the interest/enjoyment and perceived competence subscales of the 18 item Intrinsic Motivation Inventory (IMI: McAuley *et al.*, 1989; McAuley *et al.*, 1991) were used as indicators of intrinsic motivation and perceived competence respectively. These subscales were used in two ways. Firstly, they were modified so that the items would relate to any exercise session in order to

measure situational intrinsic motivation and perceived competence (Appendix 1M, p199). Secondly, the items were modified to relate to exercise in general rather than a specific exercise session to measure contextual intrinsic motivation and perceived competence (Appendix 1M, p199). In both cases participants responded on a 7 point Likert-type scale with verbal anchors reading, 'strongly disagree' (1) and 'strongly agree' (7). For the situational IMI, participants were asked to consider the exercise session they had just completed. For the general IMI, participants were asked to consider their involvement in exercise. These subscales have adequate internal consistency and good construct validity (McAuley *et al.*, 1991).

Physical Activity Enjoyment Scale. The Physical Activity Enjoyment Scale (PACES; Appendix 1N, p201) developed by Kendzierski and DeCarlo (1991) measured enjoyment of specific exercise sessions. This comprises 18 items in which participants respond to each bipolar item on a 7 point scale. Participants were asked to rate how they felt at the moment about the physical activity they had been doing in the last two weeks. The scale has been found to have acceptable internal consistency, validity and reliability (Kendzierski and DeCarlo, 1991).

Semi-Structured Interview. After the first 12 weeks of the study, participants were asked a series of questions regarding their involvement in the study using a semi-structured interview (Appendix 4B, p234). Participants were asked general questions about exercise which incorporated how their feelings about exercise had changed over the 12 weeks, things that had interfered with them being able to exercise, what would have helped them do more exercise and reasons for wanting to begin and continue to exercise. They were also asked to choose one from the following three statements: I feel I, 1)have to exercise, 2)should exercise or 3)want to exercise. Participants were also asked about specific aspects of being involved in the exercise programme. These included the aspects that they had enjoyed and did not like as much, how they had felt about keeping the exercise diary, how they had felt about either being told what to do all the time or being left to structure their own exercise programme (depending on which group they were allocated to), how their pattern of exercise was affected by meeting the researcher every fortnight, and finally if they had stuck to the goals that were set at the beginning of the 12 weeks (if goals had been set). The interviews were tape-recorded and transcribed later.

Procedure

This study employed a between subjects mixed model design. All participants attended an information session, three individual consultations (at 0, 12 and 24 weeks) and met with the researcher for five to 10 minutes every fortnight for the first 12 weeks. Participants were stratified by age, sex and predominant causality orientation and were then randomly allocated to one of four groups. Group 1 comprised predominately control oriented individuals placed in a controlling environment. Group 2 comprised predominately control oriented individuals placed in an autonomous environment. Group 3 comprised predominately autonomy oriented individuals placed in a controlling environment. Group 4 were the control group.

Participants were classified as being predominately autonomy, control or impersonally oriented based on their responses to the ECOS. A mean score was calculated for each of the subscales and an overall mean and standard deviation for all items was calculated. A z-score for each subscale was calculated based on each individual's overall mean and standard deviation. The subscale which had the largest z-score was designated as their predominant orientation. Participants who responded to the first advert were assigned to one of three groups. Those classified as being predominately control oriented (n = 18) were grouped into pairs by age and sex. One from each pair was randomly assigned to the controlling environment (group 1) while the other was assigned to the autonomous environment (group 2). Those who were classified as being impersonally oriented (n = 5) were treated as control oriented as this was their next predominant orientation. Those who were classified as being predominately autonomy oriented (n = 17) were assigned to the controlling environment (group 3). Those who were recruited from the second advert (7 autonomy oriented, 4 control oriented and 1 impersonally oriented) were placed into the control group (group 4). This procedure resulted in there being 12 participants in group 1, 12 in group 2, 17 in group 3 and 12 in group 4.

Information session. After the initial telephone or email contact, interested parties were invited to attend an information session. Six information sessions were conducted. The purpose of the session was to give participants more detailed information about the study, what would be expected of them and to give them some information about how to exercise safely and effectively.

Participants were told that the purpose of the study was to compare two motivational treatments to encourage exercise participation and that they would be randomly assigned to one of the motivational intervention groups. It was explained that once they had attended the information session they would have to schedule a time to meet with the researcher individually to discuss exercise, complete some basic fitness measurements and to fill out some questionnaires. Then for 12 weeks they would meet with the researcher, at a time convenient to them, for five to 10 minutes every fortnight. Finally, it was explained that after 12 weeks and again after 24 weeks they would be invited back to the lab to complete the fitness measures again and fill out more questionnaires.

The content of the session was designed to increase participant's knowledge about exercise. It covered the differences between physical activity, exercise and active living, the physiological and psychological benefits that can be obtained from exercise, the three facets of fitness (stamina, strength and suppleness), the four principles of training (progressive overload, specificity, adaptation and reversibility) and how to achieve overload. The current American College of Sports Medicine (ASCM; 1998) exercise guidelines for improving fitness and for general health were explained as well as the recommendations for weight loss. The dose response effect was explained and it was emphasised that moderate intensity exercise was effective for increasing fitness. Information on how to calculate age-related maximum heart rate (HR max) and heart rates corresponding to specific percentages of that HR max was covered. Individuals were encouraged to calculate their own HR max and were given a graph of the heart rates that corresponded to particular percentages of HR max. How to measure and regulate exercise intensity physiologically by monitoring pulse rate at the wrist was explained and participants were given practice by assessing their resting heart rate. The RPE scale was also discussed as a psychological way of monitoring and regulating exercise intensity. Information was given about how to structure an exercise session that was devoted to increasing fitness including the principles and importance of performing a warm up and cool down. The benefits of strength and flexibility training and the guidelines that should be followed to increase strength and flexibility were also discussed. Lastly, some general psychological strategies that could be used to motivate individuals to keep exercising were described.

The session was concluded by the participants filling out an informed consent form, a health questionnaire, the demographics questionnaire, the LTPA questionnaire and the ECOS. Each person scheduled a time to attend the individual consultation.

Week 0 Consultation. The consultation took place in the physiology laboratory. The consultation began with a discussion about exercise and was specific to the group each individual had been allocated to. All participants were given a copy of the RPE scale with values representative of moderate intensity indicated, a schedule of fitness class times for the local sports centre (if they had expressed an interest in attending these classes) and two leaflets from the Health Education Authority, 'Getting active, feeling fit' and 'Are you getting enough?'. They were also given a flexibility programme (Appendix 5A, p235) and a toning exercise programme (Appendix 5B, p240). The flexibility programme consisted of a series of flexibility exercises for the back, sides, neck, shoulders, arms, chest, hips, legs and whole body modified from Alter (1988; 1996) and The National Coaching Foundation Introductory Study Pack 2 – The Body in Action (1992). This handout gave information about the proper procedure for warming up and cooling down before completing the stretches, how long each stretch should be held, how many times each stretch should be completed and finally, how often the programme should be completed in order to improve flexibility. Diagrams were given to show the proper procedure for completing the stretches. The toning exercise programme consisted of a series of muscle strengthening exercises, not using weight training equipment. Exercises were given for abdominals, back, legs, arms/chest and hip/buttocks. The handout gave step by step instructions and illustrations on how to complete each exercise and how many times each exercise should be completed. Details were also given on how to make each exercise harder or easier so that they could be tailored to individual strength. Their age related HR max and the range of exercising heart rates which constituted moderate intensity were calculated. This discussion concluded with participants being given the exercise diary and the information they were required to record was explained. A convenient time and place was scheduled for the fortnightly meeting to take place and participants were given the SEES, situational IMI and PACES to complete after the last exercise session of the fortnight. This part of the consultation lasted around 15 to 20 minutes. The fitness assessment was then completed and was followed by the completion of questionnaires.

Controlling Consultation. The focus of the consultation was to impart as much of a controlling influence as possible over the participants in groups 1 and 3 within the confines of ethical considerations. They were told that the purpose of the consultation was to give them an exercise programme that they should try to follow and it was emphasised that to stay motivated it was important to concentrate on what they wanted to achieve, e.g., how fit they will get if they continue to exercise or how many calories they are burning whilst exercising. Deci *et al.* (1994) state that if a statement makes use of the words, 'should', 'must' or 'have to' then the functional significance of the statement will be controlling. Understanding of the information session was checked before information was gained about their reasons for wanting to begin to exercise and the time they had available to fit exercise in. A programme of exercise was prescribed based around what individuals wanted to achieve and what activities they enjoyed. During every consultation moderate intensity exercise was prescribed. The programme included what days the participant would exercise, what type of exercise they would do and what intensity and duration the exercise session would take and these were set as goals for the participant to achieve. It was repeatedly emphasised that it was important to have a target number of exercise sessions to attain each week and to achieve the goals that were set. Any problems they thought might arise to prevent them exercising and ways of overcoming them were discussed. Finally, psychological strategies that could be employed to help participants stay motivated were discussed. Participants were told that keeping the exercise diary was an important part of the project so that the researcher could get an idea about how much exercise participants were doing.

Autonomous consultation. This consultation was intended to be a collaborative discussion about behaviour change (becoming active) and was based around some of the principles of motivational interviewing and the client-centred approach to consultations as described by Rollnick *et al.* (1999). Certain factors were taken into account throughout the consultation. An emphasis was placed on personal choice and control at all times in order to build an environment that respected the autonomy of the individuals and put the control of their exercise session in their own hands. Simple advice giving was avoided unless the participant specifically asked for it, in which case information was exchanged neutrally and within a client-centred framework. Participants were encouraged to express any concerns they had about behaviour change and generate their own ways of overcoming those concerns. It was explained that the researcher was not there to tell them what to do or to prescribe a programme of exercise that they must

stick to, but that the purpose of the consultation was to talk about exercise and how they thought they could fit a programme of exercise into their life and to discuss any concerns they might have about it. A series of open questions were formulated to gain information from participants relating to: understanding of the information session, reasons for wanting to join the study, outcomes they wanted to achieve from exercising, what exercise they enjoyed doing and situations that might interfere with them exercising. This led onto an exploration into their perceptions of confidence about taking up exercise as suggested by Rollnick *et al.* (1999) and of their thoughts on goal setting. Participants were encouraged to set their own goals if they felt this would be beneficial and to think about resetting them every fortnight if they found them to be useful. Throughout the consultation emphasis was placed on the enjoyment to be gained from exercise rather than achieving an outcome. Finally, participants were told that keeping the exercise diary was just something that the researcher needed for the project and that participants were not being judged or evaluated by anything they put into it. This was to try to reduce the controlling influence that the diary may have been perceived to have.

Control Group Consultation. Participants in group 4 were told that the purpose of the consultation was to give out some more information to help them exercise, for them to complete the fitness tests and fill out some questionnaires. Participants were given the RPE scale, flexibility and toning exercise programmes, fitness class schedule (if desired) and the Health Education Authority leaflets. It was emphasised that keeping the exercise diary was just something the researcher needed for the study. Participants in group 4 differed from those in groups 1 to 3 because they were not given a one to one consultation to develop an exercise programme. Every attempt was made not to impart a controlling or autonomous influence, they were simply given advice about exercise.

Fitness assessment. The procedure for the fitness assessment was the same at pre-test, 12 weeks and 24 weeks. Participant's age, height, weight, body fat percentage and resting heart rate was recorded. Body fat percentage was assessed using the Body Stat 1500 machine, which measures body fat using bioelectrical impedance analysis from electrodes placed on the wrist and ankle. Resting heart rate was measured when the participants were lying supine using a Cateye PL-6000 heart rate monitor. The sensor was attached to the participant's ear lobe and the receiver was held by the researcher. In order to familiarise participants with the SEES, it was completed before undertaking the

submaximal exercise test on a Powerjog 'G' series running machine. The procedures for the submaximal exercise test were explained and the heart rate monitor was fitted again. Before they began, participants were asked if they had been on a treadmill before and those who had not were given extra time to become familiar with the equipment. After a 4 minute warm up at a slow walking pace, participants walked briskly for 4 minutes and then briskly on a gradient for 4 minutes. These speeds and gradients were chosen to elicit heart rates of around 90, 110 and 140 beats per minute without the participants having to run on the treadmill. Heart rate was measured every minute and the steady state reading at 4 minutes was used in the prediction of VO_{2max}. RPE was taken at the end of each stage by participants pointing to a rating on the scale held out to them. Once the test was finished participants were given time to warm down for a duration of their own choosing and then asked to complete the SEES questionnaire again. The speed/gradient and heart rate values from each stage were entered into a regression analysis using SPSS. The age related HR max value was used to predict VO_{2max}. Seven participants completed all submaximal exercise tests on a Monarch cycle. This was a result of the treadmill being out of use when the initial consultation was first scheduled or due to injury preventing participants walking briskly.

Questionnaire Completion. Participants completed a batch of questionnaires. At 0, 6, 12 and 24 weeks participants completed: the ECOS, BREQ, contextual interest/enjoyment and perceived competence subscales of the IMI and the LCE scale. In addition, at pre-test they also completed the Perceived Expectations Scales, at week 12 the Experimenter Effect Scales and at week 24 the Perceived Outcomes Scales. Perkins and Epstein (1988) state that within exercise adherence research it is important that both intervention and control groups are equivalent with respect to non-specific aspects of the exercise intervention such as experimenter attention and expectations of success. This is to ensure that any effects of the intervention can be attributed to the treatment. The perceived expectations scales were developed to ensure that all groups had the same expectations about their involvement in the study. The experimenter effect scales were developed to ensure that there was no experimenter bias and that all groups were treated in the same manner.

Fortnightly meetings. These meetings took place either at the University or at the participant's workplace or home. One participant in group 2 and two from group 4 were not able to meet the researcher face to face because of transport problems. These

fortnightly meetings were conducted over the telephone and questionnaires were sent and returned by mail. The researcher recorded the type of exercise, intensity and duration of exercise the participant had written in their diary for the previous fortnight and checked that no exercise sessions had been missed out. Participants also completed the LTPA questionnaire. Completed SEES, situational IMI and PACES questionnaires were collected and blank questionnaires were given out. Participants in group 1 and 3 (controlling environment) were given feedback on the amount of exercise they had done in relation to their goals and it was emphasised again that it was important to stick to the goals they had been set to achieve what they set out to achieve. Participants in group 2 were simply asked if they had any questions about exercise, no feedback or comments were made about their exercise involvement. For those participants in group 4, no additional comments were made other than to collect the diary information. Once the data had been collected, a time and place was scheduled for the next meeting in a fortnight.

Week 12 Consultation. At the end of 12 weeks, all participants were asked to come back to the laboratory for another consultation. Firstly, participants underwent a taped semi-structured interview as detailed previously. This interview lasted between 10 and 15 minutes and asked about participants' feelings towards aspects of being involved in the exercise programme and about exercise in general. The researcher then conducted another consultation, the content of which depended on which group participants had been assigned to. Afterwards, participants were told that the researcher would not be in contact with them for another 12 weeks. At that time they would be contacted to arrange a time for them to come back to the lab for the last time. A contact number was taken from each participant. This was followed by the fitness assessment and questionnaire completion.

Consultation for Groups 1 and 2. Participants were told that the purpose of the consultation was to go over how they felt they had been getting on over the last 12 weeks and to answer any questions they may have. Participants were asked about their confidence in continuing to exercise over the next 12 weeks and the importance they attached to exercise as described by Rollnick *et al.* (1999). They were also asked if they knew how to structure their own exercise programme and if they could forsee any barriers to them being able to continue to exercise in the next 12 weeks.

Consultation for Group 3. The purpose of this consultation was to switch participants who are predominately autonomy oriented from being in a controlling environment to being in an environment which supported their autonomy. It was explained that previously the researcher had been quite prescriptive in how many times participants should have been exercising, what type of exercise they should have been doing, at what intensity and of the importance of sticking to that programme. It was then explained that the researcher was now keen to move the focus away from prescribing an exercise programme that they should try to follow, towards participants taking control over their own exercise regimen and exercising when and how they wanted to. Participants were asked about their confidence in being able to continue to exercise regularly and the importance that they attached to exercise, if they knew how to structure their own exercise programme and of any barriers they could foresee interfering with exercise. Goal setting was then introduced as a good way to help people stay motivated, although it was stated that setting goals is an individual preference which some may find beneficial while others may not. Any decision as to whether or not goals would be set over the next 12 weeks was left entirely up to the individual. Throughout the consultation, emphasis was placed on the enjoyment to be gained from exercise where previously the emphasis of the consultation had been to focus on the external rewards to be gained from exercise.

Consultation for Group 4. Participants were told that the purpose of the consultation was to find out how they felt they had got on with exercise over the previous 12 weeks and to discuss ways in which they felt the researcher could help them to stay motivated to exercise. Participants were asked about their confidence in continuing to exercise over the next 12 weeks and the importance they attached to exercise as described by Rollnick *et al.* (1999). They were then given the opportunity to discuss with the researcher what would help them to stay motivated to exercise in the next 12 weeks. Participants were then asked about their thoughts on goal setting and any barriers they could forsee interfering with their exercise habits. The emphasis of the consultation was based around the participants' predominant causality orientation so that an atmosphere supportive of this orientation was developed.

Week 24 Consultation. Only groups 1-3 were followed for a further 12 weeks. The final consultation at week 24 was the same for these participants. Participants were asked to give an account of the exercise they had completed over the previous two

weeks, including the type of exercise, the intensity and duration. A diary was provided to aid their memory. Participants were encouraged to think about each day individually and to record all activity undertaken. They also completed the LTPA questionnaire. Following this, participants underwent the fitness assessment and then completed the final batch of questionnaires.

Drop-outs. Throughout the duration of the study two male and 14 female participants dropped out of the study. There were four from group 1, two from group 2, seven from group 3 and three from group 4. A questionnaire was sent to those participants who dropped out of the study to find out their reasons for withdrawal (see Appendix 1O, p202), 12 responses were received. Two participants were injured and one became ill which forced them to withdraw. Three participants indicated family problems prevented them from continuing. Six participants reported the main reason they could not continue was that they did not have the time to exercise or to attend the fortnightly meetings required of them. Three participants stated that they had not done any exercise. Interestingly, one participant from each of group 1, 2 and 3 stated they did not feel there was sufficient pressure put on them to exercise while another from group 3 felt there was too much pressure on them to exercise.

Debriefing. After the final consultation, participants were thanked for their participation and they were given a written summary of what the project was about. They were told that once the data had been analysed a presentation would be scheduled to inform them of the results of the study.

Statistical Analyses

All analyses of variances were conducted using SPSS 9.0, the analyses of covariances were conducted using SPSS 6.1. There were two independent variables: group (a between subjects factor) and time (a within subject, repeated measures factor). Despite the number of analyses that were conducted the alpha level was not reduced but remained at 0.05. The power of the study is low because of the number of participants in each group. Franks and Huck (1986) recommend that when the power of the study is low alpha should be increased. Leaving the alpha at 0.05 is a compromise between committing a type I error due to the number of analyses conducted and a type II error due to the low power of the study. It is argued that, given the exploratory nature of the study, it was more important to prevent a type II error than a type I so by leaving the

alpha level at 0.05 the type II error risk was reduced. Furthermore, the hypotheses for the study were set a priori providing further justification for using a P value of < 0.05.

The exercise behaviour data consisted of the total number of exercise sessions and minutes of exercise per fortnight, the LTPA measure of weekly activity (measured in METS) and the measures of est. VO_{2max} taken at pre-test and weeks 12 and 24. Each of these dependent variables were analysed using a two factor (group by time) mixed design analysis of variance (ANOVA). The motivational responses to the intervention included the BREQ, the interest/enjoyment and perceived competence subscales of the contextual IMI, LCE and ECOS. The LCE and each of the subscales of the BREQ (including the RAI), contextual IMI and ECOS were also analysed using a two factor (group by time) mixed design ANOVA with data from pre-test and weeks six, 12 and 24 being used in the analysis. The exercise behaviour data and the motivational responses data were subjected to two analyses. In the first instance data up to week 12 were analysed to compare the four groups. Secondly, the analysis was rerun to include week 24 which only included groups 1 to 3. The psychological responses to the last exercise session of each fortnight included the SEES, the interest/enjoyment and perceived competence subscales of the situational IMI and PACES. Each subscale of the SEES was analysed using a two factor (group by time) mixed design analysis of covariance (ANCOVA) with the pre-exercise levels of each subscale used as the covariate. The PACES and each of the subscales of the situational IMI were analysed using a two factor (group by time) mixed design ANOVA. To maximise participant numbers in the analysis the ANOVA only compared weeks two and 12. The perceived expectations scales, perceived outcomes scales and the experimenter effect scales were analysed using a multivariate analysis of variance (MANOVA) with the questionnaire items used as the dependent variables. Finally, a test of the reciprocal relationship between situational and contextual motivation (Vallerand, 1997) was completed using a cross-lagged correlation design using the week six and week 12 measures of the interest/enjoyment subscale of the situational and contextual IMI. In the ANOVA's, Greenhouse-Geisser epsilon corrections were used to adjust the degrees of freedom when the sphericity assumption was violated. Tukey post-hoc tests were used to identify where any significant differences lay.

Results

Descriptive characteristics of participants

The characteristics of the whole sample and of each group are shown in Table 10. There were 7 males and 45 females with an average age of 42.40, $s = 9.88$ years. The sample comprised low fit individuals. Participants' est. VO_{2max} was low (mean = 29.37, s = 7.85ml.kg^{-1}.min^{-1}) corresponding to the 35th percentile (ACSM, 1995). There were no differences in measures of age, resting heart rate, height, weight, body mass index, body fat percentage or est. VO_{2max} between the four groups. There were no significant differences in any of the measures between the original sample and the final sample which omitted the drop-outs. Additionally, there were no differences in any of the measures within each group between the original sample and the final sample.

Table 10. Mean total descriptive characteristics of the initial sample and the final sample once drop-outs were omitted and group characteristics of the final sample (standard deviations are in parentheses).

	Initial sample	Final sample	Final sample			
			Group 1	Group 2	Group 3	Group 4
Age (years)	42.40	42.78	41.50	39.20	42.10	48.67
	(9.88)	(10.74)	(8.72)	(8.16)	(11.28)	(13.32)
Resting Heart Rate	63.60	62.78	58.00	62.60	64.20	65.67
(bpm)	(8.76)	(8.60)	(5.50)	(10.36)	(6.70)	(10.01)
Height (m)	1.65	1.65	1.64	1.65	1.67	1.63
	(0.08)	(0.06)	(0.06)	(0.10)	(0.10)	(0.08)
Weight (kg)	76.72	75.37	80.78	74.25	69.84	77.96
	(14.50)	(14.26)	(14.28)	(14.18)	(9.01)	(18.51)
Body Mass Index	27.98	27.72	29.94	27.35	25.08	29.08
	(4.35)	(4.52)	(4.95)	(5.03)	(2.71)	(4.21)
Body Fat (%)	35.36	35.11	37.05	35.12	31.68	37.17
	(6.88)	(6.79)	(5.37)	(6.13)	(8.54)	(5.90)
VO_{2max}	30.51	29.37	28.96	31.68	27.37	29.43
(ml.kg^{-1}.min^{-1})	(7.47)	(7.85)	(6.96)	(8.35)	(7.18)	(9.52)

Causality Orientations

In order to verify that levels of autonomy and control differed within each group, a paired samples t-test was conducted between the z-scores of autonomy and control for each group once drop-outs from the study had been omitted. Additionally, to confirm that levels of autonomy and control were different between group 3 (predominately autonomy oriented individuals) and groups 1 and 2 (predominately control oriented individuals) a multivariate analysis of variance (MANOVA) was conducted on the full sample with the z-scores of the autonomy, control and impersonal orientations being

used as the dependent variables. The MANOVA was repeated on the final sample that omitted those participants who dropped out of the study.

Group1. The t-test was significant ($t = 3.271$, $df = 7$, $P < 0.05$) showing that levels of the control orientation were greater than levels of the autonomy orientation.
Group 2. The t-test was not significant ($t = 1.252$, $df = 9$, $P = 0.24$) showing that there was no difference between levels of the control and autonomy orientations.
Group 3. The t-test was significant ($t = -5.745$, $df = 10$, $P < 0.0001$) showing that levels of the autonomy orientation were greater than levels of the control orientation.
Group 4. The t-test was not significant ($t = -1.157$, $df = 8$, $P = 0.281$) showing that there was no difference between levels of the autonomy and control orientations.
The expected pattern of results occurred for groups 1, 3 and 4, but in group 2 there was no significant difference between the z-scores of autonomy and control. However when the absolute values for control and autonomy in group 2 were compared, levels of control were greater than levels of autonomy ($t = -2.246$, $df = 9$, $P < 0.05$). The mean absolute values and the z-scores for each group on each subscale are shown in Table 11.

Group comparisons. The full sample MANOVA was significant (Hotelling's $T = 0.985$, $F_{2,6} = 7.718$, $P < 0.001$) as was the final sample MANOVA which omitted the drop outs (Hotelling's $T = 0.942$, $F_{2,6} = 4.712$, $P < 0.001$). Tukey post-hoc analysis showed that for both the full sample and the final sample the levels of autonomy were lower in groups 1 and 2 compared to group 3. Levels of control were greater in groups 1 and 2 compared to group 3. In the full sample levels of control were also greater in group 4 than group 3. Levels of the impersonal orientation were not significantly different between the groups in the full or final samples. These results confirm that groups 1 and 2 have lower levels of autonomy and higher levels of control than group 3.

Table 11. Mean z-scores and absolute levels of the autonomy, control and impersonal orientations at pre-test in the final sample once drop-outs were omitted (standard deviations are in parentheses).

	Group 1		Group 2		Group 3		Group 4	
	Actual score	z-score	Actual score	z-score	Actual score	z-score	Actual score	z-score
Autonomy	29.46	*0.093[3]	**27.73	-0.203[3]	*32.60	-0.984	35.17	-0.575
	(1.23)	(0.65)	(1.23)	(0.51)	(1.06)	(0.16)	(1.18)	(0.66)
Control	33.55	-0.847[3]	30.64	-0.612[3]	26.33	0.182	32.25	-0.276
	(1.38)	(0.19)	(1.38)	(0.66)	(1.19)	(0.49)	(1.32)	(0.31)
Impersonal	20.91	0.794	20.55	0.815	22.00	0.802	17.33	0.851
	(2.15)	(0.53)	(2.15)	(0.57)	(1.84)	(0.35)	(2.06)	(0.67)

*Note: For the actual values scores can range from 7-49. The number in superscript denotes the group to which the z-score is significantly different at P<0.05. * = z-scores of the control and autonomy orientation within each group are significantly different at P < 0.05. ** = actual scores of the autonomy and control orientations are significantly difference at P < 0.05.*

Preliminary Analyses: Perceived expectations and experimenter effect scales

The MANOVA (Hotelling's T^2 test) for the perceived expectations scales was not significant (Hotelling's $T^2 = 0.09$, $F_{9,45} = .438$, $P = 0.912$) showing that expectations about the study were not different in the 4 groups. Cronbach's alpha for the three items was 0.843. The MANOVA for the experimenter effect scales was not significant (Hotelling's $T^2 = 1.548$, $F_{8,26} = 1.591$, $P = 0.07$). Cronbach's alpha for the 7 items was 0.90.

Hypothesis 1: Exercise Behaviour

Number of Exercise Sessions. There was a significant main effect for time ($F_{4.13, 136.29} = 21.111$, $\varepsilon = 0.688$, $P < 0.001$) when the 4 groups were compared over the intervention. Tukey post-hoc analysis showed that participants exercised significantly more times every fortnight over the duration of the intervention than they had before joining the study. There was no group main effect or interaction recorded showing that all 4 groups (including the control group) were exercising at the same level. When week 24 was taken into account, there was a significant time ($F_{3,66} = 11.272$, $P < 0.001$) main effect. Post-hoc analysis revealed that participants were exercising significantly more often at weeks six, 12 and 24 than they had before joining the study (see Figure 10). This indicated that groups 1-3 had maintained their levels of exercise in the 12 weeks following the intervention.

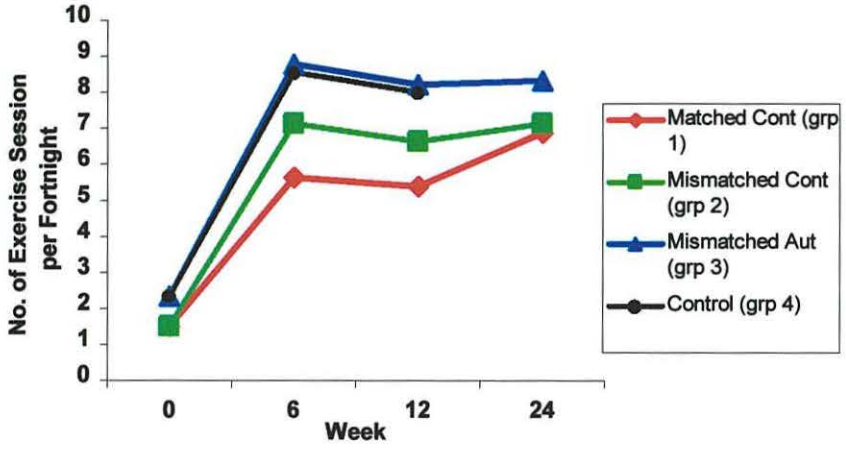

Figure 10. The number of exercise session completed each fortnight before the study and at weeks 6, 12 and 24 of the intervention. The analysis resulted in a time main effect.

Number of minutes spent exercising. There were no significant differences in the number of minutes spent exercising each fortnight during the 12 weeks or at 24 weeks.

LTPA questionnaire (METS). There was a significant main effect for time when the four groups were compared over the intervention ($F_{3,84} = 46.694$, $P < 0.001$) and also when week 24 was added ($F_{4,84} = 26.913$, $P < 0.001$). Post-hoc analysis showed that more METS were expended at weeks 2, 6, 12 and 24 compared to before participants began the study.

Changes in est. $VO_{2\,max}$. Although the est. $VO_{2\,max}$ values increased from pre-test to week 12 this increase was not significant ($F_{1,26} = 2.961$, $P = 0.1$). Mean values are shown in Table 12.

Table 12. Mean est. $VO_{2\,max}$ ($ml.kg^{-1}.min^{-1}$) values at pre-test and weeks 12 and 24 (standard deviations are in parentheses).

	Pre-test		12 weeks		24 weeks	
Group 1	29.32	(7.56)	32.68	(6.35)	29.47	(7.72)
Group 2	31.68	(8.35)	33.04	(7.75)	33.14	(5.94)
Group 3	27.37	(7.18)	30.66	(4.35)	27.62	(6.55)
Group 4	29.43	(9.52)	31.62	(8.45)	-	

Body Composition. There were significant time main effects for weight ($F_{1,24} = 46.669$, $P < 0.001$) and body fat percentage ($F_{1,24} = 28.554$, $P < 0.001$) when the four groups were compared over the intervention. Post-hoc analysis showed both weight and body

fat percentage decreased from pre-test to week 12. These effects remained when week 24 was added and there was also a group main effect for body fat percentage ($F_{1,18} = 4.912$, $P < 0.05$). It was revealed that weight and body fat decreased from pre-test to week 12 and increased from week 12 to week 24. Additionally, group 1 had a greater body fat percentage than group 3.

On the whole, the exercise behaviour data consistently shows that the exercise interventions resulted in individuals doing more exercise throughout the intervention than they had done before beginning the study. Additionally, these levels of exercise were being maintained 12 weeks after the intervention finished.

Hypothesis 2: Situational Responses to Exercise

Only weeks 2 and 12 were included in the analysis to maximise participant numbers in the ANOVA.

Affective Response. Table 13 shows the mean and standard deviations for each subscale of the SEES at weeks 2 and 12.

Table 13. Mean values for the SEES subscales at weeks 2 and 12 of the intervention (standard deviations are in parentheses).

SEES		Week 2		Week 12	
Positive well-being					
	Group 1	19.50	(3.02)	20.17	(3.55)
	Group 2	17.88	(3.14)	19.75	(4.62)
	Group 3	20.00	(3.46)	22.89	(2.89)
	Group 4	20.00	(4.08)	18.75	(1.71)
Psychological Distress					
	Group 1	7.50	(3.89)	6.17	(2.14)
	Group 2	6.38	(3.50)	7.50	(5.35)
	Group 3	5.11	(2.42)	4.56	(1.33)
	Group 4	5.25	(1.89)	5.50	(1.92)
Fatigue					
	Group 1	9.50	(4.81)	10.00	(3.90)
	Group 2	14.25	(3.66)	11.00	(4.37)
	Group 3	11.44	(6.71)	11.11	(6.09)
	Group 4	12.00	(3.37)	11.00	(4.16)

PWB. The ANCOVA found a group by time interaction that approached significance ($F_{3,22} = 2.63$, $P < 0.08$). Post-hoc analysis indicated that at week 12, group 1 had lower levels of PWB (20.17) than group 3 (22.89) and higher levels than group 4 (18.75), and group 3 had higher levels of PWB than group 4. At week 2 there had been

no differences between these groups. Additionally, at week 2 group 1 had higher levels of PWB (19.5) than group 2 (17.88) but at week 12 this difference had disappeared (20.17 and 19.75 respectively). The time by group interaction is shown in Figure 11.

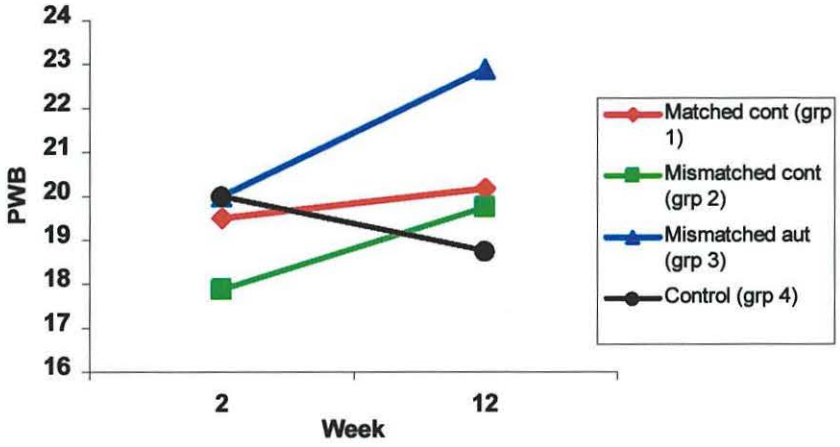

Figure 11. The interaction between time and group with respect to PWB measured at weeks 2 and 12.

PD. No significant effects were recorded for psychological distress.

Fat. No significant effects were recorded for fatigue.

Situational Intrinsic Motivation Inventory

Interest/Enjoyment. The ANOVA resulted in a significant time by group interaction ($F_{3,24} = 4.147$, $P < 0.05$). Post-hoc analysis revealed that at week 12, group 4 had lower levels of interest/enjoyment than groups 1, 2 and 3, and group 2 had higher interest/enjoyment than group 1 but lower interest/enjoyment than group 3. At week 2 there had been no differences between these groups (see Figure 12).

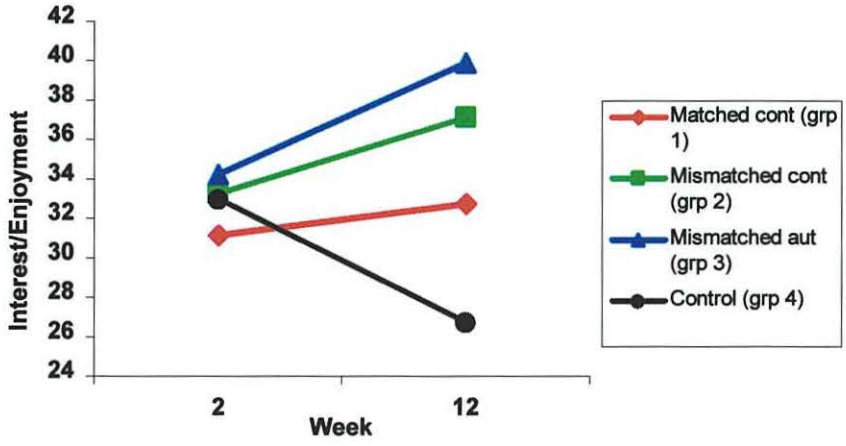

Figure 12. The interaction between time and group with respect to interest/enjoyment measured at weeks 2 and 12.

Perceived Competence. There was a significant time main effect ($F_{1,37} = 19.474$, $P < 0.001$). Post-hoc analysis revealed that levels of perceived competence were greater at week 12 than at week 2.

PACES. The ANOVA found a significant time main effect ($F_{1,24} = 5.942$, $P < 0.05$). Post-hoc analysis showed that enjoyment was greater at week 12 than at week 2.

Hypothesis 3: Contextual Responses to the Exercise Intervention

Two sets of analyses were conducted on these data. The first incorporated data from pre-test and weeks 6 and 12 and included all 4 groups. The second incorporated pre-test and weeks 6, 12 and 24 and included only groups 1, 2 and 3 (group 4 were only followed for 12 weeks).

Exercise Causality Orientation Scale

Autonomy. There were significant time ($F_{2,58} = 17.911$, $P < 0.001$) and group ($F_{3,29} = 5.322$, $P < 0.01$) main effects when levels of autonomy were compared in the four groups over the intervention. Tukey post-hoc analysis revealed that levels of autonomy were greater at weeks 6 and 12 compared to pre-test and that groups 1 and 2 had lower levels of autonomy than group 3. These time ($F_{3,63} = 17.139$, $P < 0.001$) and group ($F_{2,21} = 8.053$, $P < 0.01$) main effects remained when week 24 was included in the analysis. Post-hoc analysis showed that levels of autonomy at weeks 6, 12 and 24 were significantly greater than at pre-test and groups 1 and 2 had significantly lower levels of autonomy than group 3 (see Figure 13).

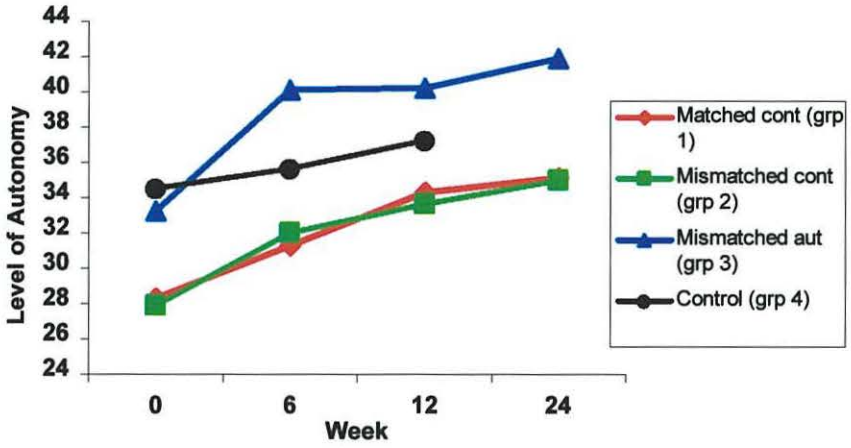

Figure 13. Levels of the autonomy orientation at pre-test and weeks 6, 12 and 24. The analysis resulted in a time main effect.

Control. There were no significant effects recorded for levels of the control orientation.

Impersonal. There were no significant effects recorded for levels of the impersonal orientation.

Relationship between exercise behaviour and levels of autonomy and control. A Pearsons correlation was conducted between each of the causality orientations and exercise behaviour (number of exercise sessions completed). Exercise behaviour was positively related to levels of the autonomy orientation ($r = 0.284$, $P < 0.01$). There was no relationship between exercise behaviour and levels of the control or impersonal orientations.

Behavioural Regulation in Exercise Questionnaire

External Regulation. There were no significant effects recorded.

Introjected Regulation. There was a significant time main effect when all four groups were compared ($F_{2,58} = 5.867$, $P < 0.01$) and when week 24 was taken into account ($F_{3,63} = 3.427$, $P < 0.05$). Tukey post-hoc analysis revealed that the use of introjected regulation was greater at week 6 than at pre-test.

Identified Regulation. There was a significant time main effect when all four groups were compared ($F_{2,58} = 4.930$, $P < 0.05$) and when week 24 was taken into account ($F_{3,63} = 4.509$, $P < 0.01$). Post-hoc analysis showed that the use of identified regulation was greater at week 12 and 24 than at pre-test.

Intrinsic Regulation. There was a significant time main effect when all four groups were compared ($F_{2,56} = 11.165$, $P < 0.001$) and when week 24 was included ($F_{3,63} = 6.449$, $P < 0.001$). Tukey post-hoc analysis showed that over the 4 groups there was significantly greater use of intrinsic regulation at weeks 6 and 12 than at pre-test and at week 12 than at week 6. Over groups 1-3, levels of intrinsic regulation were greater at weeks 12 and 24 than at pre-test (see Figure 14).

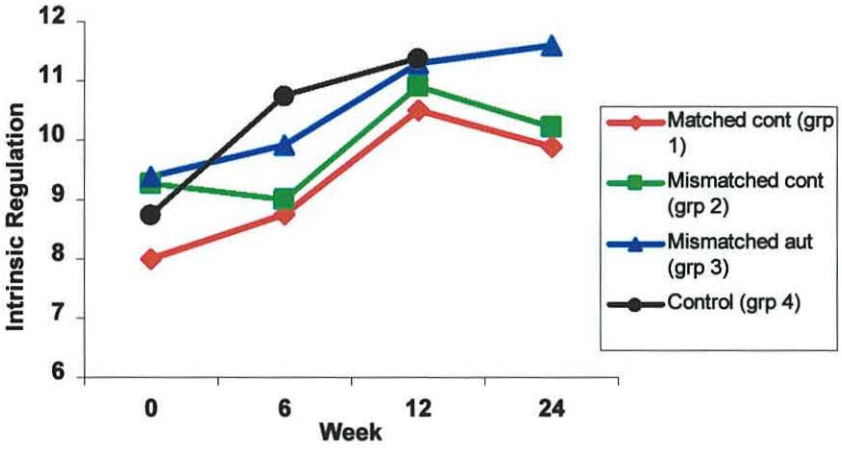

Figure 14. Levels of intrinsic regulation at pre-test and weeks 6, 12 and 24. The analysis resulted in a time main effect.

Relative Autonomy Index (RAI). There was a significant time main effect when weeks 0, 6,12 and 24 were compared ($F_{2.05,49.17} = 4.52$, $\varepsilon = 0.683$, $P < 0.05$). Tukey post-hoc analysis revealed that RAI was significantly greater at week 24 than at week 6 (see Figure 15).

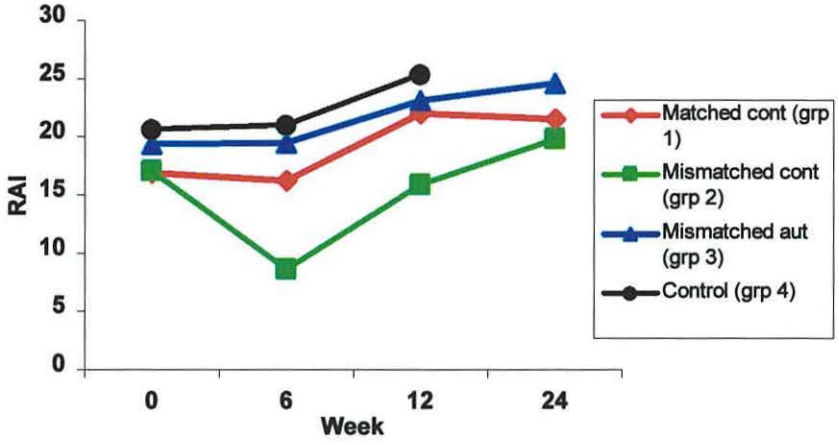

Figure 15. RAI at pre-test and weeks 6, 12 and 24.
The analysis resulted in a time main effect.

Locus of Causality. There was a significant time main effect when all 4 groups were compared ($F_{2,58} = 9.675$, $P < 0.001$) and when week 24 was included ($F_{3,63} = 4.881$, $P < 0.01$). Tukey post-hoc analysis revealed that locus of causality was more internal at week 12 compared to pre-test and week 6 and was more internal at week 24 than week 6.

Contextual Intrinsic Motivation Inventory.

Interest/enjoyment. There was a significant time main effect when all 4 groups were compared ($F_{2,54} = 12.429$, $P < 0.0001$) and when week 24 was included ($F_{3,60} = 7.329$, $P < 0.0001$). Tukey post-hoc analysis revealed that over the 4 groups interest/enjoyment increased from pre-test to week 12 and from week 6 to week 12. Over groups 1-3 interest/enjoyment was greater at week 12 and 24 compared to pre-test (see Figure 16).

Perceived Competence. There was a significant time main effect when all 4 groups were compared ($F_{2,52} = 28.634$, $P < 0.0001$) and when week 24 was included ($F_{3,60} = 14.200$, $P < 0.0001$). Tukey post-hoc analysis showed that over the 4 groups perceived competence increased from pre-test to week 6 and from week 6 to week 12. Over groups 1-3 perceived competence was higher at weeks 6, 12 and 24 compared to pre-test (see Figure 17).

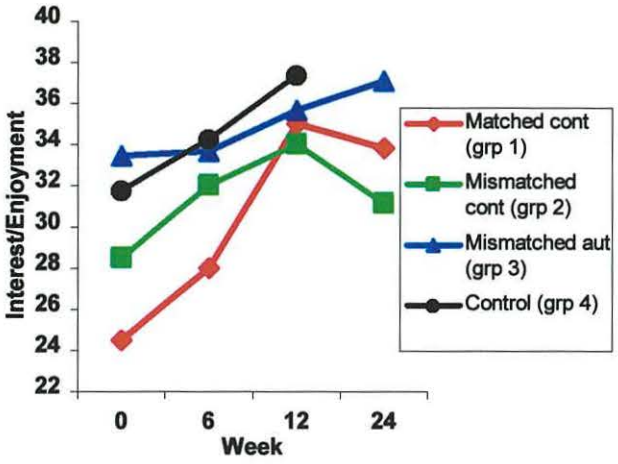

Figure 16. Levels of interest/enjoyment at pre-test and weeks 6, 12 and 24. The analysis resulted in a time main effect

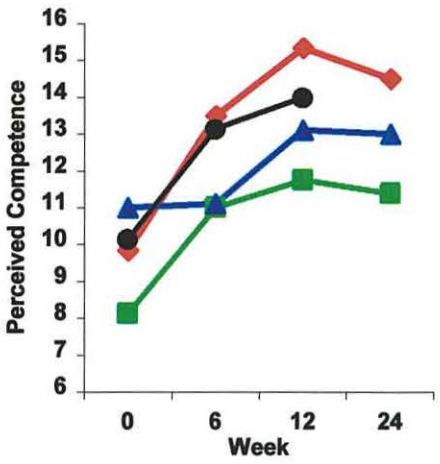

Figure 17. Levels of perceived competence at pre-test and weeks 6, 12 and 24. The analysis resulted in a time main effect.

Perceived Outcomes. The mean scores for the perceived outcomes scales are shown in Table 13. The MANOVA which compared the perceived outcomes of the study between the 4 groups was not significant (Hotelling's $T^2 = 0.040$, $F_{9,.96} = 0.139$, $P = 0.998$). All 4 groups perceived the outcomes to be the same. It can be seen that all participants perceived that being involved in the study had increased their fitness, benefited their health and helped them to exercise regularly.

Table 14. Mean scores for the perceived outcome scales (standard deviations are in parentheses)

	Group 1	Group 2	Group 3	Group 4
Improve fitness	6.00	5.78	5.80	5.56
	(0.41)	(0.39)	(0.37)	(0.39)
Improve health	5.50	5.11	5.30	4.89
	(0.45)	(0.42)	(0.40)	(0.42)
Exercise regularly	6.13	6.00	5.90	5.89
	(0.43)	(0.40)	(0.38)	(0.40)

Note the subscales range from 0 to 7.

Hypothesis 4: A test of the reciprocal relationship between contextual and situational intrinsic motivation. A cross-lagged correlational analysis was carried out to investigate whether there was a reciprocal relationship between situational and contextual intrinsic motivation measured at weeks 6 and 12 as Vallerand (1997) proposed (see Figure 18). It can be seen that there is a significant positive correlation between contextual intrinsic

motivation assessed at weeks 6 and 12 but not for situational intrinsic motivation. There is also a significant correlation between situational and contextual intrinsic motivation at week 6 but not at week 12. More importantly, there was a significant correlation between contextual intrinsic motivation at week 6 and situational intrinsic motivation at week 12 but not between situational intrinsic motivation at week 6 and contextual intrinsic motivation at week 12. This provides support for the top-down influence of contextual motivation on situational motivation but not the bottom-up effect of situational motivation on contextual.

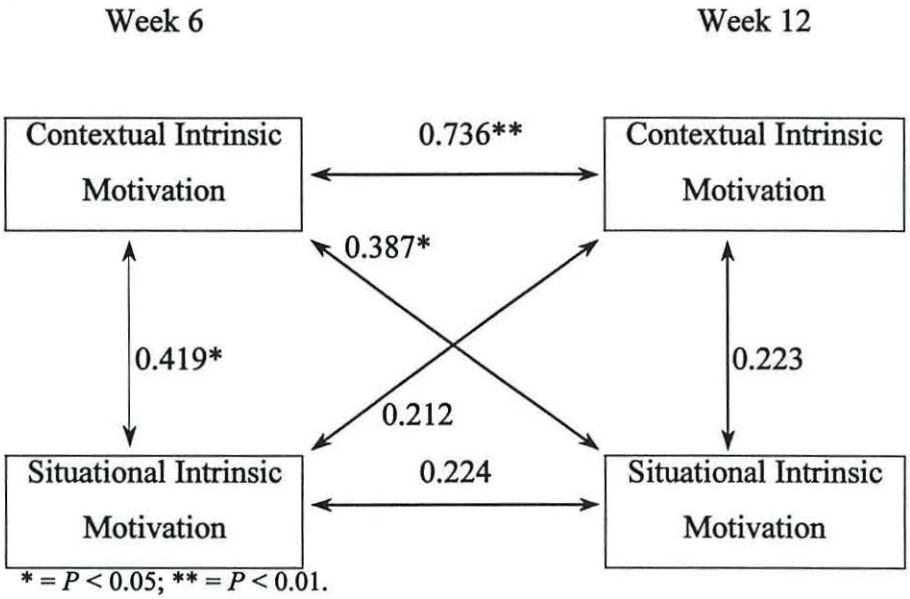

Figure 18. Cross-lagged correlations for situational and contextual intrinsic motivation during weeks 6 and 12.

Semi-Structured Interview

The interview was structured around 13 basic questions with any emerging themes explored using further questioning. The analysis of the qualitative data is not undertaken using any theory driven methodology and is not intended to be a thorough content analysis. These data are to be used to provide support for the conclusions drawn from the quantitative data.

Involvement in the exercise programme

When participants were asked "What aspects of being involved in the exercise programme have you enjoyed?" five main themes emerged. These were enjoyment from the actual exercise (21 participants), the health, fitness and weight loss benefits they felt (14 participants), the motivation from simply being involved in the study (17

participants), having regular contact with the researcher (10 participants) and more generally, the structure that the study gave to their exercise regimen (seven participants). When the responses from each group were compared there were not many differences. All reported reasons of enjoyment and made some reference to the features of the study, either having contact with the researcher (groups 1 and 4), being involved in the study (groups 2, 3 and 4) or the structure the study gave (groups 3 and 4). Participants in all groups, with the exception of group 2, made reference to the extrinsic benefits gained from the exercise.

When asked, "What aspects of being involved in the study have you not enjoyed?" only 14 participants felt there was something they had not enjoyed. These included: a feeling of having to exercise when they did not feel like it (seven participants) or because they had to for the project (three participants), the time commitment required of the project (two participants), exercise becoming repetitive (two participants), embarrassment at not having done any exercise (one participant), having set their goal too high and not having achieved it (one participant) and finally, getting sweaty during the exercise (one participant). There were no differences in the responses given by the different groups.

Changes in feelings towards exercise

Participants were asked, "How have your feelings about exercise changed over the 12 weeks, were there any times when you have enjoyed exercising more or when it has been more of a struggle?" Responses to this were varied. The main responses regarding a change in feelings included: began to enjoy it (eight participants) and noticed the physical and mental benefits resulting from it (11 participants). Individual responses included: a change in attitude about what exercise actually is, being more receptive to exercise, now wanting to exercise rather than putting it off, finding the time to exercise was easier than it was thought to be, wanting to increase the intensity of the exercise after a while and it becoming part of a routine, a habit. Three participants reported that they found exercise more enjoyable at the beginning than the end, while five participants reported it to be more enjoyable at the end than the beginning. Two participants reported that they enjoyed exercising more with a friend and one person stated that it had been easier to fit in exercise at the beginning when it was a novelty but it got more difficult at the end. One participant reported not enjoying the exercise but feeling at 12 weeks that she could do it and that it is not a problem. With regards to when individuals found it a struggle to exercise, two participants noted that they

struggled to exercise in the beginning while four participants struggled more at the end. Other responses included: when they were ill or injured (three participants), when they did not enjoy the exercise they were doing (five participants), when other commitments interfered (eight participants) when the weather was bad (four participants) and when there was a break in their routine (four participants). There were no differences in the responses given by the different groups.

The exercise diary

When asked about their feelings towards keeping the exercise diary, responses can be categorised into those who kept it simply because it was a requirement of the study and those who felt it helped them. Fourteen participants reported that they kept it for me and 15 participants reported that they used it themselves, five participants reported both reasons. There were no major differences between the responses given by the different groups, the only observation was that those in group 3 (mismatched autonomous individuals) only reported keeping it for themselves. Comments made by participants included: it was no problem (13 participants), keeping the diary had helped (seven participants), it was a good idea (four participants), felt that they had achieved something (three participants), it was a bit of a chore (five participants), was embarrassed when there was nothing in it (one participant) and gave you a little prod if there was nothing in it (one participant). There were no differences in the responses given by the different groups.

Things that interfered with exercise

The major barriers to exercise were mainly centred on time commitments. These were due to commitments of family (15 participants), work (14 participants), social life (six participants) and holidays (two participants). Other barriers included: injury (three participants), illness (three participants), household chores (two participants), tiredness (three participants), transport problems (one participant), the weather (three participants), laziness (three participants) and not putting exercise first (one participant). There were no differences within groups with respect to barriers to exercise.

The good things experienced from exercising

The good things that participants reported they gained from exercise can be split into physical and psychological aspects (there were no differences between the groups). The physical things included: increased fitness (8 participants), feeling invigorated/energised

(five participants), seeing changes with their body (five participants), feeling less fatigued (four participants), weight loss (two participants), feeling the health benefits (three participants) and reduced back pain (one participant). The psychological things experienced included: generally feeling better (eight participants), enjoyment (six participants), feeling like they had done something (four participants), a sense of achievement (six participants), increased self-esteem (one participant), meeting people (one participant), a feeling of how important exercise is (one participant) and distraction from everyday life (one participant).

Things that may have helped individuals to do more exercise

Participants were asked to identify what would have helped them to do more exercise. Main factors reported were: having more time (10 participants), exercising with someone (six participants), greater pressure being exerted by the researcher (two participants from group 1 and one from group 4), attending a structured class or a structured class organised by the researcher (three participants), better facilities (two participants) and a larger choice of activities (two participants). Other, individual, responses included: seeing results more quickly, having less stressful lives, having more money, more motivation, feeling less tired and a better climate. There were no differences in the responses given by the different groups.

Experience of assigned exercise environment

Participants in groups 1 and 3 were asked "How did you feel about being told how and when you should exercise?" All nine participants in group 1 indicated positive comments. They felt it was a help, that they needed to be told and that it provided them with good guidance and structure. From group 3, four participants indicated that it helped, two participants stated they were not happy and that they work better when they decide on their own and three participants stated there was not a problem being told the problem was actually doing it.

Participants in group 2 were asked, "How did you feel about being left to structure your own exercise regime?" Out of the eight participants who were interviewed, six were happy being left on their own and two felt they would have liked more input and to have felt more regimented to exercise.

Participants in group 4 were asked, "How did you feel about being given information about exercise and being left to structure your own exercise regimen?" Six participants reported that they were happy, one person commented that they would have felt under too much pressure otherwise and another stated it had given her more discipline this way. However, two individuals indicated a structured programme or a group exercise session with the researcher would have helped. Three participants stated that it was difficult and more structure would have been better.

Comparisons of the main reasons for exercising at the start and after 12 weeks

The reasons that were reported at the beginning of the study were mainly extrinsic. Weight loss (21 participants), fitness (16 participants), health (seven participants) and to feel better (three participants) featured most prominently with an additional reason being an awareness that they were not exercising (two participants). After 12 weeks, the most predominant reasons were still the same: fitness (20 participants), weight (16 participants) and health (10 participants). Additionally more intrinsic reasons were reported, three participants indicated exercising for enjoyment and three indicated exercising for the feel good factor. There were no differences in the responses given by the different groups.

Main impetus for exercise

Participants were asked "If I asked you to choose a statement about how you felt about exercise would you choose: I feel I have to exercise, should exercise or want to exercise?" There were no differences between the groups. All but three responses were split between individuals exercising because they felt they should (16 participants) and because they wanted to (19 participants).

Effect on exercise behaviour of having to meet the researcher every fortnight

Participants were asked, "What effect did having to meet with the researcher every fortnight have on your exercise behaviour?" Ten participants indicated that it had had no effect while the others indicated it had had some effect. The effect it had was to: help motivation (10 participants), make people exercise (seven participants), act as a reminder to exercise (two participants) and keep interest going (one participant). Individuals also commented that they felt that they would let the researcher down if they did not exercise (three participants), that it was good to be monitored (one

participant) and that it made you feel accountable for your actions (one participant). There were no observable differences between the groups.

Achievement of goals

Participants were asked, "Did you try to stick to the goals that had been set?" All those who had stated that they set goals expressed that they had tried to achieve them (23 participants), one participant from group 2 exercised when she wanted to rather than stick to the goals that were set. One individual expressed a preference not to set goals.

Discussion

The purpose of this study was to investigate the differences in exercise behaviour and psychological responses between a group of individuals whose exercise environment was structured to match their predominant causality orientation for exercise, two groups whose exercise environment was not matched to their predominant causality orientation and a control group who were provided only with an education component and a fitness assessment. The study comprised a 12 week intervention period and a follow up at 24 weeks (12 weeks post-intervention).

Exercise Behaviour

There was a significant increase in the amount of exercise that all participants engaged in over the 12 week intervention period from an average of 1.9 exercise sessions per fortnight before joining the study to 6.7 sessions. Additionally, the level of exercise achieved during the intervention was still being maintained at 24 weeks (7.44 sessions), 3 months after the intervention finished. However, the self-reported increase in exercise behaviour was not supported by an increase in est. VO_{2max}. This may suggest that the self-report diary data is unreliable. However, Cooke (1996) warns that predicted maximal oxygen uptake scores should be interpreted with extreme caution. Predicted max VO_2 values are generally within 10-20% of an individual's actual $VO_{2\,max}$ value (McArdle et al., 1994). If a maximal test had been performed then this error would have been reduced and a significant result may have been found.

The results did not support the hypothesis that providing a controlling environment to control oriented individuals would result in greater levels of exercise than providing an autonomous environment or that providing a controlling environment for autonomy oriented individuals would have a negative effect on exercise behaviour. All three

intervention groups and the control group reported the same increases in exercise during the intervention. This suggests that within this population of predominately autonomy and control oriented individuals, causality orientation and exercise environment did not interact to affect the adoption and maintenance of exercise behaviour. In fact, simply providing individuals with information about exercise and a fitness assessment and one to one contact once a fortnight (the control condition) has the same benefits as structuring individualised exercise programmes in both autonomy and control oriented individuals. Previous research has shown that simply providing information about exercise to increase knowledge does not increase participation in exercise (Biddle and Mutrie, 1991). Indeed, Dunn (1996) reported that few exercise scientists believe that the number of individuals participating in exercise can be increased by education alone. However, this study has shown that giving information about exercise and providing fortnightly support will lead to prolonged increased participation. It is likely that the structure provided by the fortnightly support is the crucial difference (Robison and Rogers, 1994). Whether the control group would continue to participate when the fortnightly support was removed was not investigated.

The most positive outcome of the study was that exercise behaviour was being maintained at week 24 and provides support for this type of intervention as a medium to promote maintenance of an exercise programme. Marcus *et al.* (2000) concluded that frequent contact with individuals seems to be important during the maintenance phase of interventions but to what extent this contact needs to occur and when contact is no longer necessary is not known. These results suggest that fortnightly contact is sufficient in the short term and will promote adherence for a further 12 weeks without requiring further contact. Longer term effects greater than 6 months were not investigated.

Methodological Issues

There are certain features of the treatment conditions that should be taken into account when interpreting these findings. Every effort was made to ensure that there was no controlling influence imparted on the control group and group two (those placed in the autonomous exercise environment). However, it emerged during the semi-structured interview that simply being involved in the study became a controlling influence. Individuals from all four groups reported that they felt they had to exercise and felt that

they would have let the researcher down if they had not, although they all reported this to be a good feature of being involved.

> 'I like the fact that I had to do it because I had committed to you to do it, I wouldn't have done it otherwise.' (Individual from group 2)

> 'Seeing you in two weeks time, that's made me think, oh I've got to do it.' (Individual from group 3)

> 'If I had been left alone I wouldn't have bothered but knowing that I'd got to answer to you at the end of the time that made me do it and forced me to do it and its been a very good thing.' (Individual from group 4)

The nature of the study meant that to ensure the information recorded in the diary was accurate and to provide an additional controlling influence on those in groups 1 and 3, participants had to meet with the researcher every fortnight. This may have imparted external pressure to exercise on those participants in groups 2 and 4 even though the meetings were conducted in an autonomous fashion with no direct controlling feedback being given. From the semi-structured interview results, it can be seen that some individuals did extract control from these meetings.

> 'It's encouraged me to do it because I know there is someone keeping an eye on me.' (Individual from group 2)

> 'I think just knowing that I am going to be talking to you and you are going to be looking at my diary once a fortnight spurs me on.' (Individual from group 4)

In future studies, this influence may be reduced by conducting the fortnightly meetings over the telephone or by someone else, other than the researcher, conducting the meetings.

Keeping the exercise diary was a very salient aspect of the study and may also have become a controlling influence in itself. Self-monitoring of exercise behaviour has been

shown to stimulate observation, evaluation and the regulation of behaviour within individuals and has been regarded as a factor which might influence the promotion of maintenance of exercise (Martin and Dubbert, 1985; Noland, 1989). Efforts were made to reduce this controlling influence to participants in groups 2 and 4 by explaining that it was not being used to monitor or judge the individuals. However, half the participants from groups 2 and 4 indicated that they had found it useful to keep them motivated.

> 'Because I was keeping the diary I felt I had to stick to the programme.' (Individual from group 2)

> 'It was probably quite helpful because it meant another psychological way to encourage you to actually do something. If you didn't do anything, apart from not getting any exercise, there was a blank space in your diary so it was another little tiny prod if you like to sort of get up and do something.' (Individual from group 4)

It is difficult to know how this influence may be reduced or avoided because the diary method of recording exercise behaviour has been recognised as a better method of assessment of exercise behaviour than retrospective questionnaires (Perkins and Epstein, 1988). Self-report questionnaires do not show the same level of validity, indeed the correlation between the LTPA and the exercise diary data, although significant, was only 0.38.

One other aspect which should be acknowledged is that during the information session and the consultations to groups 1 to 3, the importance of setting goals was emphasised and all participants reported having an extrinsic goal such as weight loss or increasing fitness as a motive for joining the study. Goal setting is acknowledged as a powerful way of motivating behaviour (Hardy *et al.*, 1996) and Rothman (2000) suggests that when behaviour change is motivated by a desire to achieve a specific goal it should be easier to initiate behaviour. It may be that having set these goals individuals were exercising to achieve them regardless of whether they were in a matched or mismatched environment and this was one of the predominant reasons for adherence to exercise. This may also explain why the control group achieved the same level of exercise as the intervention groups. During the semi-structured interview the majority of individuals reported trying to stick to the goals that had been set.

During the intervention period it may be interpreted that it was the contact with the researcher and keeping the exercise diary that brought about the change in exercise behaviour because there was no difference between the control group and the intervention groups. However, this does not seem to support self-determination theory (SDT: Deci and Ryan, 1985a) which suggests that the presence of a surveillant or evaluator can be detrimental to self-determination and intrinsic motivation (Deci and Ryan, 1987) and so will be unfavourable to maintenance of exercise behaviour. Carron *et al.* (1996) reported a small negative effect of powerful others on adherence behaviour. Perhaps 12 weeks is not long enough for this influence to have a negative impact. In the 12 week period following the intervention, participants did not have contact with the researcher nor have to keep an exercise diary, this should have produced a more autonomous environment for exercising. Therefore, these controlling non-specific treatment effects are less likely to have influenced the maintenance of the new level of exercise from week 12 to 24 rather it was a feature of the intervention.

On reflection, whilst for groups 2 and 4 there may have been additional unwanted control generated by the diary and the fortnightly support, for groups 1 and 3 it may be that we were not successful in generating a controlling environment with enough control. In effect the environment and the experimenter may not have been perceived as providing a controlling, pressured influence instead may have been perceived as being autonomy supportive due to the structure, competence and feelings of relatedness that were generated. However, the level of autonomy support that was provided would still be less than that provided within the autonomous environment. In structuring the controlling consultation there was an awareness of certain ethical considerations such as undermining the individuals' freedom of choice and being overtly unpleasant to participants, and the consequent risk of incurring participant drop out. Therefore, the consultation was made as controlling as practically possible within the confines of these issues. In doing so more empathy and autonomy support was generated potentially confounding the development of a controlling environment.

Situational Responses

The purpose of measuring the psychological responses to exercise fortnightly throughout the intervention was to try to explain (at the situational level) any changes that may have occurred in exercise behaviour over the 12 weeks. The positive well-being (PWB) results showed that at week two the matched control oriented individuals

had higher levels of PWB than the mismatched control oriented individuals. This is not unexpected. It may be that the mismatched control oriented individuals were not receiving enough controlling information their orientation would suggest they require, which has led to reduced PWB. However, an increase in PWB in the mismatched group resulted in there being no difference between the groups at week 12. At this point the control group had less PWB than the matched control oriented individuals and the autonomy oriented individuals. Therefore, despite exercising at the same frequency and intensity as the intervention groups, the control group did not experience the same affective benefits. In fact, they showed the lowest levels of PWB (although actual levels were at the mid range of possible values). Finally, the autonomy oriented individuals showed greater PWB than the control oriented individuals when they were both in a controlling environment. Overall, these results suggest that being in a somewhat controlling environment will not promote PWB unless individuals are predominately autonomy oriented. However, an autonomous environment will still promote PWB in control oriented individuals. The fact that the control group showed the lowest levels of PWB suggests that providing personalised exercise programmes helps to promote PWB after each exercise session. Affective responses generated by exercise have been shown to influence adherence to exercise (King *et al.*, 1988) and it has been suggested that if exercise is regarded as a positive experience and positive affect results it is less likely individuals will give up participating (McAuley *et al.*, 1991; McAuley, 1994). Therefore, it seems that being autonomy oriented will result in the most positive affective responses and promoting PWB in control oriented individuals will be achieved by placing them in an autonomous environment. It is important to note that there was no significant decrease in PWB or increase in PD shown after each exercise session from week two to 12 in any of the conditions. Levels of PWB remained in the upper end of the range possible (20.7) and levels of PD remained in lower ranges (5.9). On a cautionary note this interaction for PWB was only approaching significance ($P < 0.08$) and conclusions should be interpreted tentatively.

Levels of intrinsic motivation experienced situationally after each exercise session were operationalised and measured by the interest/enjoyment subscale of the IMI. It was shown that all three intervention groups had higher levels of intrinsic motivation than the control group at week 12. Therefore, when a personalised exercise regimen is prescribed or developed in conjunction with the individual and structured around activities that individuals express a preference for, there is a greater level of intrinsic

motivation reported following each exercise session than when individuals are left to structure their own exercise regimen.

The matched control oriented individuals had less intrinsic motivation than the mismatched control and autonomy oriented individuals. These results support the hypotheses based on the theories of self-determination and causality orientations (Deci and Ryan, 1985a). It is understood that for intrinsic motivation to be developed the environment or situation must support the individual's self-determination and enhance perceptions of competence. The higher levels of intrinsic motivation in the mismatched control oriented individuals compared to the matched control oriented individuals can be attributed to the fact that the autonomous environment would foster self-determination and an increase in intrinsic motivation. The controlling environment however, will undermine self-determination and intrinsic motivation. This supports the proposals of SDT that to maximise intrinsic motivation, control oriented individuals should be placed in an autonomous environment. Nevertheless, the autonomy oriented individuals showed the greatest levels of intrinsic motivation despite being in a controlling environment. This suggests that having a predominance of the autonomy orientation protects the individual from losing intrinsic motivation in an environment that does not support self-determination. Deci and Ryan (1985) have commented that a strong autonomy orientation is particularly resilient and less susceptible to the loss of self-determination and intrinsic motivation in a controlling environment.

Self-determination theory states that an increase in perceived competence is required alongside self-determination to increase intrinsic motivation. Thus, the increase in situational perceived competence, reported during the intervention, will have contributed to the increase in intrinsic motivation. The exercise that was advocated to all participants throughout the intervention was of moderate intensity and the diary data showed that participants had exercised at an average RPE of 12 throughout the 12 weeks. Not only has this moderate intensity been shown to be more conducive to producing positive affective responses (e.g., Parfitt and Eston, 1995) but it could be anticipated that most sedentary individuals would be able to complete exercise of this intensity and as a result gain the positive feedback and increased perceptions of competence that result from success experiences (Bandura, 1977).

Levels of enjoyment recorded following exercise (using PACES) were greater at week 12 than at week two. This is a very positive outcome of the intervention because

enjoyment is one factor that has been shown to be important to exercise adherence (Wankel, 1993). Contrary to what was expected, providing individuals with a matched exercise environment did not influence levels of enjoyment any more than a mismatched environment.

Contextual responses

Psychological responses to the intervention were also measured at the contextual level, i.e., to exercise in general. The intervention resulted in levels of the autonomy orientation increasing in all participants from pre-test to weeks six, 12 and 24 including those who were placed in a somewhat controlling environment. Thus, the knowledge gained from the information session, from participating in regular exercise and by being supported throughout, meant that individuals felt more confident to motivate themselves. This is supported by the fact that during the 12 weeks that they were not being monitored participants maintained the same levels of exercise that they had during the intervention. As expected, the autonomy oriented individuals had greater levels of autonomy than both groups of control oriented individuals. It was anticipated that the mismatched control oriented individuals would show greater levels of the autonomy orientation than the matched control oriented individuals at week 12 because they had been exercising in an autonomy supportive environment. In fact, it was not expected that the matched control oriented individuals would increase in the autonomy orientation at all. This was not the case, both groups showed similar levels. SDT predicts that autonomy can only be increased in an autonomy supportive environment. The process of internalisation is theorised to occur only in an autonomy supportive environment (Deci and Ryan, 1985a; 1987). This may suggest that the controlling environment was in fact perceived as having a degree of autonomy support. This would account for the increased levels of the autonomy orientation in the control oriented individuals placed in the controlling environment. Interestingly, levels of the control orientation did not change over the intervention despite some individuals being placed in a somewhat controlling environment. These data may suggest that levels of the control orientation are stable over time but levels of the autonomy orientation are open to change. Alternatively, it may be that, as suggested, the exercise environment was not controlling enough to influence levels of control orientation and a more autocratic environment was required. This requirement for more control was identified by some participants during the interview when they were asked what would have helped them to do more exercise. Comments made included:

'Somebody a bit more stricter to say come on you've got to (exercise).' (Individual from group 1)

'If you had given me a row every two weeks because I hadn't done it, it might have spurred me on.....you needed to tell me every two weeks you're crap you're not doing enough.' (Individual from group 1)

It can be concluded that, in control oriented individuals, levels of autonomy will increase with regular exercise to the same extent when they exercise in environments which differ in levels of autonomy support. In autonomy oriented individuals levels of autonomy will increase even in a somewhat controlling environment. Importantly, it was found that levels of the autonomy orientation had a significant positive relationship with exercise behaviour whilst the control orientation showed no relationship. This further underscores the importance of increasing levels of the autonomy orientation and supports conclusions drawn by Biddle (1999) that autonomous regulation of behaviour plays an important role in the prediction of physical activity. The importance of the autonomous regulation with regards to behaviour change was shown by Williams *et al.* (1996). They found that more autonomous motivation for weight loss resulted in greater weight loss and maintenance of weight loss. Further, they showed autonomous motivation to be predicted by levels of general autonomy orientation and perceptions of the autonomy support provided by the interpersonal climate.

In the present study it was shown that being involved in the intervention resulted in greater use of more self-determined forms of behavioural regulation (introjected, identified and intrinsic) which is also shown as an increased RAI from week six to week 24. It has previously been discussed that the processes of internalisation and integration, which result in movement along the self-determination continuum, will only occur in an autonomy supportive environment. Therefore, these results may again suggest that the controlling environment was being perceived as having a degree of autonomy support and was not truly controlling. However, the results do show that by exercising on a regular basis individuals shift towards exercising because they value the benefits that it brings and because they enjoy it rather than because they feel external pressure to do so. This will occur in environments that vary in their degree of autonomy support. These results support previous research that shows an association between

regular exercise and more self-determined forms of behavioural regulation (Mullan *et al.*, 1997). Comments from the semi-structured interview support this conclusion.

> 'I've started seeing, you know, gaining something from it (exercise), I've got into a frame of mind now that I want to do it.' (Individual from group 1)

> 'I feel well and I've enjoyed, very much enjoyed exercising.' (Individual from group 3)

> 'I want to exercise and I feel I have to exercise because I am seeing the benefits.' (Individual from group 1)

Participants also reported having a more internal perceived locus of causality at weeks six, 12 and 24 compared to pre-test. This latter result indicates a shift from individual's having the perception of there being an external source responsible for the initiation of their behaviour to them perceiving themselves to be responsible. This suggests that the impact of the experimenter and being involved in the study was less of an influence at weeks six, 12 and 24 than it had been at the beginning of the study.

The intervention resulted in an increase in intrinsic motivation towards exercise in general. Levels at the end of the intervention period and at the 24 week follow-up were greater than at pre-test. These results lend support to the position that regular participation in exercise will result in increases in intrinsic motivation for exercise (Dishman, 1987; Wankel, 1993; Ingledew *et al.*, 1998; Li, 1999). However, unlike situational intrinsic motivation there were no differences between the groups. This may suggest that participation in exercise is the key to increased contextual intrinsic motivation and the environment and the individual's predominant causality orientation are not as important at the contextual level as they are at the situational. Similarly to situational intrinsic motivation, the growth in self-determination shown by increases in the autonomy orientation and RAI and the increases in perceived competence experienced throughout the intervention will have contributed to the increased intrinsic motivation (Deci and Ryan, 1985a).

Interestingly, although there were increases in situational and contextual intrinsic motivation, results of the cross-lagged correlations do not support Vallerand's (1997) proposals that repeated experience of intrinsic motivation at the situational level will have a bottom up effect on intrinsic motivation at the contextual level. This has been shown by Kowal and Fortier (2000) in a group of Master's level swimmers. Although there was a significant correlation between situational and contextual intrinsic motivation at week six, the correlation was not significant at week 12. More importantly, there was no significant correlation between situational intrinsic motivation at week six and contextual intrinsic motivation at week 12. Had this been significant it would have supported Vallerand's proposal. Perhaps a longer timespan of exposure to situational intrinsic motivation is required to influence contextual motivation. Vallerand (1997) does not stipulate a timeframe in which this occurs. There was support for the top-down effect of contextual motivation on situational motivation shown by the significant correlation between contextual intrinsic motivation at week six and situational intrinsic motivation at week 12. This implies that contextual motivation for exercise in general will influence the experience of intrinsic motivation following each specific exercise session. Support for this top-down effect has been found in previous studies conducted in the exercise environment (see Vallerand and Rousseau, 2000).

It has been shown that when individuals begin exercising extrinsic motives play a big role in motivating behaviour (Ingledew *et al.*, 1998). Rothman (2000) suggests that if individuals experience the outcomes they want and are satisfied with these outcomes then maintenance of behaviour is more likely to occur. The physiological data showed that fitness improved and weight and body fat percentage decreased from pre-test to week 12. However, from week 12 to 24 there was no change in fitness, and weight and body fat percentage increased back to pre-test levels. The perceived outcomes questionnaire (administered at week 24) showed that individuals had perceived their involvement in the programme to have improved their fitness, benefited their health and helped them to exercise regularly. This was supported by results of the semi-structured interview. Participants indicated a variety of physical and psychological benefits that they felt they had got out of exercising from increased fitness, weight loss and feeling less fatigued to generally feeling better and gaining a sense of achievement. Participants also reported that feeling these benefits was one thing they enjoyed about being involved in the study. Therefore, it seems that the perceptions of the benefits

being obtained were more positive (as shown by the responses to the perceived outcomes scales) than the actual physiological results which showed no increase in fitness nor any decrease in body mass from pre-test to week 24 (positive changes were only shown from pre-test to week 12). This perception that outcomes are being achieved is important given that it takes time for these benefits to occur and for some they may not be readily apparent in a physiological or psychological assessment, and are viewed as a positive aspect of the study.

Limitations of the research

The first things that must be discussed are the low participant numbers and the relatively high number of participants who dropped out. There were 53 participants to begin with and 16 dropped out. Given these low numbers, the power of the study was low and as a result statistical significance is more difficult to achieve. Therefore, the alpha level was raised to 0.1. On the positive side, the majority of results emerged at $P < 0.001$ or 0.01, thus we can be confident that they are not just a chance occurrence, however caution should be advised when interpreting those at $P < 0.1$ and 0.05. The responses obtained from the questionnaire sent to those participants who had dropped out showed that the main reason for withdrawing was a lack of time to meet with the researcher and to exercise. This is one of the most commonly cited barriers to exercise (Wankel, 1988). There were no differences in the reasons given for drop out between the groups. Perhaps in future studies, fortnightly contact could take place by telephone rather than face to face and this may alleviate some of the time commitments required of the participants and may prevent such a large drop out rate. Every effort was made to structure exercise programmes that participants felt were achievable and that could be fitted into a busy schedule. In some cases this had not happened.

The study attempted to structure two different exercise environments, one autonomous and one controlling. Whilst the direct comments made during the consultations and fortnightly meetings were consistent with simulating the different environments, the interpretation of those comments by the participants may have differed from that intended. This is especially relevant for the control oriented individuals in the autonomous environment. Deci and Ryan (1985a) state that control oriented individuals will search out opportunities to be controlled and may have interpreted comments made as being controlling when in fact they were not. Additionally, Deci and Ryan (1985a) state that autonomy oriented individuals will seek out the informational aspects of any

situation. It maybe that the autonomy oriented individuals in group 3 interpreted the controlling influence which was being imparted as being informational. Three participants from group 3 stated that they found the guidance that they were given was useful which may indicate that they interpreted the researchers comments as a guide to what they should be doing rather than as pressure to do it. It has previously been proposed that the controlling environment may not have been imparting enough control and that it was perceived as being autonomy supportive. Therefore, instead of structuring a controlling and an autonomous environment two environments were generated that varied in their degree of autonomy support.

A problem with most exercise intervention research is the self-selection bias. The individuals who respond to an advert asking for volunteers are inherently different and more motivated than those individuals who do not respond by virtue of the fact that they are making an effort to change their behaviour. However, because individuals cannot be forced to take part in exercise intervention studies this problem of self-selection cannot be overcome. This study focused on predominately autonomy and control oriented individuals because given the nature of impersonally oriented individuals it was thought unlikely that they would volunteer for the study. Only five participants were found to be predominately impersonally oriented. These individuals were treated as being control oriented as this was their next predominant orientation and there is known to be a positive correlation between the impersonal and control orientations (see Chapter 5). Despite this bias, the sample seems representative of the population who are likely to be targets of health promotion programmes to increase exercise behaviour and of those most likely to respond. Although the population was not totally sedentary at the outset, they had a low fitness level and they were not achieving the amount of exercise necessary to achieve fitness or health benefits. This population is known to be one that can achieve the most benefits by increasing their exercise habits (Pate, 1995). Additionally, the majority of participants were overweight and this is a population likely to benefit from increasing their exercise behaviour. Most participants were working full time and had family commitments meaning that they would not have much free time to devote to exercise. This again emphasises their increased motivation towards the study and also provides a stringent test of the motivational intervention to be able to increase participation in these individuals. Although caution should be taken in generalising the results to the whole population, especially those who are predominately impersonally oriented, in practical terms the results are likely to be very applicable.

It should be taken into account that this intervention took place between March and October when the promotion of exercise is likely to be easier due to better climate and lighter evenings. This was one of the reasons it was decided to implement the intervention at this time. Caspersen *et al.* (1985b) have reported that there are seasonal variations in exercise behaviour. Prevalence of activity drops from around 70% during the summer months to around 45% in the winter months. Therefore, the levels of activity achieved during the intervention and the maintenance of this behaviour may not have been so positive had the intervention taken place over the winter months.

At the outset it was highlighted that individuals will have a certain level of each of the three causality orientations and that individuals were being categorised according to their predominant orientation. There is no way of knowing how much the less prominent orientation affected their involvement in the study and their responses to the questionnaires. Indeed, this may explain why certain hypotheses were not met. Even though within each group scores on the two orientations were significantly different (except the control group), individuals from all four groups were high on both orientations. Future research should attempt to recruit individuals with greater disparities between their scores on the autonomy and control orientations and those who have show either very low or very high levels of each orientation.

In conclusion, despite the limitations of this research the exercise intervention produced a number of interesting results. Firstly, it resulted in an increase in the amount of exercise that individuals participated in during the intervention with this level of exercise being maintained 12 weeks post-intervention. At the situational level, to promote positive well-being and intrinsic motivation individuals either need to be autonomy oriented or be in an autonomy supportive exercise environment. At the contextual level, levels of the autonomy orientation were increased irrespective of the individual's causality orientation and exercise environment in which they exercised and was shown to predict exercise behaviour. Behavioural regulation became more self-determined. Together these results show that individuals felt more confident in being able to motivate themselves and began exercising because they wanted to and because of the importance of the outcome rather than because they felt they should or had to. The implications of these results and directions for future research will be discussed in Chapter 7.

CHAPTER 7

General Discussion

Summary

This series of studies set out to investigate the effect of self-determination and the individual differences that are present in motivational orientation on exercise behaviour and the affective and motivational responses to exercise. Its purpose was to provide an indication of the exercise environment that will encourage the most positive responses and may promote the adoption and maintenance of regular exercise in individuals with different motivational orientations. The theoretical basis for the programme of research was Deci and Ryan's (1985a) self-determination theory (SDT) and its sub-theories, cognitive evaluation theory (CET) and causality orientations theory (COT). These investigations took place at the situational level in response to an acute bout of exercise and at the contextual level to a programme of regular exercise (Vallerand, 1997).

The premise of the first study (Chapter 3) was that affective responses would be more positive and interest/enjoyment would be higher following a preferred intensity exercise session where self-determination was supported compared to a prescribed intensity exercise session where self-determination was limited. The results showed that increased perceptions of choice (increased self-determination) made no difference to the affective response or to interest/enjoyment following acute exercise. However, individuals chose to exercise at a higher intensity in the preferred intensity session and still reported the same affective response and RPE. It was suggested that individuals may naturally select an exercise intensity which results in high levels of PWB and low levels of PD and fatigue. Additional analysis led to two possible avenues of research. The effect of pre-exercise levels of affect, which had been shown to influence the affective response to exercise, and the effect that individual differences with respect to motivational orientation had on affective and motivational responses to exercise. These individual differences, explained in terms of causality orientations (Chapter 4), were shown to influence the intensity at which individuals chose to exercise and the affective and motivational responses that were reported following the two exercise sessions. Conclusions tentatively suggested that the preferred exercise environment was more beneficial for decreasing PD and fatigue in both control and autonomy oriented individuals. The investigation of the effect of causality orientations was the route chosen and the remainder of the thesis explored causality orientations in more detail.

The measurement of causality orientations was addressed in study two (Chapter 4). A measurement tool to assess causality orientations specific for exercise (the ECOS) was developed and was shown to be factorially valid and reliable. Furthermore, its concurrent validity was supported by the emergence of hypothesised relationships between its three subscales and the conceptually related constructs of general causality orientations, behavioural regulation and self-consciousness. However, some expected relationships did not emerge. It was concluded that the scale should be used empirically to further research into causality orientations and exercise, and in the exercise setting to investigate the interaction between causality orientations and the exercise environment on exercise behaviour and the psychological responses to regular exercise.

The final study (Chapter 6) combined these two uses of the ECOS in a six month field based intervention study investigating participation in exercise and the psychological responses to exercise. Comparisons were made between individuals who exercised in an environment supportive of their predominant causality orientation, individuals who exercised in an environment that did not support their predominant orientation and a control group given only an education component and a fitness assessment. It was concluded that providing an exercise environment that supported the individual's predominant causality orientation did not result in greater exercise behaviour over the twelve week intervention period or in the twelve weeks following the intervention than when the environment did not support the predominant orientation. All individuals achieved the same increase in exercise behaviour. However, differences did emerge in psychological responses. At the situational level, being autonomy oriented resulted in the greatest levels of intrinsic motivation and PWB. Furthermore, the autonomous environment promoted greater intrinsic motivation and PWB than the controlling environment for control oriented individuals. At the contextual level, it was shown that levels of the autonomy orientation were increased, more self-determined behavioural regulation was observed and levels of intrinsic motivation and perceived competence increased over the 24 weeks irrespective of the predominant causality orientation or the exercise environment. Levels of the autonomy orientation were shown to predict exercise behaviour whilst levels of the control orientation did not. Limitations of the research were discussed.

The specific implications and limitations of the first and second studies have been presented within their respective chapters. This final chapter seeks to combine these

conclusions with those of the third study. Additionally, the practical implications from the third study for the promotion of exercise behaviour and future research directions will be discussed.

Theoretical Implications

Deci and Ryan (1985a) state that individuals have an innate desire to experience self-determination, perceived competence and relatedness. The results of study one suggested that contrary to CET, not everyone had the same desire for self-determination. This was shown by many individuals stating a preference to exercise in the prescribed intensity condition where self-determination was limited. This provides support for the tenets of COT that there are individual differences with respect to the degree to which individuals want situations to support their autonomy. Koestner and Zuckerman (1994) have previously demonstrated this in an educational context.

Deci and Ryan (1985a) proposed within CET that situations that are autonomy supportive and provide experiences of success will result in increased feelings of self-determination and perceived competence (and relatedness) and concomitantly increased intrinsic motivation. Furthermore, these relationships will occur at three levels of generality, the situational, contextual and global levels (Vallerand, 1997). Therefore, the conditions that supported self-determination in studies one and three should have been accompanied by increased intrinsic motivation. The results from study one did not provide support for this proposal. At the situational level, the increased self-determination perceived during the preferred intensity exercise session did not translate into greater perceptions of interest/enjoyment (used to indicate intrinsic motivation). Additionally, there was a trend for control oriented individuals to show greater intrinsic motivation for the prescribed exercise session, a situation which should not support the promotion of intrinsic motivation. In contrast the results of study three did support SDT. They showed that at both the situational and contextual level, levels of self-determination and perceived competence increased during and following the intervention and this translated into increased intrinsic motivation.

The process of internalisation, described within OIT, which leads to individuals moving along the self-determination continuum from less self-determined forms of behavioural regulation to more self-determined forms of regulation is said to occur within an autonomy supportive environment (Deci and Ryan, 1985a; Ryan, 1995). Deci *et al.*

(1994) do state that some internalisation can occur within a controlling environment but that it will only result in introjected regulation. Conclusions drawn from study three suggest that a controlling environment may be just as likely to increase levels of autonomy and promote more self-determined forms of behavioural regulation as an autonomous environment. Although, it was suggested that the controlling environment generated within study three may not have provided enough control and was interpreted as being somewhat autonomy supportive. This may provide an explanation for this result.

An alternative explanation may be that participation in regular exercise, whatever the environment, brings with it more self-determined regulation and a greater inclination to motivate oneself in a more autonomous manner. Knowledge about exercise is a known determinant of exercise participation (Dishman *et al.*, 1985) and a lack of knowledge is frequently cited as a barrier to exercise (Willis and Campbell, 1992). A preference to be motivated by external means at the outset of an exercise programme may be a reflection of a lack of knowledge about what type of exercise to do or how much exercise to do. The information component and the structure provided in the intervention resulted in individuals feeling more confident that they knew how to exercise appropriately. In the qualitative interview (study three) many participants reported that having an exercise programme structured for them was good because without it they would not have known what they should be doing. Once individuals are exercising regularly, and experience the subsequent benefits, more self-determined forms of behavioural regulation may dominate to encourage further participation. From study three, it was shown that all participants experienced extrinsic benefits from exercising and found this to be a positive aspect of the intervention.

Deci and Ryan (1985a) and Vallerand (1997) suggest that the most positive affective, cognitive and behavioural consequences result from being intrinsically motivated or having more self-determined forms of behavioural regulation. Furthermore, these consequences exist at the three levels of generality. Empirical research in a variety of contexts supports these proposals (see Vallerand, 1997 and Vallerand and Rousseau, 2001 for reviews). This would suggest a more autonomy supportive environment should promote more positive responses. The results from study one showed that supporting the autonomy of the individual did not result in there being more positive affective or motivational responses to an acute bout of exercise. Although, the RPE

values reported following the preferred condition were similar to those of the less intensive prescribed condition indicating that there was a positive perception of the autonomy supportive condition. Results from study three more clearly support the proposals of SDT. At the situational level, greater levels of PWB resulted and intrinsic motivation was enhanced by regular exercise in an autonomous environment.

In marrying the tenets of COT with those of CET, it is suggested that only individuals who are autonomy oriented and who interpret situations in an informational manner can become intrinsically motivated, will display self-determined forms of behavioural regulation and gain the positive consequences associated with these states. Control oriented individuals are likely to extract a controlling influence from any environment. This is not conducive to enhancing self-determination. Conclusions from studies one and three provided mixed support for this theoretical position. As CET would predict, situationally a controlling environment did not promote PWB (study three) and in fact increased PD (study one) in control oriented individuals. However, contrary to COT, these individuals did increase in PWB (study three) and showed no decrement in PD (study one) when they exercised in an autonomous environment. Contextually, results do not support COT because control oriented individuals showed increases in the autonomy orientation, in self-determined forms of behavioural regulation and in intrinsic motivation irrespective of the environment in which they exercised (although the extent to which the environment was entirely controlling is open to question). COT is supported by results that showed that autonomy oriented individuals showed the greatest levels of PWB, situational intrinsic motivation and levels of autonomy. Therefore, it seems that it is only a controlling environment that is detrimental to affective responses. As long as control oriented individuals' exercise in an autonomy supportive environment, affective responses will be positive, this is consistent with SDT.

COT suggests that a strong autonomy orientation protects against a loss of self-determination and intrinsic motivation whilst in a controlling environment. The results of study three upheld this proposal, in fact, situational and contextual intrinsic motivation, PWB and levels of autonomy were increased. It also proposes that control oriented individuals will search for a controlling influence from any situation. Results suggest that this may not be the case within the context of exercise. If this had occurred, control oriented individuals placed in an autonomous environment would not

have been expected to show the increased autonomy, self-determination and intrinsic motivation they did. These conclusions may suggest that for control oriented individuals, it is the actual context and characteristics of the environment which predominate over the individual's orientation in the interpretation of the situation and not the orientation which plays the major role as suggested by Deci and Ryan (1985a; 1985b). Williams *et al.* (1996) also concluded this to be the case in their study of weight loss. They suggested that the perception of environmental autonomy support was of greater practical significance than the level of autonomy orientation to influence the autonomy of the individual and their subsequent persistence with the programme.

There is a disparity in the results between studies one and three with regards to situational intrinsic motivation. In study one, control oriented individuals showed a trend towards exhibiting more intrinsic motivation in the controlling condition. However in study three, the controlling environment did not promote intrinsic motivation in control oriented individuals. This contrast in results may be a reflection of the methods used to classify individuals as being autonomy and control oriented. In study one, individuals were asked which exercise session they preferred and as a result this gave a measure of their need or desire to operate within an autonomous or controlling environment. Therefore, the result showing that individuals reported more interest/enjoyment within that session is not unusual. In study three, individuals were classified on the basis of their causality orientation and this gave a measure of their disposition to perceive the environment in an autonomous or controlling manner. Therefore, the controlling environment would not be conducive to increasing intrinsic motivation as stated in SDT. These two methods are clearly assessing two different aspects of SDT and thus the disparity in results is not surprising.

It has been previously stated that the proposals of SDT will operate at the situational, contextual and global levels. Vallerand (1997) proposed that there is a reciprocal bottom-up and top-down relationship between motivation at each of the three levels. The relationship between the global and contextual levels was supported in study two by the emergence of positive correlations between the subscales of the GCOS and the ECOS. The results of study three provide only partial support for this relationship between the contextual and situational level. Support was provided for the top-down effect of contextual intrinsic motivation to situational intrinsic motivation. This has previously been demonstrated by Blanchard and Vallerand (1998, cited in Vallerand and

Rousseau, 2001) in a cross-sectional study. The results of study three provide support for a causal effect given the time lagged nature of the correlations. However, the bottom-up effect that has been reported previously (Kowal and Fortier, 2000) was not supported in study three. Vallerand (2001) recently suggested that the bottom-up effect of situational motivation on contextual motivation maybe influenced by situational affective responses, had this been taken into account support may have been found for the bottom-up relationship.

Situational and contextual motivation are specific states that are more open to be influenced and changed by environmental factors. Conclusions from study three suggest that the autonomy orientation may be more amenable to change than the control orientation which did not change over the intervention (although a more autocratic environment may give a different result). It should be reiterated that in study two, the autonomy and control orientations were shown to be orthogonal. Individuals do not lie on a continuum from control oriented to autonomy oriented, their levels on the autonomy and control orientations are independent and cannot be predicted from each other.

In conclusion, the results of this thesis provide mixed support for the proposals of SDT and whilst SDT has much to contribute to the study of motivation to exercise, they suggest that the three sub-theories of CET, OIT, and in particular, COT should be considered collectively and not in isolation.

Practical Implications

One of the purposes of this programme of research was to identify which exercise environment will produce the most positive affective responses and more self-determined forms of motivation and to investigate the effect that being predominately autonomy or control oriented would have on this relationship. This information can then be used to provide individualised exercise programmes that may help promote adoption of exercise and hopefully enhance adherence rates and prevent drop out. From the previous discussion of results, the following conclusions can be drawn.

From the tenets of SDT and the review of literature (chapter two) it was speculated that a preferred intensity regimen may lead to more positive affective responses to exercise as individuals would have greater perceptions of autonomy and would be likely to select

a moderate exercise intensity (see Dishman *et al.*, 1998; Eston *et al.*, 1999). Conclusions from study one suggest that we can be confident that in a one-off exercise session in a fit population, prescribing an exercise intensity will not be detrimental to affective state. Although, allowing an individual to select his/her own exercise intensity will result in him/her exercising at a high intensity that is more beneficial from a physiological perspective. Additionally, this higher intensity will be interpreted as positively as a lower intensity and will result in an equally positive affective state or the maintenance of an already positive state, depending on pre-exercise levels of affect. It should be remembered however, that due to the nature of the population in study one, these results cannot be generalised to a low fit, sedentary population. Research is ongoing to replicate this study using a sedentary population.

When causality orientation was taken into account, results from study one showed that the control orientation influenced the intensity at which individuals preferred to exercise. Therefore, when prescribing an exercise intensity it should be considered that control oriented individuals prefer to exercise at a moderate intensity while autonomy oriented individuals prefer to exercise at a high intensity. Conclusions from studies one and three show that causality orientations and the exercise environment interact to influence the affective response to both acute and chronic exercise. For both high and low fit control oriented individuals stimulating an autonomous environment will be the most beneficial for promoting PWB in the long term and reducing PD and fatigue in the short term. Although not specifically tested, it can be assumed that autonomy oriented individuals will also benefit from being in this environment. These results support the proposals of SDT, which suggest the most positive affective responses result from an autonomy supportive environment.

It can be speculated that these positive affective responses generated from the autonomous environment will provide individuals with a positive perception of exercise and this may encourage future participation (Rothman, 2000). Weiner (1986) and Vallerand (1987) discuss models of emotion which highlight the importance of appraisal processes in the generation of an emotion. They both suggest that the outcome of an activity, e.g., success or failure, will generate an initial emotion which is the main predictor of the emotional response following exercise (see Biddle *et al.*, 2001 for review). Subsequently, an appraisal of the activity or the attribution given for the outcome of the activity will augment the effect of the initial appraisal. Weiner (1986)

suggests that both these processes will influence subsequent behaviour. McAuley (1991) showed that greater frequency of exercise was associated with more internal, stable and personally controllable attributions. This suggests that if an individual perceives that they have had a good exercise session (e.g., they achieved their goal) then this will produce a positive emotional response (e.g., happiness). This will be followed by a strengthening of that response once the individual makes an attribution for that success. This affective response is likely to be more positive following an attribution to an internal, stable and personally controllable factor, such as effort (Forsterling, 1985). Subsequently, Weiner (1986) would suggest that future activity would be reinforced by this positive emotion leading to a repeat of that activity. From a practical perspective, this highlights the importance of structuring the exercise environment in such a way that perceptions of success are experienced so that the initial emotional response is positive. Additionally, promoting the autonomy of the individual will make it more likely that attributions will be made to personally controllable factors.

The conclusions drawn by many researchers (Boothby *et al.*, 1981; Dishman, 1987; Frederick and Ryan, 1993; Wankel, 1993; Ingledew *et al.*, 1997; Ryan *et al.*, 1997; Biddle, 1999) would suggest intrinsic motivation was crucial to the long term maintenance of exercise. However, the motivational benefits of extrinsic motivation, especially in the adoption of exercise should not be ignored. Qualitative data from study three also showed that individuals had multiple reasons for engaging in exercise. Both intrinsic and extrinsic sources of motivation were reported. The extrinsic benefits that are gained from exercise are always apparent to the individual and are continually being reinforced and contribute to the cognitive evaluation of the exercise session. Although the results from study three showed that contextual and situational intrinsic motivation increased over the duration of the study, it could be suggested that the increases in levels of autonomy and the use of more self-determined forms of behavioural regulation also observed during the study are of more practical significance to adherence to exercise. Chatzisarantis and Biddle (1998) suggest that exercising because of the value that individuals attach to the benefits of exercise (identified regulation) is the main reason individuals report for exercising. This form of behavioural regulation has been termed the threshold of autonomy (Whitehead, 1993). The provision of an environment which supports autonomy is an easier and more controllable task for the exercise consultant and will take into account the multiple

surface motives individuals may have for exercise without relying on motivation from intrinsic means.

Although it has been acknowledged that the concept of autonomy is important for long lasting behaviour change (Deci and Ryan, 1985a; Ryan *et al.*, 1997; Williams *et al.*, 1998; Biddle, 1999), it is usually discussed as a means of encouraging intrinsic motivation, rather than as a concept on its own. The results of study three suggest there may be a causal effect from increased participation in exercise to more self-determined forms of behavioural regulation (this cannot be ascertained for certain as the study did not compare the results with individuals who did not increase their exercise behaviour) which supports previous cross-sectional research (Mullan *et al.*, 1997). This suggests that it may not be the development of intrinsic motivation that is important for promoting long term participation in exercise but only that individuals are encouraged to form more self-determined types of behavioural regulation and in addition become more autonomous in their orientation. Results from study three show that this increase in self-determined regulation and levels of autonomy can be achieved by participation in regular exercise irrespective of the individual's causality orientation and level of autonomy support provided by the environment. This latter result is contrary to the predictions of CET.

This has implications for exercise promotion schemes particularly GP referral schemes. The prevailing practice in these schemes is the prescription of an exercise regimen for a number of weeks (Taylor, 1999). This results in an instructor prescribing a regimen of exercise for the individual to adhere to. Additionally, many sports centres adopt this approach when the general public approach them for advice. From a SDT perspective this practice provides a very controlling influence and does not support the autonomy of the individual and would be predicted to be detrimental to exercise participation, particularly for autonomy oriented individuals. In fact previous research has shown that autonomous self-regulation was associated with greater adherence to taking medication (Williams *et al.*, 1998) and that a controlling environment is detrimental to behavioural persistence (Thompson and Wankel, 1980; Vallerand and Bissonette, 1992). The conclusions drawn from study three, however, suggest this practice may not be as detrimental as SDT predicts it to be. Regular exercise in a controlling environment did not have the expected negative effect on exercise behaviour in the short or long term, in fact it resulted in the same exercise behaviour as the autonomous condition. Therefore,

a (somewhat) controlling environment will not negatively affect participation in exercise in either autonomy or control oriented individuals over 12 weeks nor influence the development of autonomous forms of regulation. This will prove to be very beneficial for encouraging autonomous exercise behaviour and to reduce the individual's reliance on the exercise instructor or counsellor. It was shown in study three that when the controlling pressure was removed the control oriented individuals did not show the expected decline in adherence that COT would predict. Caution should be advised when generalising the findings to the GP referral population as the extent of the controlling influence afforded in this environment and the pattern of causality orientations within this population is unknown. However, the fact still remains that promoting an autonomy supportive exercise environment in which individuals provide input into their exercise programme and are not regimented to exercise in a particular way on a particular day is more beneficial. As predicted by SDT, study three showed that this environment will promote the most positive affective outcomes and more intrinsic motivation from exercise in both autonomy and control oriented individuals.

It was highlighted in study three that the conclusions drawn could not be generalised to predominately impersonally oriented individuals as the influence of the impersonal orientation was ignored. This orientation is characterised by individuals perceiving an independence between behaviour and outcomes, therefore individuals would not perceive there to be any benefits for initiating an exercise programme. It is likely that in a setting where individuals are responding, voluntarily, to health promotion programmes or who have spontaneously decided that they are going to exercise, that they will not have high levels of the impersonal orientation. However, in a GP referral and cardiac rehabilitation setting or in other such settings where beginning a programme of exercise is important for the prevention of ill-health, it is likely that the impersonal orientation will be more prominent (although it may still not be predominant). Individuals may be exercising simply because they have been told to by their GP or consultant and do not actually perceive that the exercise will help them in any way. It could be speculated that these individuals would be best served initially by being in a controlled environment such as that generated in study three. This would be beneficial for a number of reasons. The controlling pressure as well as the genuine interest provided by an exercise leader may ensure individuals adhere to exercise (even if it is just to satisfy the doctor). Once individuals are exercising it is likely that they will

experience the good things that can be gained from exercise and begin to attach value to them (as shown in study three) and this regular exercise will result in an increase in the autonomy orientation. Ultimately, this may encourage a shift in predominant orientation from impersonal to one of control or hopefully, one of autonomy.

To summarise, the interaction of causality orientation and the exercise environment does not influence exercise participation. Given support, individuals will initiate a regular programme of exercise and adhere to that programme irrespective of the manner in which this advice and support is given. Enhancing the individual's self-determination seems to be the key to maintenance of exercise behaviour and as SDT predicts this will be achieved with regular participation in exercise in an environment which provides some degree of autonomy support. Furthermore, the most positive affective responses and greatest situational intrinsic motivation will be achieved from an autonomous environment or being autonomy oriented. Therefore, it is important to increase levels of the autonomy orientation in control oriented individuals with the aim of making it the predominant orientation.

Methodological Limitations

There are a number of methodological limitations which should be recognised when interpreting the results of this thesis. The most appropriate method of assessing intrinsic motivation has not been discovered. The use of behavioural measures and assessments of the experience of interest/enjoyment which accompanies being intrinsically motivated have been criticised from a conceptual standpoint, although their use is appreciated from a methodological perspective (Vallerand, 1997). A problem occurs because interest/enjoyment serves as both the indicator of intrinsic motivation and the outcome. A circular argument occurs. Deci (1987) also states that measures used to operationalise intrinsic motivation have become confused with the actual construct of intrinsic motivation. Markland and Hardy (1997) and Vallerand and Fortier (1998) report this to be the case with the IMI, one of the frequently used self-report measures of intrinsic motivation. However, it still remains one of the only situational measures of intrinsic motivation for exercise. Due to the theoretical concerns over the full IMI, more recently its interest/enjoyment subscale has been used to indicate levels of intrinsic motivation (Markland, 1999) and although it is not assessing the full construct of intrinsic motivation it does provide an indication of the experience of intrinsic motivation. However, it still suffers from a methodological limitation. The

items are worded in such a way that it cannot be ascertained for certain that the construct being assessed is intrinsic motivation and not extrinsic motivation. For example, one item states 'I enjoyed participating in exercise very much'. If an individual scores highly, this is taken as an indicator of intrinsic motivation (or interest/enjoyment). However, it may be that the individual enjoys participating for the extrinsic benefits they have obtained and in this case the item is assessing extrinsic motivation. Therefore, it can assess the intensity of motivation but it may not be so clear as to its direction (Markland and Hardy, 1997).

A further problem exists in the measurement of intrinsic motivation at the contextual level, there is no validated measure of contextual intrinsic motivation, the nearest measurement tools are the intrinsic regulation subscale of the BREQ or the intrinsic motivation subscales of the Exercise Motivation Scale (EMS: Li, 1999). However, these subscales are not assessing the construct of intrinsic motivation per se but the extent to which individuals use intrinsic motives to regulate behaviour. Therefore, in study three the situationally based IMI was reworded to relate to exercise in general. In doing this, it is appreciated that it will have implications for the validity of results of study three.

Investigations using COT are influenced by how the three causality orientations are treated. It was discussed in studies two and three that Deci and Ryan (1985a; 1985b) state that individuals should not be categorised as autonomy, control or impersonally oriented but described in a dimensional sense according to their levels of each of the three orientations. However, it has been argued that by using this dimensional view it becomes hard to make meaningful comparisons between individuals and groups especially in a research context and that classification according to a predominant orientation makes comparisons easier (Koestner and Zuckerman, 1994). This approach ignores the effect of the next predominant orientation. Furthermore, it is acknowledged that this method ignores the interaction that will exist between two orthogonal constructs that co-exist within each individual (Harwood, 2000). In order to provide a matched exercise environment, individuals had to be classified according to their predominant orientation but by taking this stance the effect of the sub-dominant orientations was ignored. It cannot be ascertained what effect these had on the interpretation of the exercise environment in which individuals were exercising, their effect on exercise behaviour, or the response to the questionnaires. In future analysis

using the ECOS, it may be pertinent to use quadrant analysis to investigate the interactive effects of the autonomy and control orientations on exercise behaviour. In this case, four orientation profiles would be constructed, high autonomy-high control, high autonomy-low control, low autonomy-high control, low autonomy-low control and analysed using a 2 X 2 multivariate analysis of variance. This was suggested by Hardy (1998) as a means to explore the interactive effects of task and ego goal orientations. To simplify the analysis the effect of the impersonal orientation is not being considered. It is likely that those individuals who are contemplating or preparing to exercise will not show a profile with a high level of the impersonal orientation anyway, and given the positive correlation it shows with the control orientation (see study two) it is more important to contrast the autonomy and control orientations. This situation would be different however, if research involved those individuals who were not considering exercise or who were sceptical about the benefits of exercise and their ability to achieve them.

A further issue regarding the proposals of COT is the values that would constitute someone being described as having a high or a low level of each of the orientations. Typically, for each population a median or mean value for each subscale is found with those above classified as high and those below classed as low. However, this method may result in those classed as low still registering a score on the upper end of the range of possible scores. This means that there would not be a high and a low group but a high and a higher group. Additionally, this method results in sample specificity which makes comparison between studies difficult. These are pertinent issues that also arise within goal orientations research and have not been resolved (see Harwood, 2000). Results from study three showed that, although within each group the score for the predominant orientation was significantly higher than the score for the sub-dominant orientations, the next predominant orientation (autonomy for groups 1 and 2 and control for group 3) scored at the middle of the range of scores available. This suggests that individuals did present with a moderate level of the sub-dominant orientation and this should be taken into account when the results are interpreted.

Finally, a methodological limitation of the thesis as a whole regards the different fitness levels of the participants in studies one and two. The individuals who participated in study one were classed as highly fit and those who took part in study three were initially

sedentary. Therefore, when comparing and contrasting the results of the two studies this disparity in fitness level should be taken into account.

Future Research

It is the case with most research that more questions are generated than are actually answered. This thesis is no different. In concluding Chapters three, four and five suggestions for future research resulting from the studies were proposed. The effect of pre-exercise affective state on the response to acute exercise still remains an important research area and our conclusion that individuals naturally select an intensity that results in the most positive affective state remains untested. The ECOS is still in its infancy and more research is required to confirm its construct and predictive validity.

Unfortunately, there is no quick answer to the question 'How do we get individuals to adhere to a programme of exercise?' nor is there an easy way to prevent individuals from dropping out. Study three provided evidence that causality orientation is not necessarily a factor that influences whether or not individuals will adopt or adhere to a programme of regular exercise. Theory driven research should continue to investigate this area and identify factors that are important to the promotion of exercise. In particular, the relevant importance of extrinsic motives for long term participation should be investigated rather than dismissing their use as unimportant to long term adherence. Rothman's (2000) proposal that maintenance of exercise will be influenced by the individual's experience of the outcomes of exercise deserves attention.

Even though the interaction between causality orientation and exercise environment was not shown to influence exercise behaviour, it was shown to affect the psychological responses that result. Therefore, the study of causality orientations still has much to contribute to exercise adherence research. Study three showed that levels of the autonomy orientation were increased and were a significant predictor of that exercise behaviour. Therefore, increasing levels of the autonomy orientation, especially within control oriented individuals, is important. Research should investigate whether predominantly control oriented individuals can switch to become predominately autonomy oriented following a period of regular exercise, or if their levels of the control orientation (which have been shown to be resistant to change) will still dominate. Additionally, the environment that will be most conducive to this change needs to be established as well as the length of time this process will take to occur. The starting

point may be to investigate patterns of causality orientations in conjunction with stages of change (Prochaska and DiClemente, 1984) and compare individuals in the preparation and action stages with those in the maintenance stage, before investigating the results more thoroughly in a longitudinal investigation. Furthermore, the interaction of the two orientations should be explored.

Duda and Hall (2001) have suggested that models of motivation which complement and extend from each other should be considered collectively to give a complete understanding of motivation. The theoretical links between Achievement Goal Theory (AGT) and SDT have recently been described (Duda, 1992; Duda and Hall, 2001; Ntoumanis, In press) with research having provided support for the relationship between a task orientation and intrinsic motivation (see Duda and Hall, 2001 for review). Empirical testing of the relationships between goal orientations and measures of self-determined regulation have found the task orientation to show a positive relationship with intrinsic and identified regulation and the ego orientation to show a positive relationship with external regulation (Brunel, 1999; Petherick and Wiegand, In press; Ntoumanis, In press). In comparison, the results of study two showed that the autonomy orientation was positively correlated with intrinsic and identified regulation while the control orientation was positively correlated with external regulation. This suggests that the regulatory forces motivating behaviour are the same for the task orientation and the autonomy orientation and for the ego orientation and the control orientation. This may not be surprising given that each pair share certain similarities. For example, both the task orientation and the autonomy orientation are concerned with the intrinsic properties of the situation, while the ego orientation and the control orientation are concerned with the outcomes of the activity. Future research may combine the two theories to investigate whether there is any relationship between the autonomy and task orientations and the ego and control orientations.

The reciprocal relationship between contextual and situational motivation proposed by Vallerand (1997) remains largely untested within the context of exercise. The third study provided only partial support for the corollaries of the model which it investigated. Research should continue to test the tenets of the model, particularly between the situational and contextual level. Additionally, research should investigate whether the global level is actually a stable personality level of motivation that cannot

be changed, or whether levels of global motivation can be influenced by increased contextual motivation.

It was highlighted in Chapter two that the mechanism or mechanisms behind the post-exercise increase in affective state are still unsupported. This remains at the forefront of exercise psychology research. If these mechanisms are established then this will inform researchers and practitioners of the properties required of an exercise session to ensure that positive affective responses are generated, thus enhancing the likelihood of future participation. However, before this can be attempted research is necessary to produce a more appropriate measurement tool which is grounded in a theoretical model, is specific to the affective states generated by exercise and can assess both the positive and negative aspects of the affective experience. The instruments available to measure affective responses to exercise have been criticised on the basis of their theoretical grounding and psychometric properties (Gauvin and Rejeski, 1998; Ekkekakis and Petruzzello, 1999). Ekkekakis and Petruzzello (1999) suggest that the way forward in research into affective responses is to take a dimensional approach using models which detail the structure and relationships between different affective states. These models, for example, the circumplex model (Russell, 1980) and the two-factor model of affect (Watson *et al.*, 1988), have the advantage of retaining a broad perspective on the affective responses generated by exercise although they may obscure some of the important features of affect (see Larson and Diener, 1992 and Gauvin and Brawley, 1993 for reviews). The use of these models in the study of exercise related affect have largely been ignored to date.

Research that considers the impersonal orientation is also of importance because those individuals in GP referral programmes, or rehabilitation settings, may be predominately impersonally oriented. It is especially important that these individuals are supported in the best manner, to ensure that they adhere to their exercise programmes in order to prevent ill-health. Research should investigate the pattern of causality orientations in this population whose motives for participating in exercise will be largely extrinsic.

Those individuals who remain largely inaccessible from a research perspective are those who do not respond to health promotion strategies or who do not volunteer for research into exercise. These individuals are likely to be in the precontemplation stage of behaviour change. They represent an interesting population to study, for it may provide

insight into why some people do not respond to health promotion advice, why they do not exercise and what would help them actually contemplate participating in exercise. This is likely to be another population who are predominately impersonally oriented.

This programme of research has highlighted the importance of taking individual differences into account when investigating the affective and motivational responses to both acute and chronic exercise. Using SDT and more specifically causality orientations theory as a theoretical framework, causality orientations were identified as one individual difference factor that may influence these responses although are not so important regarding the extent to which exercise is adopted and maintained. Initial findings suggest levels of the autonomy orientation and not the control orientation are important for predicting participation in exercise over a six month period. Providing an environment with varied degrees of autonomy support will result in increases in autonomy, self-determined regulation, perceived competence and intrinsic motivation in both autonomy and control oriented individuals. Situationally, the most positive affective responses will result from an environment with greater amounts of autonomy support and in those with a predominance of the autonomy orientation. There was no support for the proposal that the exercise environment should be matched to the individual's predominant causality orientation to promote adoption and maintenance of a programme of exercise. However, the concept of causality orientations remains a fruitful line of research within adherence to exercise. Practitioners within the field of exercise promotion should be wary of treating individuals homogeneously and expecting to achieve positive results all of the time.

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Appendix 1

Questionnaires used within the research

Appendix 1A

Subjective Exercise Experiences Scale (SEES)

By circling a number on the scale below each of the following items, please indicate the degree to which you are experiencing each feeling *now*, at this point in time, *before/during/after exercising*.

1	2	3	4	5	6	7
NOT AT ALL			MODERATELY		VERY MUCH SO	

I FEEL:

1) GREAT

1 2 3 4 5 6 7

2) AWFUL

1 2 3 4 5 6 7

3) DRAINED

1 2 3 4 5 6 7

4) POSITIVE

1 2 3 4 5 6 7

5) CRUMMY

1 2 3 4 5 6 7

6) EXHAUSTED

1 2 3 4 5 6 7

7) STRONG

1 2 3 4 5 6 7

8) DISCOURAGED

1 2 3 4 5 6 7

9) FATIGUED

1 2 3 4 5 6 7

10)TERRIFIC

1 2 3 4 5 6 7

11)MISERABLE

1 2 3 4 5 6 7

12)TIRED

1 2 3 4 5 6 7

Appendix 1B
21 item version of the Intrinsic Motivation Inventory (IMI)

Please answer the following questions considering the exercise session you have just completed. circle the answer which reflects how you feel.

1	2	3	4	5	6	7
STRONGLY DISAGREE						STRONGLY AGREE

1.	I enjoyed participating in the exercise session.	1	2	3	4	5	6	7
2.	I think I am pretty good at the exercise session.	1	2	3	4	5	6	7
3.	I put a lot of effort into the exercise session.	1	2	3	4	5	6	7
4.	I did not feel nervous at all while participating in the exercise session.	1	2	3	4	5	6	7
5.	The exercise session was fun to do.	1	2	3	4	5	6	7
6.	I am satisfied with my performance in the exercise session.	1	2	3	4	5	6	7
7.	I didn't try very hard to do well in the exercise session.	1	2	3	4	5	6	7
8.	I felt very tense when completing the exercise session.	1	2	3	4	5	6	7
9.	I haven't really had a choice about how hard I've had to exercise.	1	2	3	4	5	6	7
10.	The exercise session was very boring.	1	2	3	4	5	6	7
11.	I tried very hard in the exercise session.	1	2	3	4	5	6	7
12.	I was very relaxed while completing the exercise session.	1	2	3	4	5	6	7
13.	I felt like I had to complete the exercise session at a given intensity.	1	2	3	4	5	6	7
14.	The exercise session did not hold my attention.	1	2	3	4	5	6	7
15.	I would describe the exercise session as very interesting.	1	2	3	4	5	6	7
16.	I am pretty skilled at the level of exercise required in the session.	1	2	3	4	5	6	7
17.	I didn't put much energy into the exercise session.	1	2	3	4	5	6	7
18.	I felt pressured while completing the exercise session.	1	2	3	4	5	6	7
19.	I thought the exercise session was quite enjoyable.	1	2	3	4	5	6	7
20.	While completing the exercise session, I thought about how much I was enjoying it.	1	2	3	4	5	6	7
21.	I exercised at a given intensity because I had no other choice.	1	2	3	4	5	6	7

Appendix 1C
Ratings of Perceived Exertion Scale (RPE)

6	No exertion at all
7	
	Extremely light
8	
9	
10	Very light
11	
12	Light
13	
14	Somewhat hard
15	
16	Hard (heavy)
17	
18	Very hard
19	Extremely hard
20	Maximal exertion

Appendix 1D
Self-report activity history and health questionnaire

Please complete this questionnaire, all the information you give will be treated in the strictest confidence.

NAME:

AGE:

WHAT ARE YOUR MAIN EXERCISE ACTIVITIES:

HOW LONG HAVE YOU PARTICPATED IN THESE ACTIVITIES:

HOW OFTEN DO YOU EXERCISE PER WEEK:

WHAT OTHER (IF ANY) EXERCISE DO YOU PARTICIPATE IN:

WHAT HOBBIES DO YOU HAVE:

DO YOU SUFFER ANY MEDICAL PROBLEMS THAT HINDER YOUR EXERCISE HABITS (IF SO PLEASE EXPLAIN):

HEALTH QUESTIONNAIRE

NAME:

DATE:

RESEARCHER

PLEASE ANSWER THESE QUESTIONS TRUTHFULLY AND COMPLETELY. THE SOLE PURPOSE OF THIS QUESTIONNAIRE IS TO ENSURE THAT YOU ARE IN A FIT AND HEALTHY STATE TO COMPLETE THE EXERCISE TESTS.

		YES/NO
1.	HAVE YOU HAD ANY KIND OF ILLNESS OR INFECTION IN THE LAST 2 WEEKS?	.....
2.	ARE YOU TAKING ANY FORM OF MEDICATION?	.....
3	DO YOU HAVE ANY FORM OF INJURY?	.....
4.	HAVE YOU HAD TO CONSULT YOUR DOCTOR IN THE LAST 3 MONTHS?	.....
5.	HAVE YOU EATEN IN THE LAST HOUR?	.....
6.	HAVE YOU CONSUMED ANY ALCOHOL IN THE LAST 24 HOURS?	.....
7.	HAVE YOU PERFORMED EXHAUSTIVE EXERCISE WITHIN THE LAST 48 HOURS?	.....

IF THE ANSWER TO ANY OF THE ABOVE QUESTIONS IS YES, THEN YOU MUST NOTIFY THE RESEARCHER BEFORE UNDERGOING THE EXERCISE TESTS.

SIGNATURE OF PARTICIPANT .....

Appendix 1E

Leisure Time Physical Activity Scale

We are interested in how much physical activity you do in a normal week (a full seven days), how many times a week do you usually do the following types of activities for more than 15 minutes?

Please circle one number in answer to EACH of the FOUR questions below.

1. Strenuous Exercise
This is any exercise you do that makes your heart beat very fast such as vigorous sport (football, hockey, netball, athletics etc.), aerobics, running, hard cycling, vigorous swimming and so on.

I take part in strenuous exercise for at least 15 minutes during my free time:

0 1 2 3 4 5 6 7+ Times per week

2. Moderate Exercise
This is any exercise you do that makes your heart beat quite fast but is not exhausting such as brisk walking, cricket, rounders, easy cycling, easy swimming and so on.

I take part in moderate exercise for at least 15 minutes during my free time:

0 1 2 3 4 5 6 7+ Times per week

3. Mild Exercise
This is any exercise you do that only needs a small amount of effort such as easy walking, golf, bowling, fishing from the bank and so on.

I take part in mild exercise for at least 15 minutes during my free time:

0 1 2 3 4 5 6 7+ Times per week

4. Considering a 7-day period (a week), during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

Often	Sometimes	Never/rarely
1	2	3

Appendix 1F
General Causality Orientations Scale (GCOS)

Please read each scenario below. By circling a number on the scale below each response a, b & c, indicate the extent to which EACH response would be characteristic of you in that situation.

1) You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is:
   1. What if I can't live up to the new position? (IMP)
   2. Will I make more at this position? (CONT)
   3. I wonder if the new work will be interesting? (AUT)

2) You have school age daughter. On parents night the teacher tells you that your daughter is doing very poorly and doesn't seem involved in the work. You are likely to:
   1. Talk it over with your daughter to understand further what the problem is. (AUT)
   2. Scold her and hope she does better. (IMP)
   3. Make sure she does the assignments, because she should be working harder. (CONT)

3) You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It's likely that you might think:
   1. It's not what you know, but who you know. (CONT)
   2. I'm probably not good enough for the job. (IMP)
   3. Somehow they didn't see my qualifications as matching their needs. (AUT)

4) You are a work's supervisor and have been charged with the task of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:
   1. Telling the three workers the situation and having them work with you on the schedule. (AUT)
   2. Simply assign them the times that each can break to avoid any problems. (CONT)
   3. Find out from someone in authority what to do or do what was done in the past. (IMP)

5) A close friend of yours has been moody lately, and a couple of times has become very angry with you over "nothing". You might:
   1. Share your observations with them and try to find out what is going on for them. (AUT)
   2. Ignore it because there's not much you can do about it anyway. (IMP)
   3. Tell them that you're willing to spend time together if and only if they make more effort to control themselves. (CONT)

6) You have just received the results of a test you took, and you discovered that you did very poorly. Your initial reaction is likely to be:
   1. "I can't do anything right", and feel sad. (IMP)
   2. "I wonder how it is I did so poorly", and feel disappointed. (AUT)

3. "That stupid test doesn't show anything", and feel angry. (CONT)

7) You have been invited to a large party where you know very few people. As you look forward to the evening you would likely expect this:
   1. You'll try to fit in with whatever is happening in order to have a good time and not look bad. (CONT)
   2. You'll find some people with whom you can relate. (AUT)
   3. You'll probably feel somewhat isolated and unnoticed. (IMP)

8) You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterised as:
   1. Take charge: that is, you would make the most of the major decisions yourself. (CONT)
   2. Follow precedent: you're not really up to the task so you'd do it the way its been done before. (IMP)
   3. Seek participation: get inputs from others who want to make them before you make the final plans. (AUT)

9) Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you are likely to think:
   1. You didn't really expect the job, you frequently get passed over. (IMP)
   2. The other person probably "did the right things" politically to get the job. (CONT)
   3. You would probably take a look at other factors in your own performance that led you to be passed over. (AUT)

10) You are embarking on a new career. The most important consideration is likely to be:
   1. Whether you can do the work without getting in over your head. (IMP)
   2. How interested you are in that kind of work. (AUT)
   3. Whether there are good possibilities for advancement. (CONT)

11) A person who works for you has generally done an adequate job. However, for the past two weeks their work has not been up to par and they appear to be less actively interested in their work. Your reaction is likely to be:
   1. Tell them that their work is below what is expected and that they should start working harder. (CONT)
   2. Ask them about the problem and let them know you are available to help work it out. (AUT)
   3. Its hard to know what to do to get them straightened out. (IMP)

12) Your company has promoted you to a position far from your present location. As you think about the move you would probably:
   1. Feel interested in the new challenge and a little nervous at the same time. (AUT)
   2. Feel excited about the higher status and salary that is involved. (CONT)
   3. Feel stressed and anxious about the upcoming changes. (IMP)

Appendix 1G
Behavioural Regulation in Exercise Questionnaire (BREQ)

WHY DO YOU ENGAGE IN EXERCISE?

Using the scale below, please indicate to what extent each of the following items is true for you.

		Not true for me		Sometimes true for me		Very true for me
1)	I exercise because other people say I should	0	1	2	3	4
2)	I feel guilty when I don't exercise	0	1	2	3	4
3)	I value the benefits of exercise	0	1	2	3	4
4)	I exercise because its fun	0	1	2	3	4
5)	I take part in exercise because my friends/ family/partner say I should	0	1	2	3	4
6)	I feel ashamed when I miss an exercise session	0	1	2	3	4
7)	It's important to me to exercise regularly	0	1	2	3	4
8)	I enjoy my exercise sessions	0	1	2	3	4
9)	I exercise because others will not be pleased with me if I don't	0	1	2	3	4
10)	I feel like a failure when I haven't exercised in a while	0	1	2	3	4
11)	I think its important to make the effort to exercise regularly	0	1	2	3	4
12)	I find exercise a pleasurable activity	0	1	2	3	4
13)	I feel under pressure from my friends/ family to exercise	0	1	2	3	4
14)	I get restless if I don't exercise regularly	0	1	2	3	4
15)	I get pleasure and satisfaction from participating in exercise	0	1	2	3	4

Appendix 1H
Locus of Causality for Exercise Scale (LCE)

By circling a number on the scale below each statement, please indicate the extent to which each statement refers to you.

1) I exercise because I like to rather than because I feel I have to.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

2) Exercising is not something I would necessarily choose to do, rather it is something I feel I ought to do.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

3) Having to exercise is a bit of a bind but it has to be done.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

Appendix 1I
Self-Consciousness Scale – Revised (SCS-R)

Please indicate on the scale below each statement the extent to which each is like you. Try to be as honest and as accurate as possible throughout and not let your answer to one question influence your answer to another. There are no correct or incorrect answers.

		Not at all like me	A little like me	Somewhat like me	A lot like me
1)	I'm always trying to figure myself out.	0	1	2	3
2)	I'm concerned about my style of doing things	0	1	2	3
3)	It takes me time to get over my shyness in new situations.	0	1	2	3
4)	I think about myself a lot.	0	1	2	3
5)	I care a lot about how I present myself to others.	0	1	2	3
6)	I often daydream about myself.	0	1	2	3
7)	Its hard for me to work when someone is watching me.	0	1	2	3
8)	I never take a hard look at myself.	0	1	2	3
9)	I get embarrassed very easily.	0	1	2	3
10)	I'm self-conscious about the way I look.	0	1	2	3
11)	Its easy for me to talk to strangers.	0	1	2	3
12)	I generally pay attention to my inner feelings.	0	1	2	3
13)	I usually worry about making a good impression.	0	1	2	3
14)	I'm constantly thinking about my reasons for doing things.	0	1	2	3
15)	I feel nervous when I speak in front of a group.	0	1	2	3
16)	Before I leave my house. I check how I look.	0	1	2	3
17)	I sometimes step back (in my mind) in order to examine myself from a distance.	0	1	2	3
18)	I'm concerned about what other people think of me	0	1	2	3
19)	I'm quick to notice changes in my mood.	0	1	2	3
20)	I'm usually aware of my appearance.	0	1	2	3
21)	I know the way my mind works when I work through a problem.	0	1	2	3
22)	Large groups make me nervous.	0	1	2	3

Appendix 1J
Social Desirability Scale

Below are a number of statements concerning personal attitudes. Please read each statement and indicate by circling the appropriate response, whether or not the statement is true or false for you personally.

1)	It is sometimes hard for me to go on with my work if I am not encouraged.	True / False
2)	I sometimes feel resentful when I don't get my way	True / False
3)	On a few occasions, I have given up doing something because I thought too little of my ability.	True / False True / False
4)	There have been times when I felt like rebelling against people in authority even though I knew they were right.	True / False True / False
5)	No matter who I am talking to, I'm always a good listener.	True / False
6)	There have been occasions when I took advantage of someone.	True / False
7)	I'm always willing to admit it when I make a mistake.	True / False
8)	I sometimes try to get even rather than forgive and forget.	True / False
9)	I am always courteous, even to people who are disagreeable.	True / False
10)	I have never been irritated when people expressed ideas very different from my own.	True / False
11)	There have been times when I was quite jealous of the good fortune of others.	True / False
12)	I am sometimes irritated by people who ask favours of me.	True / False
13)	I have never deliberately said something that hurt someone's feelings.	True / False

Appendix 1K
Perceived Expectations Scale

The following questions are concerned with your expectations about your involvement in this study. Please answer each question honestly, by circling a number on the scale below each question.

1) To what extent do you believe that being involved in the programme will help improve your level of fitness?

Not at all						Very much
1	2	3	4	5	6	7

2) To what extent do you believe that being involved in the programme will help improve your health?

Not at all						Very much
1	2	3	4	5	6	7

3) To what extent do you believe that being involved in the programme will help you to exercise regularly?

Not at all						Very much
1	2	3	4	5	6	7

Perceived Outcomes Scale

The following questions are concerned with your perceptions of the outcomes of being involved in this study. Please answer each question honestly, by circling a number on the scale below each question.

1) To what extent do you believe that being involved in the programme has helped improve your level of fitness?

Not at all						Very much
1	2	3	4	5	6	7

2) To what extent do you believe that being involved in the programme has helped improve your health?

Not at all						Very much
1	2	3	4	5	6	7

3) To what extent do you believe that being involved in the programme has helped you to exercise regularly?

Not at all						Very much
1	2	3	4	5	6	7

Appendix 1L
Experimenter Effect Scales

The following questions ask about your opinions of the way in which the researcher conducted the information session and consultations. Please be as honest as possible. Any negative responses will help her to improve her delivery in future projects. Answer each question in terms of whether you agree or disagree with each statement about the researcher.

	Strongly Disagree					**Strongly Agree**
The researcher…..						
1) Was clearly knowledgeable about the information presented in the information session.	1	2	3	4	5	6
2) Was able to communicate at the right level.	1	2	3	4	5	6
3) Was interested in what you had to say during the consultations.	1	2	3	4	5	6
4) Was respectful of you as a participant.	1	2	3	4	5	6
5) Handled any questions adequately.	1	2	3	4	5	6
6) Tried to develop a rapport with you.	1	2	3	4	5	6
7) Was enthusiastic during the consultations.	1	2	3	4	5	6
8) Provided you with good written information to help you to exercise.	1	2	3	4	5	6

Appendix 1M
Situational interest/enjoyment and perceived competence subscales of the Intrinsic Motivation Inventory

Interest/enjoyment

	Strongly Disagree						Strongly Agree
1) I enjoyed participating in the exercise session.	1	2	3	4	5	6	7
2) The exercise session was fun to do.	1	2	3	4	5	6	7
3) The exercise session was very boring.	1	2	3	4	5	6	7
4) The exercise session did not hold my attention.	1	2	3	4	5	6	7
5) I would describe the exercise session as very interesting.	1	2	3	4	5	6	7
6) While completing the exercise session, I thought about how much I was enjoying it.	1	2	3	4	5	6	7
7) I thought the exercise session was quite enjoyable.	1	2	3	4	5	6	7

Perceived Competence

1) I thought I was pretty good at the exercise session.	1	2	3	4	5	6	7
2) I am satisfied with my performance in the exercise session.	1	2	3	4	5	6	7
3) I was pretty skilled at the level of exercise required in the session.	1	2	3	4	5	6	7

Contextual interest/enjoyment and perceived competence subscales of the Intrinsic Motivation Inventory

Interest/enjoyment

	Strongly Disagree						Strongly Agree
1) I enjoyed participating in exercise very much.	1	2	3	4	5	6	7
2) I find exercise fun to do.	1	2	3	4	5	6	7
3) I think that exercise is boring.	1	2	3	4	5	6	7
4) I find that exercise does not hold my attention.	1	2	3	4	5	6	7
5) I would describe participating in exercise as very interesting.	1	2	3	4	5	6	7
6) I think my exercise sessions are quite enjoyable.	1	2	3	4	5	6	7
7) While I am participating in exercise, I think about how much I am enjoying it.	1	2	3	4	5	6	7

Perceived Competence

1) I think I am pretty good at the types of exercise that I do.	1	2	3	4	5	6	7
2) I think I do pretty well in my exercise sessions, compared to other people.	1	2	3	4	5	6	7
3) I am pretty skilled at the level of exercise I undertake.	1	2	3	4	5	6	7

Appendix 1N
Physical Activity Enjoyment Scale

Please rate how you feel *at the moment* about the physical activity you have been doing in the last 2 weeks on the scale below each item.

I enjoy it						I hate it
1	2	3	4	5	6	7
I feel bored						I feel interested
1	2	3	4	5	6	7
I dislike it						I like it
1	2	3	4	5	6	7
I find it pleasurable						I find it Unpleasurable
1	2	3	4	5	6	7
I am very absorbed in this activity						I am not at all absorbed in this activity
1	2	3	4	5	6	7
It's no fun at all						It's a lot of fun
1	2	3	4	5	6	7
I find it energising						I find it tiring
1	2	3	4	5	6	7
It makes me depressed						It makes me happy
1	2	3	4	5	6	7
It's very pleasant						It's very unpleasant
1	2	3	4	5	6	7
I feel good physically while doing it						I feel bad physically while doing it
1	2	3	4	5	6	7
It's very invigorating						It's not at all invigorating
1	2	3	4	5	6	7
I am very frustrated by it						I am not at all frustrated by it
1	2	3	4	5	6	7
It's very gratifying						It's not at all gratifying
1	2	3	4	5	6	7
It's very exhilarating						It's not at all exhilarating
1	2	3	4	5	6	7
It's not at all stimulating						It's very stimulating
1	2	3	4	5	6	7
It gives me a strong sense of accomplishment						It does not give me a sense of accomplishment
1	2	3	4	5	6	7
It's very refreshing						It's not at all refreshing
1	2	3	4	5	6	7
I felt as though I would rather be doing something else						I felt as though there was nothing else I would rather be doing
1	2	3	4	5	6	7

Appendix 10
Drop-out questionnaire

Name .....(optional)

Please could you circle a number on the scale beside each question to indicate the extent to which it reflects how you felt about your participation in the exercise study.

I withdrew from the study because:	Strongly Disagree	Disagree	Agree	Strongly Agree
1) I felt that there was too much pressure on me to exercise	1	2	3	4
2) I felt that there was not enough pressure on me to exercise	1	2	3	4
3) I did not have the time to exercise	1	2	3	4
4) I did not have the time to fulfil the requirements of meeting with the researcher every fortnight	1	2	3	4
5) I got injured	1	2	3	4
6) I had not done any exercise	1	2	3	4
7) Of other reasons	1	2	3	4

Please write below any other reasons why you withdrew that have not been covered:

.....

.....

.....

Were there any other specific aspects of being involved in the study which you did not like?

.....

.....

.....

Were there any aspects of being involved in the study which you did enjoy?

.....

.....

.....

Please feel free to comment on any aspect of the project and the researcher

.....

.....

Appendix 2

Consent Forms

Appendix 2A

Participant Consent Form (Study 1)

Design of study
You will be asked to attend the physiology laboratory 3 times with each session lasting around 30 minutes.

The 1st session will be submaximal exercise test which will involve you running on the treadmill at a speed of 6mph and 7mph for 4 minutes each stage. You will be asked to wear a mouthpiece in order that oxygen uptake can be measured and a heart rate monitor to measure heart rate throughout the exercise bout. Before and after the test you will be asked to fill in the subjective exercise experiences scale (SEES).

The 2nd and 3rd sessions will involve you exercising on the treadmill continuously for 20 minutes. You will be asked to wear a heart rate monitor throughout the exercise bout. At each 5 minute interval you will be asked to indicate your RPE on a scale shown and to complete the SEES measures. After the exercise session you will be required to complete the SEES again and the Intrinsic Motivation Inventory (IMI).

Confidentiality
All information given to the experimentor will be treated with the utmost confidentiality as will the results gained from the experiment. No reference to any individual will be made in the analysis of results.

You are free to withdraw consent and to discontinue participation in the study at any time.

Enquiries
If you have any questions concerning the procedures of the experiment feel free to voice them to me.

Thank you for your participation.

Elaine Rose
University of Wales, Bangor
S.S.H.A.P.E.S.
Ffriddoedd Building
Victoria Drive
Bangor
Tel: 01248 383495

I hereby give my consent to participate in the research study which has been explained to me above.

SIGNED:.....

NAME:.....

DATE.....

Appendix 2B
Informed Consent Form (Study 3)

Design of Study

This study is investigating motivation to exercise and is comparing 2 motivational techniques.

At the outset of the study you will be asked to come to the University on two occasions. Firstly, you will be asked to attend an information session which will last around 1 hour. This is designed to provide information on how to exercise safely and what types of exercise are needed to improve fitness and provide health benefits. Secondly, you will be asked to meet with Elaine for ½ to 1 hour, at a time convenient to you, to discuss exercise and to undertake a fitness assessment. The fitness assessment will require you to walk on a treadmill for 20 minutes. Measurements of height, weight and body fat will also be taken. Finally, you will be asked to complete a batch of questionnaires.

Following these 2 sessions, Elaine will meet with you fortnightly for 12 weeks, again at a time convenient to you, for around 15 minutes to find out how much exercise you have undertaken. There will also be a couple of questionnaires to fill out every fortnight.

After 12 weeks you will be asked to undertake the fitness assessment again and complete the batch of questionnaires. Finally, 12 weeks later, you will be contacted for a final follow up about your exercise habits.

Confidentiality

All information given to the experimenter will be treated with the utmost confidentiality as will the results gained from the experiment. No reference to any individual will be made in the analysis of results.

Health

I understand I have to complete a health questionnaire which I will complete honestly. I confirm that I have no underlying complaints that prevent me from exercising and if need be I have checked with my GP that I can begin a programme of exercise.

Withdrawal

You are free to withdraw consent and to discontinue participation in the study at any time.

Enquiries

If you have any questions concerning the procedures of the experiment feel free to voice them to me.

Thank you for your participation

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I hereby give my consent to participate in the research study which has been explained to me above. I have been given opportunity to voice any queries or concerns to the investigator.

Signed ..... (Participant)

Signed ..... (Investigator) Date.....

Appendix 3

ECOS Development

Appendix 3A

Initial 19 scenarios of the Exercise Causality Orientations Scale (ECOS)

1) You are beginning a new exercise programme. You are likely to:
    1. Attend a structured exercise class where an exercise leader is telling you what to do. (CONT)
    2. Attend a gym where you decide for yourself which exercises to complete. (AUT)
    3. Tag along with your friends and do what they do. (IMP)

2) You are exercising in a setting where you are being told which exercises to participate in. You are likely to feel:
    1. Happy, because you are being told what to do and how to do it. (CONT)
    2. Unhappy, because you would prefer to decide how you want to exercise. (AUT)
    3. Not particularly bothered, because you don't know why you are there in the first place. (IMP)

3) You are beginning a new exercise programme. You are likely to:
    1. Feel interested in the new challenge and look forward to feeling its benefits. (AUT)
    2. Look forward to gaining the rewards such as weight loss, improving your appearance, etc. (CONT)
    3. Feel stressed and anxious about the new situation. (IMP)

4) You are exercising in a gym where you have to decide how you are going to exercise. You are likely to feel:
    1. Happy, because you like to choose how you exercise. (AUT)
    2. Unhappy, because you prefer for someone else to direct how you exercise. (CONT)
    3. Not particularly bothered. (IMP)

5) You have just been told that your exercise ability is poor. Your initial reaction would be:
    1. "I wonder why I did so poorly" and feel determined to try harder. (AUT)
    2. "I can't do anything right" and feel sad. (IMP)
    3. "I don't want to be good at this anyway" and feel annoyed. (CONT)

6) You are asked to keep a record of all the weekly exercise you have completed in an exercise diary. You are likely to view the diary:
    1. As a reminder of how incapable you are at fulfilling the task. (IMP)
    2. As a way to measure your progress and to feel proud of your achievements. (AUT)
    3. As a reminder that you must exercise so that there is something written in the diary. (CONT)

7) Your best friend asks if he/she can start exercising with you. You would likely handle this by:
   1. Agreeing, it would be fun to have someone to talk to while you exercised. (AUT)
   2. Putting them off, you don't want anyone you know to see you exercise. (IMP)
   3. Agreeing, it will be good to have someone to compare myself to. (CONT)

8) In order to monitor how well you are doing in an exercise programme you are likely to want:
   1. To be given a lot of praise and encouragement from others. (CONT)
   2. To evaluate your own performance and provide yourself with positive feedback. (AUT)
   3. To just hope that what you are doing is correct. (IMP)

9) You have been exercising regularly for 6 months but recently you have been missing sessions and are finding it hard to get motivated to exercise. You are likely to:
   1. Approach someone to help motivate you. (CONT)
   2. Ignore the problem, nothing can be done to improve your motivation. (IMP)
   3. Employ your own strategies to motivate yourself. (AUT)

10) You are going to see a fitness instructor to get an exercise programme for you to follow. You would likely:
   1. Want to be involved in making decisions about what goes in the programme. (AUT)
   2. Not really mind how the programme was devised. (IMP)
   3. Want to let the fitness instructor decide what exercises you should do. (CONT)

11) You have been told that setting goals is a good way to motivate yourself to exercise. You would likely:
   1. Set your own realistic but challenging goals. (AUT)
   2. Get someone else to set goals for you to give you something to aim for. (CONT)
   3. Not set goals because you may not be able to live up to them. (IMP)

12) In partnership with a fitness instructor you draw up a written contract of how much exercise you have agreed to do per week and when you are going to do it. This is likely to make you feel:
   1. Anxious, because you do not think you will be able to achieve the targets that have been set. (IMP)
   2. Happy, because you know exactly what you have to do and when you have to do it. (CONT)
   3. Unhappy, because it has taken away the spontaneity of exercising when you choose to and you now feel compelled to exercise at set times. (AUT)

13) During a discussion with an exercise counsellor he/she presents many options on the best way for you to exercise to achieve fitness and health benefits. It is likely that your first thought would be:
   1. What do you (the exercise leader) think I should do? (CONT)
   2. What do I think is the best option for me? (AUT)
   3. What has everyone else done in the past? (IMP)

14) You had been exercising regularly for about 6 months but have not done anything in the last month. You are keen to get back into it but are worried that you might 'slip' again. You are likely to:
   1. Ask someone to tell you how to avoid the situation in the future. (CONT)
   2. Resign yourself to the fact that nothing can be done to prevent it happening again. (IMP)
   3. Make plans on how you would cope with the situation in the future. (AUT)

15) You are not physically active at the moment but you are being encouraged to take up exercise. Your initial thought is likely to be:
   1. It could be fun. (AUT)
   2. What will I get out of it? (CONT)
   3. Nothing will increase my physical activity levels. (IMP)

16) During an exercise session how hard you are working out is likely to be governed by:
   1. How hard someone else has told you to exercise. (CONT)
   2. How hard everyone else is exercising. (IMP)
   3. How you are feeling whilst exercising at the intensity you choose. (AUT)

17) At the initial consultation with a fitness instructor he/she suggests that you have a fitness assessment. Your reaction is likely to be:
   1. That it will just confirm how unfit you are. (IMP)
   2. That it will be interesting to know how fit you are. (AUT)
   3. That it will enable you to evaluate your improvements so you can be as fit as you should be. (CONT)

18) Staff at your local sports centre have started noting down each time you attend to exercise. This is likely to make you feel:
   1. Interested in what they are using the information for. (AUT)
   2. Anxious about what they will think of you. (IMP)
   3. Motivated by the fact that you now have to go so people know you are exercising. (CONT)

19) You are a member of your local health club. They have just introduced a reward system whereby after you attend for a certain number of times you get a free t-shirt. You would probably:
   1. View it as a reason to continue exercising. (CONT)
   2. Ignore it as you won't achieve the target anyway. (IMP)
   3. Think of it as achieving a goal you have set yourself. (AUT)

Appendix 3B
Correlation Matrix of 19 scenario ECOS (first pilot study)

	CONT 1	AUT 1	IMP 1	CONT 2	AUT 2	IMP 2
CONT 1	1.000					
AUT 1	-0.241***	1.000				
IMP 1	-0.061	-0.113	1.000			
CONT 2	0.408***	-0.139*	0.039	1.000		
AUT 2	-0.282***	0.248***	-0.097	-0.685***	1.000	
IMP 2	-0.222***	-0.209**	0.220***	-0.247***	0.128*	1.000
AUT 3	0.114	0.378***	-0.101	0.278**	-0.115	-0.453***
CONT 3	0.125*	0.124*	0.021	0.232**	-0.162**	-0.070
IMP 3	0.050	-0.289***	0.262***	0.043	-0.056	0.201**
AUT 4	-0.188**	0.651***	-0.170**	-0.235***	0.369***	-0.225***
CONT 4	0.317***	-0.374***	0.107	0.461***	-0.340***	0.117
IMP 4	0.033	-0.226***	0.124*	0.044	-0.021	0.269***
AUT 5	0.155*	0.290***	-0.125*	0.143*	-0.004	-0.332***
IMP 5	0.065	-0.068	0.192**	0.090	0.036	0.075
CONT 5	-0.112	-0.213**	0.116	-0.145*	0.157*	0.340***
IMP 6	0.084	-0.189**	0.239***	-0.030	0.003	0.157*
AUT 6	0.092	0.326***	-0.093	0.206**	-0.107	-0.338***
CONT 6	0.088	0.040	0.318***	0.094	-0.080	0.168**
AUT 7	0.052	0.060	0.168**	0.209**	-0.055	-0.108
IMP 7	-0.089	-0.077	0.092	-0.052	0.049	0.195**
CONT 7	0.096	0.098	0.157*	0.047	0.012	-0.108
CONT 8	0.189**	-0.010	0.190**	0.274***	-0.140*	-0.077
AUT 8	0.034	0.233***	-0.078	0.068	0.036	-0.349***
IMP 8	-0.059	-0.124*	0.225***	-0.011	-0.053	0.274***
CONT 9	0.216**	0.002	0.056	0.266***	-0.179**	-0.215**
IMP 9	-0.149*	-0.165**	0.034	-0.001	0.035	0.405***
AUT 9	0.051	0.218***	-0.132*	-0.012	0.073	-0.250***
AUT 10	-0.015	0.219***	-0.094	0.010	0.122	-0.181**
IMP 10	0.028	-0.071	0.074	0.098	-0.174**	0.082
CONT 10	0.244***	-0.161*	0.125*	0.346***	-0.302***	0.058
AUT 11	0.016	0.343***	-0.137*	0.097	0.034	-0.337***
CONT 11	0.162**	0.029	0.038	0.189**	-0.124*	-0.110
IMP 11	-0.085	-0.197**	0.092	0.005	0.058	0.341***
IMP 12	-0.118	-0.211**	0.0148*	0.022	-0.002	0.260***
CONT 12	0.182**	0.195**	0-.106	0.170**	-0.044	-0.206**

	CONT 1	AUT 1	IMP 1	CONT 2	AUT 2	IMP 2
AUT 12	-0.155*	-0.009	0.001	-0.112	0.114	0.048
CONT 13	0.153*	-0.101	0.0159*	0.181**	-0.104	-0.042
AUT 13	0.092	0.128*	-0.071	0.066	0.071	-0.166**
IMP 13	0.096	-0.108	0.195**	0.124*	-0.050	0.113
CONT 14	0.202**	-0.027	0.029	0.207**	-0.140*	0.028
IMP 14	-0.196**	-0.177**	0.121	-0.103	0.108	0.213**
AUT 14	0.236***	0.125*	-0.016	0.085	0.013	-0.202**
AUT 15	0.131*	0.216**	-0.021	0.234***	-0.080	-0.369***
CONT 15	0.094	0.220***	-0.135*	0.216**	-0.049	-0.140*
IMP 15	-0.018	-0.233***	0.089	-0.071	0.019	0.325***
CONT 16	0.118	-0.119	0.140*	0.164**	-0.139*	0.013
IMP 16	-0.006	-0.152*	0.293***	0.033	-0.011	0.135*
AUT 16	-0.009	0.150*	-0.080	0.052	0.060	-0.140*
IMP 17	-0.030	-0.222***	0.189**	0.027	-0.048	0.338***
AUT 17	-0.056	0.302***	-0.085	0.127*	-0.044	-0.261***
CONT 17	0.132*	0.338***	-0.096	0.196**	-0.050	-0.432***
AUT 18	-0.046	-0.010	-0.002	0.041	-0.037	0.011
IMP 18	0.088	-0.229***	0.229***	0.183**	-0.169**	0.066
CONT 18	0.201**	-0.051	0.214**	0.270***	-0.163**	-0.032
CONT 19	0.121	-0.052	0.047	0.227***	-0.162*	-0.151*
IMP 19	-0.029	-0.187**	0.244***	0.013	-0.029	0.251***
AUT 19	0.193**	0.018	-0.008	0.203**	-0.104	-0.198**

	AUT 3	CONT 3	IMP 3	AUT 4	CONT 4	IMP 4
AUT 3	1.000					
CONT 3	0.443***	1.000				
IMP 3	-0.248***	-0.100	1.000			
AUT 4	0.362***	0.101	-0.294***	1.000		
CONT 4	-0.093	0.035	0.308***	-0.545***	1.000	
IMP 4	-0.190**	-0.026	0.013	-0.208**	0.097	1.000
AUT 5	0.444***	0.149*	-0.269***	0.172**	-0.051	-0.079
IMP 5	-0.003	0.095	0.434***	-0.095	0.184**	0.005
CONT 5	-0.316***	-0.031	0.183**	-0.116	0.097	0.289**
IMP 6	-0.209**	0.002	0.380***	-0.163**	0.170**	0.002
AUT 6	0.478***	0.269***	-0.307***	0.259***	-0.060	-0.151*
CONT 6	-0.021	0.113	0.096	0.035	0.007	0.167**
AUT 7	0.162**	0.209**	-0.074	0.072	0.076	-0.005
IMP 7	-0.165**	0.015	0.310***	-0.057	0.078	0.014

	AUT 3	CONT 3	IMP 3	AUT 4	CONT 4	IMP 4
CONT 7	0.184**	0.200**	0.005	0.159*	-0.062	0.058
CONT 8	0.135*	0.202**	0.257***	-0.044	0.154*	-0.011
AUT 8	0.371***	0.146*	-0.214**	0.285***	-0.175**	-0.125*
IMP 8	-0.128*	0.108	0.156*	-0.094	0.121	0.179**
CONT 9	0.247***	0.232***	0.024	-0.023	0.102	-0.118
IMP 9	-0.357***	0.011	0.255***	-0.132*	0.089	0.246***
AUT 9	0.341***	0.180**	-0.303***	0.204**	-0.170**	-0.029
AUT 10	0.307***	0.015	-0.072	0.241***	-0.147*	-0.130*
IMP 10	-0.088	0.140*	0.119	-0.047	0.106	0.119
CONT 10	-0.057	0.226***	0.115	-0.112	0.243***	0.176**
AUT 11	0.470***	0.128*	-0.293***	0.344***	-0.191**	-0.161**
CONT 11	0.114	0.088	0.000	-0.010	0.119	-0.009
IMP 11	-0.251***	-0.014	0.319***	-0.127*	0.133*	0.163**
IMP 12	-0.200**	-0.005	0.352***	-0.199**	0.213**	0.086
CONT 12	0.315***	0.162**	-0.151*	0.205**	-0.071	-0.133*
AUT 12	-0.072	-0.063	-0.003	0.080	0.008	0.063
CONT 13	0.015	0.185**	0.091	-0.086	0.152*	0.051
AUT 13	0.346***	0.174**	-0.173**	0.196**	0.013	-0.016
IMP 13	-0.120	0.074	0.230***	-0.076	0.139*	0.128*
CONT 14	0.066	0.194**	0.104	-0.061	0.204**	0.002
IMP 14	-0.224***	-0.015	0.277***	-0.159*	0.075	0.136*
AUT 14	0.257***	0.161*	-0.151*	0.071	-0.054	-0.089
AUT 15	0.427***	0.111	-0.236***	0.213**	-0.061	-0.096
CONT 15	0.285***	0.246***	-0.072	0.155*	0.042	-0.094
IMP 15	-0.357***	0.046	0.170**	-0.215**	0.135*	0.159*
CONT 16	-0.050	0.033	0.177**	-0.117	0.201**	0.076
IMP 16	-0.128*	0.047	0.256***	-0.146*	0.170**	0.103
AUT 16	0.281***	0.090	-0.158*	0.158*	-0.133*	-0.040
IMP 17	-0.180**	0.154*	0.354***	-0.175**	0.160*	0.093
AUT 17	0.468***	0.133*	-0.329***	0.298***	-0.175**	-0.092
CONT 17	0.554***	0.182**	-0.298***	0.289***	-0.137*	-0.157*
AUT 18	0.136*	0.152*	-0.050	-0.051	-0.092	-0.017
IMP 18	-0.070	0.129*	0.396***	-0.198**	0.314***	0.069
CONT 18	0.120	0.166**	0.062	-0.075	0.173**	-0.016
CONT 19	0.043	0.157*	0.047	-0.009	0.112	-0.029
IMP 19	-0.235***	0.032	0.272***	-0.176**	0.096	0.143*
AUT 19	0.161**	0.155*	-0.093	0.012	0.149*	0.017

	AUT 5	IMP 5	CONT 5	IMP 6	AUT 6	CONT 6
AUT 5	1.000					
IMP 5	-0.156*	1.000				
CONT 5	-0.436***	0.252**	1.000			
IMP 6	-0.224***	0.331***	0.189**	1.000		
AUT 6	0.355***	-0.075	-0.308***	-0.300***	1.000	
CONT 6	-0.036	0.096	0.170**	0.114	0.009	1.000
AUT 7	-0.001	0.062	-0.043	-0.051	0.253***	0.119
IMP 7	-0.173**	0.228***	0.220***	0.381***	-0.168**	0.069
CONT 7	0.139*	0.059	0.027	-0.004	0.221***	0.104
CONT 8	0.051	0.292***	0.037	0.134*	0.180**	0.153*
AUT 8	0.324***	-0.017	-0.293***	-0.156*	0.310***	-0.036
IMP 8	-0.154*	0.191**	0.190**	0.194**	-0.048	0.192**
CONT 9	0.185**	0.051	-0.221***	0.019	0.236***	0.092
IMP 9	-0.373***	0.214**	0.379***	0.267***	-0.357***	0.098
AUT 9	0.332***	-0.226***	-0.148*	-0.213**	0.254***	-0.036
AUT 10	0.145*	-0.016	-0.125*	-0.162**	0.187**	-0.063
IMP 10	-0.134*	0.085	0.160*	0.163**	-0.049	0.126*
CONT 10	-0.010	0.110	0.015	0.049	0.044	0.180**
AUT 11	0.464***	-0.156*	-0.349***	-0.315***	0.453***	-0.047
CONT 11	0.117	-0.050	-0.085	-0.003	0.120	0.233***
IMP 11	-0.349***	0.332***	0.311***	0.241***	-0.351***	0.039
IMP 12	-0.244***	0.293***	0.222***	0.370***	-0.300***	-0.068
CONT 12	0.223***	-0.050	-0.161*	-0.105	0.304**	0.114
AUT 12	-0.070	0.028	-0.003	0.050	-0.128*	-0.044
CONT 13	0.067	0.174**	0.084	0.116	0.000	0.065
AUT 13	0.196**	-0.037	-0.211**	-0.029	0.194**	0.069
IMP 13	-0.025	0.153*	-0.013	0.053	-0.101	0.133*
CONT 14	0.102	0.033	-0.149*	0.057	0.209**	0.124*
IMP 14	-0.351***	0.244***	0.340***	0.278***	-0.208**	0.010
AUT 14	0.344***	-0.112	-0.261***	-0.075	0.326***	0.092
AUT 15	0.421***	0.015	-0.364***	-0.154*	0.277***	-0.013
CONT 15	0.175**	0.033	-0.071	-0.114	0.238***	0.090
IMP 15	-0.343***	0.106	0.272***	0.207**	-0.179**	0.090
CONT 16	-0.069	0.084	0.030	0.044	-0.057	0.161*
IMP 16	-0.198**	0.296***	0.121	0.213**	-0.102	0.184**
AUT 16	0.230**	-0.142*	-0.204**	-0.142*	0.216**	0.036
IMP 17	-0.296***	0.225***	0.275***	0.450****	-0.264***	0.168**
AUT 17	0.393***	-0.208**	-0.306***	-0.332***	0.361***	-0.017

	AUT 5	IMP 5	CONT 5	IMP 6	AUT 6	CONT 6
CONT 17	0.461***	-0.205**	-0.423***	-0.304***	0.455***	0.007
AUT 18	0.176**	-0.065***	-0.048	-0.116	0.126*	0.069
IMP 18	-0.162**	0.384	0.111	0.306***	-0.077	0.087
CONT 18	0.170**	0.097	-0.032	0.086	0.216**	0.311***
CONT 19	0.015	0.083*	0.002	0.220***	0.103	0.176**
IMP 19	-0.248***	0.143	0.222***	0.309***	-0.207**	0.145*
AUT 19	0.182**	0.034	-0.067	0.068	0.252***	0.137*

	AUT 7	IMP 7	CONT 7	CONT 8	AUT 8	IMP 8
AUT 7	1.000					
IMP 7	-0.438***	1.000				
CONT 7	0.187**	-0.132*	1.000			
CONT 8	0.099	0.212**	0.224***	1.000		
AUT 8	0.070	-0.079	0.181**	0.024	1.000	
IMP 8	0.096	0.080	0.043	0.017	-0.117	1.000
CONT 9	0.067	0.120	0.051	0.270***	0.077	0.026
IMP 9	-0.072	0.277***	0.004	0.060	-0.257***	0.168**
AUT 9	0.040	-0.164**	0.106	-0.090	0.405***	-0.137*
AUT 10	-0.014	-0.098	0.122	0.029	0.297***	-0.188**
IMP 10	0.235***	0.067	0.066	0.102	-0.221***	0.288***
CONT 10	0.213**	0.012	0.133*	0.249***	-0.084	0.247***
AUT 11	0.156*	-0.252***	0.113	0.012	0.495***	-0.198**
CONT 11	0.060	-0.018	0.210**	0.267***	-0.018	-0.024
IMP 11	0.005	0.235***	-0.051	0.094	-0.206**	0.247***
IMP 12	-0.106	0.327***	-0.022	0.088	-0.224***	0.274***
CONT 12	0.155*	-0.064	0.161*	0.141*	0.182**	-0.029
AUT 12	-0.018	0.012	-0.016	-0.058	0.083	0.067
CONT 13	0.133*	-0.007	0.154*	0.180**	-0.022	0.203**
AUT 13	0.011	-0.064	0.043	0.056	0.352	0.032
IMP 13	-0.050	0.085	0.105	0.192**	-0.129***	0.143*
CONT 14	0.047	0.073	0.098	0.149*	0.055*	0.117
IMP 14	-0.067	0.296***	-0.036	0.094	-0.206	0.269***
AUT 14	-0.004	-0.061	0.156*	0.029	0.315**	-0.079
AUT 15	0.129*	-0.179**	0.091	0.063	0.282***	-0.120
CONT 15	0.104	-0.129*	0.026	0.081	0.308***	0.031
IMP 15	-0.012	0.187**	-0.050	0.003	-0.288***	0.302***
CONT 16	0.050	0.116	0.167**	0.347***	-0.098***	0.121
IMP 16	0.122	0.175**	0.256***	0.197**	-0.138	0.249***
AUT 16	0.094	-0.158*	0.025	-0.065	0.320*	-0.079

	AUT 7	IMP 7	CONT 7	CONT 8	AUT 8	IMP 8
IMP 17	0.073	0.264***	0.077	0.104	-0.168***	0.354***
AUT 17	0.093	-0.202**	0.121	-0.021	0.217**	-0.126*
CONT 17	0.100	-0.177**	0.120	0.021	0.335**	-0.157*
AUT 18	0.075	-0.142*	0.194**	0.027	0.154***	0.021
IMP 18	0.053	0.282***	0.047	0.253***	-0.120*	0.263***
CONT 18	0.081	0.107	0.217**	0.162*	-0.029	0.152*
CONT 19	0.204**	0.087	0.138*	0.186**	0.039	0.136*
IMP 19	-0.063	0.334***	-0.050	0.058	-0.154*	0.089
AUT 19	0.168**	-0.085	0.121	0.117	0.168**	0.100

	CONT 9	IMP 9	AUT 9	AUT 10	IMP 10	CONT 10
CONT 9	1.000					
IMP 9	-0.260**	1.000				
AUT 9	-0.071	-0.379**	1.000			
AUT 10	0.050	-0.147*	0.134*	1.000		
IMP 10	0.025	0.120	-0.036	-0.510***	1.000	
CONT 10	0.134*	0.129*	-0.026	-0.364***	0.419***	1.000
AUT 11	0.123*	-0.391***	0.466***	0.318***	-0.188**	-0.157*
CONT 11	0.337***	-0.088	-0.018	0.033	0.113	0.182**
IMP 11	-0.053	0.521***	-0.336***	-0.067	0.060	0.097
IMP 12	-0.032	0.316***	-0.281***	-0.206**	0.110	0.090
CONT 12	0.202**	-0.178**	0.207**	0.197**	-0.027	0.095
AUT 12	-0.146*	0.218***	-0.018	-0.030	-0.010	-0.005
CONT 13	0.180**	0.057	-0.052	-0.076	0.164**	0.240***
AUT 13	0.054	-0.136*	0.346***	0.314***	-0.175**	-0.113
IMP 13	0.047	0.158*	-0.127*	-0.014	0.009	0.236***
CONT 14	0.375***	0.010	-0.021	0.013	0.078	0.183**
IMP 14	-0.089	0.353***	-0.278***	-0.073	0.095	0.083
AUT 14	0.198**	-0.234***	0.457***	0.102	-0.107	-0.018
AUT 15	0.222***	-0.328***	0.242***	0.148*	-0.083	-0.024
CONT 15	0.108	-0.090	0.237***	0.239***	-0.110	-0.017
IMP 15	0.006	0.338***	-0.301***	-0.176**	0.217***	0.184**
CONT 16	0.274***	0.092	-0.106	-0.019	0.124*	0.246**
IMP 16	0.082	0.199**	-0.174**	-0.012	0.150*	0.191**
AUT 16	-0.036	-0.105	0.286***	0.259***	-0.220***	-0.059
IMP 17	-0.069	0.287***	-0.151*	-0.018	0.184**	0.121
AUT 17	0.169**	-0.277***	0.265***	0.244***	-0.144*	-0.063
CONT 17	0.267***	-0.439***	0.397***	0.270***	-0.158*	-0.090
AUT 18	0.104	-0.085	0.143*	0.149*	-0.021	-0.020

	CONT 9	IMP 9	AUT 9	AUT 10	IMP 10	CONT 10
IMP 18	0.002	0.187	-0.164**	-0.136*	0.214**	0.252***
CONT 18	0.293***	-0.108**	0.069	-0.004	0.170**	0.224***
CONT 19	0.154*	0.048	0.005	-0.084	0.228***	0.241***
IMP 19	-0.050	0.295	-0.242***	-0.144*	0.141*	0.189**
AUT 19	0.217***	-0.107***	0.157*	0.001	0.075	0.165**

	AUT 11	CONT 11	IMP 11	IMP 12	CONT 12	AUT 12
AUT 11	1.000					
CONT 11	-0.033	1.000				
IMP 11	-0.389***	-0.088	1.000			
IMP 12	-0.297***	-0.072	0.380***	1.000		
CONT 12	0.262***	0.200**	-0.198**	-0.445***	1.000	
AUT 12	-0.104	-0.066	0.237***	0.174**	-0.403***	1.000
CONT 13	-0.041	0.224***	0.012	0.051	0.133*	-0.125*
AUT 13	0.370***	0.11	-0.142*	-0.089	0.245***	-0.002
IMP 13	-0.242***	0.166**	0.120	0.115	-0.003	0.002
CONT 14	-0.016	0.215**	-0.030	0.064	0.090	-0.026
IMP 14	-0.377***	-0.071	0.421***	0.336***	-0.263***	0.152*
AUT 14	0.294***	0.099	-0.272***	-0.228**	0.195**	-0.047
AUT 15	0.438***	0.152*	-0.230***	-0.242***	0.231***	-0.003
CONT 15	0.313***	0.167**	-0.142*	-0.175**	0.168**	-0.017
IMP 15	-0.405***	0.024	0.370***	0.306***	-0.218***	0.144*
CONT 16	-0.120	0.214**	0.110	0.76	0.052	-0.072
IMP 16	-0.270***	0.133*	0.215**	0.266***	-0.008	0.069
AUT 16	0.302***	0.011	-0.077	-0.071	0.134*	-0.043
IMP 17	-0.280***	0.031	0.280***	0.444***	-0.097	0.023
AUT 17	0.458***	0.079	-0.319***	-0.225***	0.243***	-0.045
CONT 17	0.477***	0.100	-0.362***	-0.327***	0.419***	-0.165**
AUT 18	0.162**	0.121	0.037	-0.013	0.105	-0.056
IMP 18	-0.204**	0.095	0.192**	0.423***	-0.107	0.033
CONT 18	0.136*	0.285***	-0.045	0.012	0.176**	-0.107
CONT 19	-0.021	0.245***	0.037	0.075	0.145*	-0.027
IMP 19	-0.319***	0.015	0.299***	0.271***	-0.131*	0.002
AUT 19	0.226***	0.255***	-0.102	-0.088	0.238***	-0.087

	CONT 13	AUT 13	IMP 13	CONT 14	IMP 14	AUT 14
CONT 13	1.000					
AUT 13	-0.039	1.000				
IMP 13	0.225***	0.026	1.000			

	CONT 13	AUT 13	IMP 13	CONT 14	IMP 14	AUT 14
CONT 14	0.152*	0.088	0.097	1.000		
IMP 14	0.073	-0.196**	0.137*	-0.121	1.000	
AUT 14	0.047	0.342***	0.017	0.254***	-0.300***	1.000
AUT 15	0.026	0.175**	0.059	0.032	-0.308***	0.288***
CONT 15	-0.019	0.213**	0.032	0.104	-0.141*	0.234***
IMP 15	0.146*	-0.169**	0.118	0.183**	0.345***	-0.218***
CONT 16	0.164**	-0.018	0.252***	0.260***	0.025	-0.039
IMP 16	0.127*	-0.084	0.247***	0.175**	0.282***	-0.059
AUT 16	-0.011	0.308***	-0.060	0.052	-0.166**	0.258***
IMP 17	0.134*	-0.028	0.120	0.083	0.246**	-0.129
AUT 17	-0.081	0.232***	0.049	-0.057	-0.260***	0.172**
CONT 17	-0.011	0.320***	-0.003	0.079	-0.413***	0.367***
AUT 18	0.015	0.097	-0.038	0.048	-0.106	0.120
IMP 18	0.172**	-0.053	0.197**	0.103	0.253***	-0.116
CONT 18	0.124*	-0.008	0.165**	0.228***	0.000	0.134*
CONT 19	0.219***	-0.056	0.014	0.200**	0.034	0.104
IMP 19	0.105	-0.110	0.184**	0.140*	0.290***	-0.196**
AUT 19	0.188**	0.193**	-0.055	0.269***	-0.143*	0.214**

	AUT 15	CONT 15	IMP 15	CONT 16	IMP 16	AUT 16
AUT 15	1.000					
CONT 15	0.237***	1.000				
IMP 15	-0.452***	-0.087	1.000			
CONT 16	0.035	-0.001	0.213**	1.000		
IMP 16	-0.107	-0.046	0.237***	0.429***	1.000	
AUT 16	0.149*	0.188**	-0.253***	-0.285***	-0.191**	1.000
IMP 17	-0.322***	-0.063	0.322***	0.079	0.236***	-0.003
AUT 17	0.476***	0.256***	-0.401***	0.012	-0.146*	0.198**
CONT 17	0.496***	0.279***	-0.408***	-0.002	-0.203**	0.279***
AUT 18	0.201**	0.118	0.007	-0.051	0.036	0.133*
IMP 18	-0.097	-0.020	0.147*	0.228***	0.301***	-0.057
CONT 18	0.145*	0.069	-0.023	0.209**	0.211**	-0.010
CONT 19	0.097	0.082	0.106	0.126*	0.167**	0.095
IMP 19	-0.174**	-0.195**	0.321***	0.172**	0.224***	-0.120
AUT 19	0.133*	0.135*	0.023	0.06	-0.011	0.180**

	IMP 17	AUT 17	CONT 17	AUT 18	IMP 18	CONT 18
IMP 17	1.000					
AUT 17	-0.357***	1.000				
CONT 17	-0.304***	0.598***	1.000			
AUT 18	0.082	0.202**	0.114	1.000		
IMP 18	0.388***	-0.182**	-0.189**	-0.103	1.000	
CONT 18	0.080	0.099	0.108	0.064	0.281***	1.000
CONT 19	0.119	-0.027	0.003	0.018	0.215***	0.310***
IMP 19	0.338***	-0.236***	-0.275***	-0.037	0.245***	0.070
AUT 19	-0.059	0.130*	0.218***	0.047	0.078	0.310***

	CONT 19	IMP 19	AUT 19
CONT 19	1.000		
IMP 19	-0.044	1.000	
AUT 19	0.570***	-0.187**	1.000

* = significant at $P < 0.05$; ** = significant at $P < 0.01$; *** = Significant at $P < 0.001$

Rotated Factor Solution

	Component		
	1	2	3
CONT 1	-0.220	-0.098	0.550
AUT 1	-0.101	0.608	-0.262
IMP 1	0.367	-0.024	0.208
CONT 2	-0.166	-0.038	0.706
AUT 2	0.214	0.267	-0.596
IMP 2	0.447	-0.337	-0.199
AUT 3	-0.268	0.653	0.206
CONT 3	0.143	0.378	0.341
IMP 3	0.497	-0.263	0.174
AUT 4	-0.019	0.645	-0.338
CONT 4	0.066	-.0381	0.529
IMP 4	0.182	-0.205	0.060
AUT 5	-0.428	0.440	0.19
IMP 5	0.519	0.040	0.166
CONT 5	0.484	-0.261	-0.155
IMP 6	0.531	-0.146	0.115
AUT 6	-0.302	0.521	0.266
CONT 6	0.291	0.152	0.263
AUT 7	0.010	0.186	0.277
IMP 7	0.478	-0.078	-0.005

CONT 7	0.176	0.366	0.223
CONT 8	0.271	0.168	0.443
AUT 8	-0.187	0.582	-0.011
IMP 8	0.468	-0.020	0.179
CONT 9	-0.069	0.187	0.503
IMP 9	0.568	-0.264	-0.114
AUT 9	-0.322	0.469	-0.011
AUT 10	-0.063	0.491	-0.162
IMP 10	0.211	-0.198	0.316
CONT 10	0.166	-0.142	0.553
AUT 11	-0.423	0.613	0.018
CONT 11	0.023	0.138	0.452
IMP 11	0.586	-0.214	-0.077
IMP 12	0.565	-0.222	0.012
CONT 12	-0.202	0.398	0.283
AUT 12	0.200	-0.003	-0.224
CONT 13	0.183	0.025	0.400
AUT 13	-0.070	0.498	0.036
IMP 13	0.273	-0.022	0.259
CONT 14	0.102	0.109	0.450
IMP 14	0.575	-0.205	-0.120
AUT 14	-0.232	0.415	0.215
AUT 15	-0.352	0.441	0.236
CONT 15	0.080	0.425	0.157
IMP 15	0.484	-0.328	0.058
CONT 16	0.229	-0.048	0.421
IMP 16	0.519	-0.014	0.262
AUT 16	-0.131	0.428	-0.048
IMP 17	0.624	-0.093	0.105
AUT 17	-0.375	0.502	0.066
CONT 17	-0.464	0.574	0.192
AUT 18	-0.061	0.253	0.078
IMP 18	0.483	-0.093	0.363
CONT 18	0.130	0.175	0.529
CONT 19	0.175	0.129	0.455
IMP 19	0.472	-0.217	0.070
AUT 19	-0.051	0.258	0.447

Appendix 3C
Revised 12 scenario ECOS

1) You are beginning a new exercise programme. You are likely to:
   1. Attend a structured exercise class where an exercise leader is telling you what to do. (CONT)
   2. Attend a gym where you decide for yourself which exercises to complete. (AUT)
   3. Tag along with your friends and do what they do. (IMP)

2) You are beginning a new exercise programme. You are likely to:
   1. Feel interested in the new challenge and look forward to feeling its benefits. (AUT)
   2. Look forward to gaining the rewards such as weight loss, improving your appearance, etc. (CONT)
   3. Feel stressed and anxious about the new situation. (IMP)

3) You have just been told that your exercise ability is poor. Your initial reaction would be:
   1. "I wonder why I did so poorly" and feel determined to try harder. (AUT)
   2. "I can't do anything right" and feel sad. (IMP)
   3. "Why did I need to be told this?" and feel annoyed. (CONT)

4) You are asked to keep a record of all the weekly exercise you have completed in an exercise diary. You are likely to view the diary:
   1. As a reminder of how incapable you are at fulfilling the task. (IMP)
   2. As a way to measure your progress and to feel proud of your achievements. (AUT)
   3. As a reminder that you are going to have to exercise so that there is something written in the diary. (CONT)

5) In order to monitor how well you are doing in an exercise programme you are likely to want:
   1. To be given a lot of praise and encouragement from others. (CONT)
   2. To evaluate your own performance and provide yourself with positive feedback. (AUT)
   3. To just hope that what you are doing is correct. (IMP)

6) You have been exercising regularly for 6 months but recently you have been missing sessions and are finding it hard to get motivated to exercise. You are likely to:
   1. Approach someone to help motivate you. (CONT)
   2. Ignore the problem, nothing can be done to improve your motivation. (IMP)
   3. Employ your own strategies to motivate yourself. (AUT)

7) You are going to see a fitness instructor to get an exercise programme for you to follow. You would likely:
   1. Want to be involved in making decisions about what goes in the programme. (AUT)
   2. Want the programme to be devised the way it had been done in the past. (CONT)
   3. Want to let the fitness instructor decide what exercises you should do. (IMP)

8) You have been told that setting goals is a good way to motivate yourself to exercise. You would likely:
   1. Set your own realistic but challenging goals. (AUT)
   2. Make someone important to me set goals for me to aim for/achieve. (CONT)
   3. Not set goals because you may not be able to live up to them. (IMP)

9) During a discussion with an exercise counsellor he/she presents many options on the best way for you to exercise to achieve fitness and health benefits. It is likely that your first thought would be:
   1. What do you (the exercise leader) think I should do? (CONT)
   2. What do I think is the best option for me? (AUT)
   3. What has everyone else done in the past? (IMP)

10) You are not physically active at the moment but you are being encouraged to take up exercise. Your initial thought is likely to be:
   1. It could be fun. (AUT)
   2. Will all the effort be worthwhile? (CONT)
   3. Nothing will increase my physical activity levels. (IMP)

11) During an exercise session how hard you are working out is likely to be governed by:
   1. The intensity you have been told to exercise at. (CONT)
   2. How hard everyone else is exercising. (IMP)
   3. How you are feeling whilst exercising at the intensity you choose. (AUT)

12) At the initial consultation with a fitness instructor he/she suggests that you have a fitness assessment. Your reaction is likely to be:
   1. That it will just confirm how unfit you are. (IMP)
   2. That it will be interesting to know how fit you are. (AUT)
   3. What will I achieve/gain by doing it? (CONT)

Appendix 3D
Correlation matrix of revised 12 scenario ECOS (second pilot study)

	CONT 1	AUT 1	IMP 1	AUT 2	CONT 2	IMP 2
CONT 1	1.000					
AUT 1	-0.105	1.000				
IMP 1	0.182*	-0.054	1.000			
AUT 2	0.256**	0.283**	-0.089	1.000		
CONT 2	0.181*	0.101	0.109	0.514**	1.000	
IMP 2	0.140	-0.115	0.131	-0.097	-0.001	1.000
AUT 3	0.069	0.149	-0.182*	0.367**	0.233**	-0.178*
IMP 3	0.122	-0.169	0.040	0.019	0.089	0.429**
CONT 3	-0.020	-0.012	0.149	-0.017	0.013	0.149
IMP 4	0.012	-0.331**	0.100	-0.210*	-0.102	0.166
AUT 4	0.101	0.248**	-0.108	0.438**	0.323**	-0.099
CONT 4	-0.088	0.080	-0.058	0.044	0.119	0.088
CONT 5	0.279**	0.074	0.158	0.213*	0.099	0.097
AUT 5	-0.069	0.333**	-0.065	0.289**	0.082	-0.063
IMP 5	0.050	-0.115	0.247**	-0.231**	-0.052	0.252**
CONT 6	0.344**	0.216*	0.104	0.391**	0.181*	-0.077
IMP 6	-0.133	-0.169	0.178*	-0.271**	-0.129	0.154
AUT 6	-0.048	0.029	-0.230*	0.212*	0.172	-0.009
AUT 7	-0.203*	0.270**	-0.002	0.152	0.150	0.001
IMP 7	0.030	0.177*	0.012	0.284**	0.221*	0.072
CONT 7	0.373**	-0.227*	0.064	0.150	0.199*	0.144
AUT 8	-0.059	0.253**	-0.121	0.364**	0.197*	-0.133
CONT 8	0.245**	0.008	0.176	0.071	0.039	-0.015
IMP 8	-0.015	-0.167	0.099	-0.384**	-0.195*	0.243**
CONT 9	0.068	0.044	0.071	0.134	0.014	0.250**
AUT 9	-0.084	-0.069	0.090	0.051	0.107	0.038
IMP 9	0.216*	0.008	0.292**	-0.087	-0.009	0.117
AUT 10	0.136	0.132	-0.055	0.509**	0.179*	-0.230**
CONT 10	0.037	-0.065	0.130	-0.044	0.029	0.105
IMP 10	0.019	0.022	0.045	-0.241**	-0.163	0.045
CONT 11	0.028	0.057	-0.028	0.225*	0.302**	-0.035
IMP 11	-0.014	-0.086	0.255**	-0.067	0.068	0.212*
AUT 11	0.003	0.091	0.163	0.214*	0.093	-0.100
IMP 12	-0.066	-0.212*	0.194*	-0.351**	0.009	0.308**
AUT 12	0.054	0.084	-0.005	0.112	0.133	-0.033
CONT 12	-0.136	-0.104	0.061	0.020	0.154	0.007

	AUT 3	IMP 3	CONT 3	IMP 4	AUT 4	CONT 4
AUT 3	1.000					
IMP 3	-0.059	1.000				
CONT 3	-0.174	0.429**	1.000			
IMP 4	-0.150	0.298**	0.123	1.000		
AUT 4	0.294**	-0.053	0.001	-0.328**	1.000	
CONT 4	0.075	0.128	-0.125	0.071	-0.076	1.000
CONT 5	0.092	0.223*	0.041	0.005	0.264**	0.095
AUT 5	0.421**	0.024	0.032	-0.217*	0.323**	0.104
IMP 5	-0.043	0.329**	0.170	0.200*	-0.250**	0.046
CONT 6	0.166	-0.067	-0.167	-0.120	0.373**	-0.046
IMP 6	-0.289**	0.184*	0.233**	0.282**	-0.263**	-0.021
AUT 6	0.389**	0.034	-0.141	-0.257**	0.268**	0.077
AUT 7	0.276**	-0.059	-0.014	-0.133	0.153	0.184*
IMP 7	-0.113	0.184*	0.167	-0.029	0.245**	-0.088
CONT 7	0.031	-0.020	-0.154	0.170	-0.083	0.088
AUT 8	0.453**	-0.233**	-0.254**	-0.482**	0.316**	0.050
CONT 8	-0.137	0.065	-0.052	0.173	0.067	0.062
IMP 8	-0.182*	0.225*	0.190*	0.390**	-0.247**	-0.020
CONT 9	0.055	0.175	-0.010	-0.001	0.047	0.196*
AUT 9	0.226*	0.130	0.080	-0.040	0.166	0.042
IMP 9	-0.306**	0.170	0.244**	0.285**	0.009	-0.107
AUT 10	0.411**	-0.088	0.037	-0.207*	0.272**	0.001
CONT 10	-0.165	0.185*	0.190*	0.171	0.004	0.087
IMP 10	-0.383**	0.132	0.272**	0.324**	-0.213*	-0.030
CONT 11	0.202*	0.130	0.070	0.023	0.279**	0.064
IMP 11	0.031	0.113	0.149	0.010	0.116	0.076
AUT 11	0.233**	-0.041	-0.041	-0.184*	0.145	0.023
IMP 12	-0.415**	0.185*	0.137	0.476*	-0.367**	0.171
AUT 12	0.318**	-0.054	-0.010	-0.157	0.306**	-0.012
CONT 12	0.166	0.061	0.071	-0.124	0.264**	0.000

	CONT 5	AUT 5	IMP 5	CONT 6	IMP 6	AUT 6
CONT 5	1.000					
AUT 5	0.145	1.000				
IMP 5	0.013	0.010	1.000			
CONT 6	0.234**	0.190*	-0.173	1.000		
IMP 6	-0.109	-0.251**	0.240**	-0.291**	1.000	
AUT 6	-0.041	0.305**	-0.046	-0.036	-0.357**	1.000

	CONT 5	AUT 5	IMP 5	CONT 6	IMP 6	AUT 6
AUT 7	0.047	0.278**	-0.034	0.126	-0.150	0.170
IMP 7	0.110	0.052	0.014	0.146	0.085	-0.013
CONT 7	0.130	-0.005	-0.009	0.178*	-0.093	-0.098
AUT 8	-0.091	0.289**	-0.171	0.144	-0.320**	0.397**
CONT 8	0.185*	-0.001	-0.074	0.335**	-0.082	-0.057
IMP 8	0.016	-0.152	0.312**	-0.272**	0.290**	-0.305**
CONT 9	0.178*	0.232**	-0.064	0.269**	-0.135	-0.075
AUT 9	0.140	0.154	0.051	-0.065	-0.116	0.254**
IMP 9	0.210*	-0.004	0.085	0.194*	-0.017	-0.225*
AUT 10	0.171	0.269**	-0.217*	0.210*	-0.257**	0.130
CONT 10	-0.021	-0.093	0.109	0.095	0.099	-0.136
IMP 10	-0.005	-0.198*	0.076	-0.014	0.339**	-0.275**
CONT 11	0.182*	0.198*	0.022	0.409**	-0.120	0.196*
IMP 11	-0.001	0.059	0.194*	0.166	0.088	0.153
AUT 11	0.110	0.183*	0.068	-0.002	-0.143	0.199*
IMP 12	-0.054	-0.251**	0.157	-0.223*	0.346**	-0.285**
AUT 12	0.165	0.307**	0.031	0.121	-0.244**	0.158
CONT 12	0.103	0.251**	0.143	0.073	-0.115	0.175

	AUT 7	IMP 7	CONT 7	AUT 8	CONT 8	IMP 8
AUT 7	1.000					
IMP 7	0.187*	1.000				
CONT 7	-0.230*	-0.107	1.000			
AUT 8	0.408**	-0.058	-0.040	1.000		
CONT 8	0.022	0.112	0.063	-0.217*	1.000	
IMP 8	-0.072	0.080	0.059	-0.499**	0.044	1.000
CONT 9	0.191*	0.027	0.350**	0.124	0.107	-0.019
AUT 9	0.249**	-0.033	-0.004	0.232**	0.066	-0.172
IMP 9	-0.147	0.307**	0.029	-0.352**	0.417**	0.196*
AUT 10	0.184*	0.084	0.113	0.389**	-0.110	-0.266**
CONT 10	-0.123	0.212*	0.152	-0.232**	0.216*	0.237**
IMP 10	-0.170	0.195*	-0.002	-0.433**	0.160	0.327**
CONT 11	0.074	0.120	0.210*	0.019	0.193*	0.011
IMP 11	0.002	-0.008	-0.114	-0.004	0.163	0.014
AUT 11	0.191*	0.025	0.048	0.325**	0.159	-0.173
IMP 12	-0.232**	-0.039	0.202*	-0.442**	0.146	0.389**
AUT 12	0.254**	-0.121	-0.006	0.260**	-0.008	-0.086
CONT 12	0.131	-0.034	0.080	0.120	0.099	-0.072

	CONT 9	AUT 9	IMP 9	AUT 10	CONT 10	IMP 10
CONT 9	1.000					
AUT 9	0.126	1.000				
IMP 9	0.017	-0.012	1.000			
AUT 10	0.115	0.095	-0.173	1.000		
CONT 10	0.099	-0.157	0.208*	0.005	1.000	
IMP 10	-0.150	-0.149	0.229*	-0.334**	0.168	1.000
CONT 11	0.256**	0.109	0.101	0.024	00.121	0.034
IMP 11	-0.041	-0.075	0.260**	-0.135	0.068	0.076
AUT 11	0.057	0.240**	-0.042	0.179*	-0.041	-0.142
IMP 12	0.077	-0.091	0.208*	-0.383**	0.257**	0.390*
AUT 12	0.169	0.152	-0.004	0.282**	0.049	-0.340**
CONT 12	0.168	0.197*	0.078	0.222*	0.110	-0.295**

	CONT 11	IMP 11	AUT 11	IMP 12	AUT 12	CONT 12
CONT 11	1.000					
IMP 11	0.241**	1.000				
AUT 11	-0.127	0.031	1.000			
IMP 12	0.025	0.158	-0.088	1.000		
AUT 12	0.183*	0.134	0.223*	-0.295**	1.000	
CONT 12	0.272**	0.261**	0.188*	-0.084	0.510**	1.000

* = significant at $P < 0.05$; ** = significant at $P < 0.01$; *** = Significant at $P < 0.001$

Rotated Factor Solution

	Component		
	1	2	3
CONT 1	-0.131	-0.084	0.562
AUT 1	0.162	-0.342	0.153
IMP 1	-0.033	0.345	0.243
AUT 2	0.347	-0.436	0.508
CONT 2	0.307	-0.083	0.401
IMP 2	0.042	0.532	0.077
AUT 3	0.624	-0.278	0.008
IMP 3	0.120	0.602	0.180
CONT 3	0.017	0.458	0.090
IMP 4	-0.344	0.512	0.080
AUT 4	0.446	-0.298	0.399

CONT 4	0.183	0.153	-0.005
CONT 5	0.169	0.092	0.484
AUT 5	0.581	-0.084	0.144
IMP 5	0.114	0.595	-0.131
CONT 6	0.099	-0.291	0.706
IMP 6	-0.340	0.432	-0.207
AUT 6	0.564	-0.158	-0.122
AUT 7	0.515	-0.055	-0.041
IMP 7	-0.028	0.042	0.406
CONT 7	-0.067	0.044	0.386
AUT 8	0.608	-0.479	-0.121
CONT 8	-0.106	0.133	0.541
IMP 8	-0.300	0.562	-0.041
CONT 9	0.266	0.143	0.323
AUT 9	0.479	0.139	-0.053
IMP 9	-0.221	0.346	0.513
AUT 10	0.412	-0.378	0.212
CONT 10	-0.127	0.322	0.318
IMP 10	-0.539	0.291	0.138
CONT 11	0.286	0.128	0.471
IMP 11	0.211	0.379	0.150
AUT 11	0.412	-0.034	0.033
IMP 12	-0.396	0.584	0.028
AUT 12	0.606	0.028	0.093
CONT 12	0.578	0.255	0.095

Appendix 3E
Completed version of ECOS

(The final 7 scenario version does not contain scenarios 2 and 6)

1) You are beginning a new exercise programme. You are likely to:
   1. Attend a structured exercise class where an exercise leader is telling you what to do. (CONT)
   2. Attend a gym where you decide for yourself which exercises to complete. (AUT)
   3. Tag along with your friends and do what they do. (IMP)

2) You are beginning a new exercise programme. You are likely to:
   1. Feel interested in the new challenge and look forward to feeling its benefits. (AUT)
   2. Look forward to losing weight, improving your appearance, increasing your fitness, etc. (CONT)
   3. Feel stressed and anxious about the new situation. (IMP)

3) You are asked to keep a record of all the weekly exercise you have completed in an exercise diary. You are likely to view the diary:
   1. As a reminder of how incapable you are at fulfilling the task. (IMP)
   2. As a way to measure your progress and to feel proud of your achievements. (AUT)
   3. As a way of pressurising yourself to exercise. (CONT)

4) In order to monitor how well you are doing in an exercise programme you are likely to want
   1. To be given a lot of praise and encouragement from others. (CONT)
   2. To evaluate your own performance and provide yourself with positive feedback. (AUT)
   3. To just hope that what you are doing is correct. (IMP)

5) You have been exercising regularly for 6 months but recently you have been missing sessions and are finding it hard to get motivated to exercise. You are likely to:
   1. Approach someone to help motivate you. (CONT)
   2. Ignore the problem, nothing can be done to improve your motivation. (IMP)
   3. Employ your own strategies to motivate yourself. (AUT)

6) If you were going to see a fitness instructor to get an exercise programme to follow, you would likely:
   1. Want to be involved in making decisions about what goes in the programme. (AUT)
   2. Want the programme to be devised the way it had been done in the past. (IMP)
   3. Want to let the fitness instructor decide what exercises you should do. (CONT)

7) You have been told that setting goals is a good way to motivate yourself to exercise. You would likely:
   1. Set your own realistic but challenging goals. (AUT)
   2. Make someone important to me set goals for me to aim for. (CONT)
   3. Not set goals because you may not be able to live up to them. (IMP)

8) During a discussion with an exercise counsellor he/she presents many options on the best way for you to exercise to achieve fitness and health benefits. It is likely that your first thought would be:
   1. What do you (the exercise leader) think I should do? (CONT)
   2. What do I think is the best option for me? (AUT)
   3. What has everyone else done in the past? (IMP)

9) During an exercise session how hard you are working out is likely to be governed by:
   1. The intensity you have been told to exercise at. (CONT)
   2. What everyone around you is doing. (IMP)
   3. How you are feeling whilst exercising at the intensity you choose. (AUT)

Appendix 3F
Variance-Covariance matrix of 7 scenario ECOS obtained from PRELIS 3.0

	CONT 1	AUT 1	IMP 1	AUT 2	CONT 2	IMP 2
CONT 1	5.232					
AUT 1	-0.778	4.790				
IMP 1	0.486	-0.254	3.175			
AUT 2	0.965	0.985	-0.199	2.865		
CONT 2	0.973	0.795	0.179	1.361	2.195	
IMP 2	-0.026	-0.243	0.728	-0.601	-0.066	1.983
IMP 3	0.574	-0.412	0.298	-0.460	-0.082	0.752
AUT 3	0.485	0.814	-0.108	1.096	0.933	-0.295
CONT 3	0.284	0.118	0.337	0.287	0.519	0.438
CONT 4	0.810	-0.215	0.540	0.150	0.272	0.798
AUT 4	-0.089	1.047	-0.140	1.117	0.659	-0.296
IMP 4	0.069	-0.245	0.867	-0.284	0.010	0.612
CONT 5	0.849	0.106	0.303	0.193	0.233	0.341
IMP 5	-0.130	-0.594	0.585	-0.713	-0.397	0.524
AUT 5	-0.381	1.034	-0.490	0.897	0.428	-0.649
AUT 6	-0.010	0.798	-0.312	0.856	0.459	-0.343
IMP 6	0.308	0.128	0.269	-0.007	0.055	0.162
CONT 6	0.916	-0.702	0.619	-0.146	0.167	0.317
AUT 7	-0.060	0.669	-0.288	0.886	0.489	-0.617
CONT 7	0.436	0.090	0.600	-0.242	0.090	0.565
IMP 7	-0.026	-0.539	0.408	-0.679	-0.340	0.546
CONT 8	0.850	-0.265	0.581	0.285	0.301	0.225
AUT 8	-0.034	0.390	-0.176	0.634	0.340	-0.216
IMP 8	0.193	-0.224	0.544	-0.321	-0.072	0.424
CONT 9	0.638	-0.005	0.318	0.290	0.333	0.190
IMP 9	0.665	-0.550	0.987	-0.216	0.074	0.570
AUT 9	0.185	0.415	-0.078	0.650	0.376	-0.244

	IMP 3	AUT 3	CONT 3	CONT 4	AUT 4	IMP 4
IMP 3	3.297					
AUT 3	-0.468	3.497				
CONT 3	0.466	0.962	3.518			
CONT 4	0.775	0.454	0.913	3.146		
AUT 4	-0.346	1.184	0.312	-0.055	2.729	

	IMP 3	AUT 3	CONT 3	CONT 4	AUT 4	IMP 4
IMP 4	0.649	-0.456	0.251	0.190	-0.661	3.678
CONT 5	0.255	0.663	0.405	0.909	0.220	0.003
IMP 5	0.812	-0.731	0.140	0.359	-0.627	0.809
AUT 5	-0.455	0.732	-0.111	-0.400	1.164	-0.709
AUT 6	-0.336	0.619	0.301	0.074	0.826	-0.514
IMP 6	0.506	0.123	0.422	0.555	-0.011	0.376
CONT 6	0.713	-0.161	0.373	0.723	-0.507	0.648
AUT 7	-0.553	0.995	0.449	-0.267	1.019	-0.750
CONT 7	0.537	0.157	0.362	0.911	-0.092	0.379
IMP 7	0.666	-0.871	-0.005	0.398	-0.631	0.977
CONT 8	0.308	0.211	0.717	0.771	-0.127	0.639
AUT 8	-0.216	0.436	0.277	0.042	0.642	-0.228
IMP 8	0.342	-0.118	0.307	0.409	-0.248	0.798
CONT 9	0.290	0.639	0.759	0.943	0.282	0.091
IMP 9	0.594	-0.277	0.474	0.648	-0.211	0.820
AUT 9	-0.016	0.251	0.179	0.024	0.515	0.060

	CONT 5	IMP 5	AUT 5	AUT 6	IMP 6	CONT 6
CONT 5	3.006					
IMP 5	-0.387	2.748				
AUT 5	-0.306	-0.958	2.828			
AUT 6	0.248	-0.461	1.025	2.870		
IMP 6	0.150	0.406	0.027	0.009	2.137	
CONT 6	0.383	0.586	-0.604	-0.936	0.519	3.296
AUT 7	0.081	-0.614	1.200	1.030	-0.039	-0.234
CONT 7	0.729	0.321	-0.305	-0.158	0.445	0.649
IMP 7	-0.051	0.849	-0.647	-0.485	0.161	0.578
CONT 8	0.520	0.265	-0.001	-0.009	0.513	1.259

	CONT 5	IMP 5	AUT 5	AUT 6	IMP 6	CONT 6
AUT 8	0.023	-0.198	0.690	1.044	-0.070	-0.218
IMP 8	0.199	0.521	-0.326	-0.378	0.691	0.511
CONT 9	0.709	0.002	0.195	-0.030	0.414	0.903
IMP 9	0.292	0.633	-0.494	-0.551	0.439	0.734
AUT 9	-0.051	-0.036	0.589	0.636	-0.010	-0.111

	AUT 7	CONT 7	IMP 7	CONT 8	AUT 8	IMP 8
AUT 7	2.677					
CONT 7	-0.349	2.786				
IMP7	-1.217	0.229	2.856			
CONT 8	-0.039	0.410	0.304	2.835		
AUT 8	0.741	-0.189	-0.202	-0.003	2.327	
IMP 8	-0.413	0.535	0.619	0.580	-0.077	2.311
CONT 9	0.284	0.600	0.067	0.823	0.188	0.336
IMP 9	-0.328	0.671	0.531	0.782	-0.331	0.932
AUT 9	0.564	-0.269	-0.089	0.155	0.577	-0.140

	CONT 9	IMP 9	AUT 9
CONT 9	2.833		
IMP 9	0.766	2.765	
AUT 9	0.140	-0.149	1.759

Appendix 4

Qualitative Interview Questions

Appendix 4A

Qualitative questions (Study 1)

Prescribed intensity exercise session

1. Did you feel comfortable exercising at the prescribed intensity?
   If not - can you describe your feelings?
2. During the prescribed exercise session, did your feelings change as the exercise session went on?
3. If so, in what way did they change?
4. Did you feel particularly bad during any aspect of the exercise?

Preferred intensity exercise session

1. Did you feel able to regulate your own intensity?
2. If not - what prevented you from doing so?
3. Did you feel comfortable exercising at the preferred intensity?
4. If not - can you describe your feelings?
5. During the preferred exercise session, did your feelings change as the exercise session went on?
6. If so, in what way did they change?
7. Did you feel particularly bad during any aspect of the exercise?
8. Could you describe when and if you have any explanations for this?

General questions

1. Did you feel differently in the preferred exercise session to the prescribed condition?
2. If so, in what way?
3. Which of the treatments did you prefer - exercising at a preferred or prescribed intensity?
4. What do you think was the reason for this?
5. Which of the methods used to regulate intensity would encourage you to continue exercising?
6. Do you have a reason for this choice?
7. In general, do you like to be led during an exercise session or do you like to initiate and control it yourself?
8. Is there a particular reason for your preference?

Appendix 4B
Semi structured Interview (Study 3)

1. What aspects of being involved in this exercise programme have you enjoyed?
    a) What was the main reason you continued with exercise?
2. What aspects did you not like as much?
3. How did your feelings about exercise change through the 12 weeks?
4. When did you enjoy exercising the most (or see it as less of a trauma!)?
5. When did you struggle most to keep exercising?
6. How did you feel about keeping the diary?
7. What were the things that interfered with you being able to exercise?
8. What were the good things that you got out of exercising?
9. What do you think would have helped you to do more exercise?
10. How did you feel about being given information on how to exercise and being left to structure your own exercise programme?
    a) Did you feel there was enough/too much pressure on you to exercise?
11. What were your main reasons for beginning to exercise regularly?
12. What are your main reasons now after having exercised regularly for 12 weeks?
13. If I asked you to choose a statement about how you felt about exercise would you choose, I feel I: have to exercise
    should exercise
    want to exercise
14. How was your pattern of exercise affected by having to see me every fortnight?
15. Did you try to stick to the goals that we set for you?

Appendix 5

Exercise Programmes

Appendix 5A
Flexibility Programme

Warm up and cool down

- 5 minutes of aerobic activity e.g. gentle jogging, easy cycling, jumping rope

Main points to remember when you are stretching

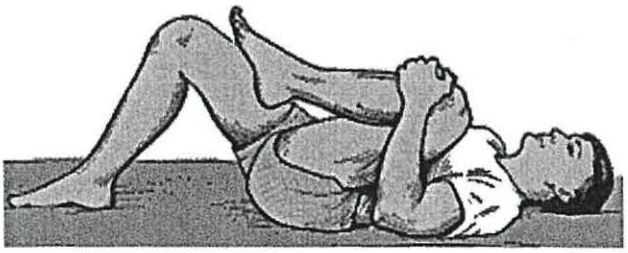
- Your muscles must be warm at all time, to do this may include interspersing a warm up with stretching if muscles cool down.
- Relax when stretching.
- Stretch your muscles slowly.
- Stretch until just before the point of discomfort, do not overstretch when you feel pain lessen the stretch.
- You must keep the muscle static when stretching, do not bounce.
- It is important to watch that your limbs are in alignment.
- Take slow, relaxed natural breaths when you are stretching, exhale as muscle is stretching, breathe in through the nose then out through nose or mouth.
- Release slowly from the stretch back to the starting position.

Stretching Programme

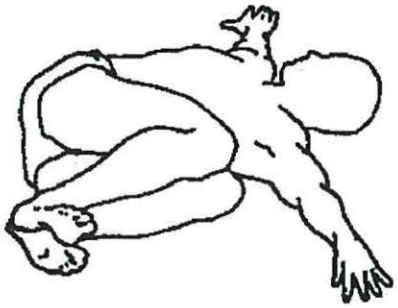
With all stretches, hold the stretch at the point of **mild** discomfort for 30 seconds. Release slowly from the stretch and return back to the starting position. Wait for 20 secs then stretch the same muscle again. Repeat stretch with the opposite limb (if appropriate).

Back

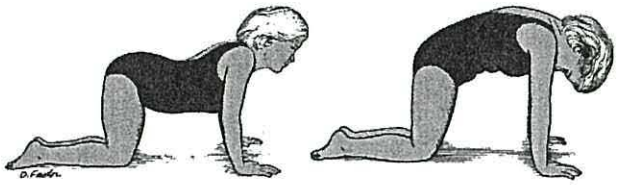
1) Keeping the back of your head on the floor, your lower back and feet flat on the floor bring one knee to your chest. Hold the knee with both hands and gently pull it in. Alternate knees. Then bring both knees into the chest.



2) Lie on your back and bend your knees, feet flat on the floor. Let your knees fall to the right while stretching your arms out wide. Hold the stretch, then roll the hips over to the left and repeat the stretch.



3) "Cat" stretch. Get down on your hands and knees and let your back sag slowly toward the floor. Then slowly arch your back away from the floor.



Sides

Stand with feet shoulder width apart and toes pointing forward. With the right arm extended above your head, bend sideways to the left from the hip, using the left hand as support. Ensure you can see your hand in front of you. Repeat on the other side.

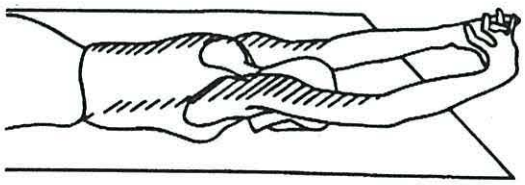
Neck

Turn your head to the side, stretching your chin toward your shoulder. Hold for 30 secs, turn head back to the centre and repeat to the other side.

Shoulders

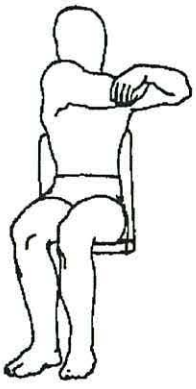
1) Stand with feet shoulder width apart. Raise one arm overhead and stretch as far as you can without bending the torso. Repeat with opposite arm.

2) Lie face down. Stretch arms out in front of you with fingers interlaced together. Lift arms off the floor until you feel slight discomfort in the back of your shoulders and upper arms.



Arms

1) Bring your right arm across to the opposite shoulder. Grasp your elbow with the opposite hand and gently push the arm over your shoulder. Repeat with your other arm.



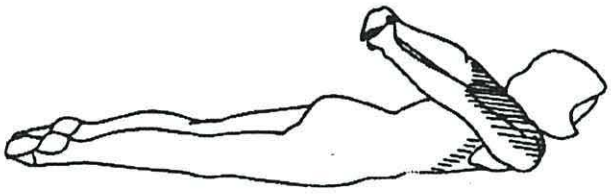
2) Stand or sit with one arm flexed and raised overhead with your hand resting on your shoulder blade. Grasp your elbow with the opposite hand and gently push your elbow behind your head. Repeat with your other arm.

Wrist and forearm

Extend your right arm straight out in front of you, palm downward. With your left hand, grasp the fingers of your right hand and pull back gently, stretching your wrist and forearm. Repeat with your left arm.

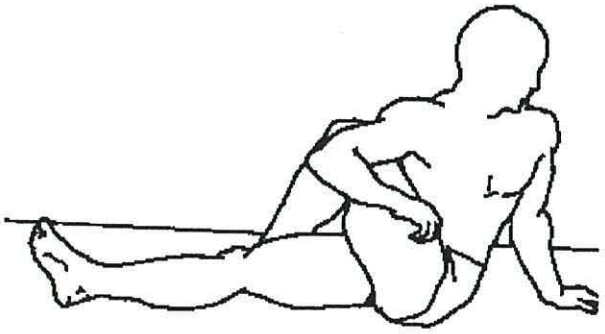
Chest

Stand with your feet shoulder width apart. Clasp your hands behind your back and gently press your arms upward, keeping your arms straight. (Can also be done lying face down on the floor.)



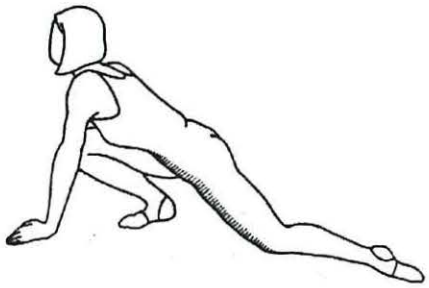
Hips

1) Sit upright on the floor with your legs crossed and your arms behind your hips for support. Cross your left foot over your right leg and slide your heel toward your buttocks. Reach over your left leg with your right arm and place your right elbow on the outside of your left knee. Look over your left shoulder while twisting your trunk and pushing back on your left knee with your right elbow. Repeat with your other leg.



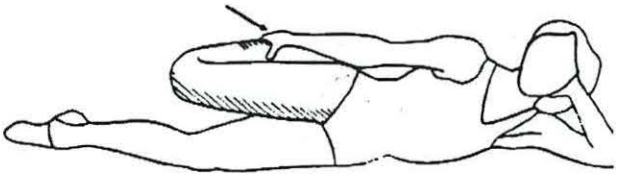
2) Sit down with the soles of your feet held together by your hand and your elbows resting against the knees. Lean forward bending from the hips, until you feel slight discomfort in the groin area.

3) Move your right leg forward until your knee is directly over your ankle. The knee of your left leg should rest on the floor. Keeping both knees in the same position, move the front of your hip down until slight discomfort is felt. Do the same with your left leg forward.

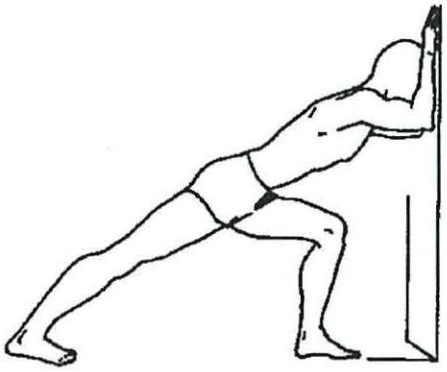


Legs

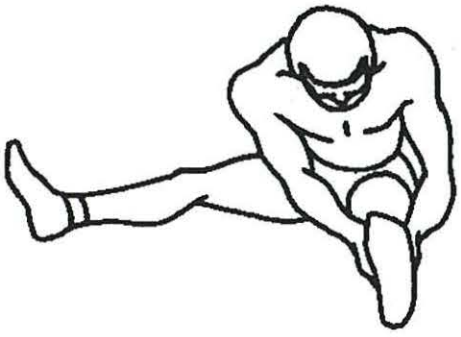
1) Lie on your left side resting your head in the palm of the left hand. Gently pull the ankle of the right leg towards your buttocks until you feel tension in the front of your thigh. Keep the leg you are stretching in alignment with your back don't pull it behind you. Turn onto your right side and do the same for your left leg.



2) Stand 4-5 steps from a wall with your palms/arms flat against the wall. Bend one leg and place the foot in front of you, keeping your other leg straight behind with your heel flat against the floor. Both feet should be facing the wall. Slowly move your chest towards the wall. Repeat with your other leg.



3) Sit upright on the floor with both legs straight. Straddle your legs as wide as possible. Rotate your body to one side and bend over one leg. Hold the stretch. Repeat stretch over other leg.



4) Sit with both legs straight in front of you. Keeping your head up and back flat reach down with both hands towards your toes.

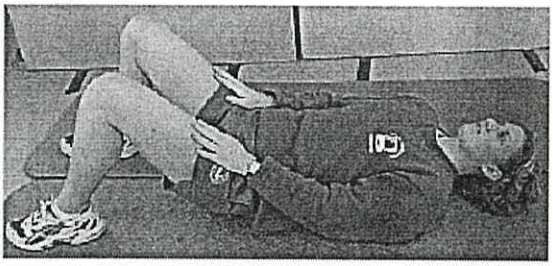
Whole body stretch

While you are lying flat on the floor, extend your legs and arms. Point your toes and stretch your fingers out until slight discomfort is felt in the feet, ankles, back, stomach, ribs, arms and shoulders.

Appendix 5B
Toning Exercise Programme

Abdominals (stomach muscles)

Crunches



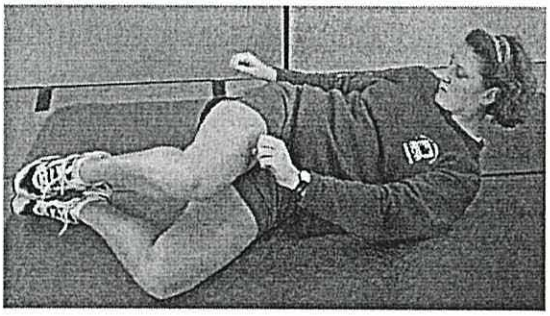
- Lie on your back with your knees bent and your feet flat on the floor.
- Place your hands by your ears. (To make it easier leave your arms by your side.)
- Contract your abdominals, squeeze your buttocks together and tilt your pelvis up.
- Slowly curl your head up, just until your shoulder blades lift off the floor.
- Ease back down.
- Make sure you breathe out on the way up and in on the way down.
- Repeat the exercise 8-12 times. Have a 1-2min rest then repeat a further 8-12 times if you feel you can.

Important points

- Do not yank on your head or put your arms behind your neck and pull the neck up as this places undue stress on the neck.
- Keep your head in line with your spine - do not tuck your chin in.
- Keep your lower back pressed into the floor.

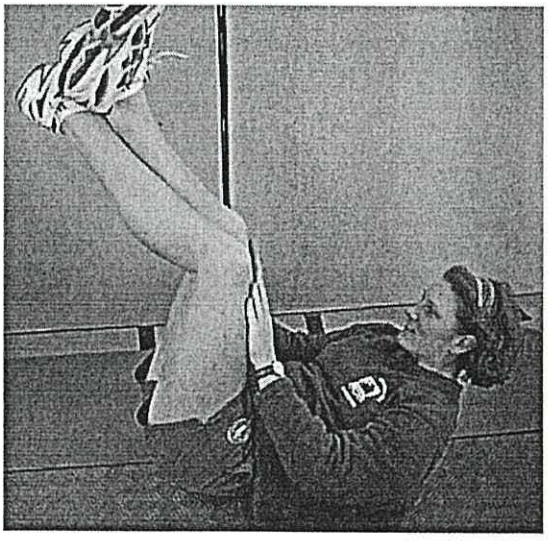
Crunch variations

To work the muscles on the sides of the stomach.



- Lift your body off the floor as you do in the crunch and with your arms by your side slide your left arm down the left side of your body towards your ankle.
- You should be able to feel the muscles squeeze together.
- Do the exercise 8-12 times to each side.

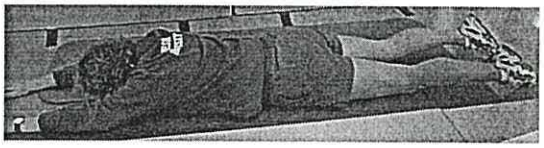
To work the lower stomach muscles

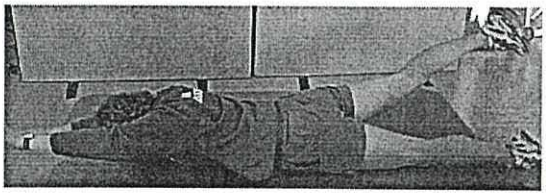


- Lie on the floor with your hips and knees bent and your feet up off the floor. Cross your feet at the ankles.
- Put your arms by your ears (or by your sides if its easier).
- Contract the muscles and lift your body towards your knees.
- This is a very small movement, don't try to bring your knees to your face.
- Repeat 8-12 times, rest for 1-2 minutes then repeat if you feel able.

Back

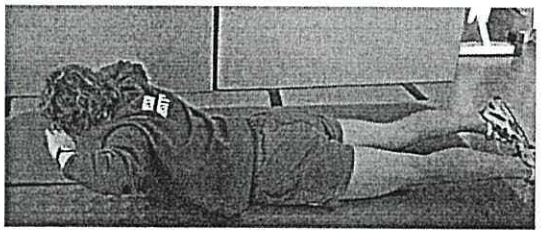
Back extension





- Lie on your stomach flat on the floor.
- Extend your arms straight out above your head
- Keeping your head in line with your spine, lift your right leg and left arm off the floor contracting the muscles in your back.
- Hold for 2 secs, then relax.
- Repeat by lifting your left leg and right arm.
- Repeat exercise 8-12 times.

Torso raise



- Lie on your stomach on the floor
- Place your hands by your ears, elbows pointing to the side.
- Slowly lift your head and shoulders off the floor keeping your feet and lower legs on the floor.
- Hold for 2 secs, then slowly lower your body to the ground.
- Repeat 8-12 times

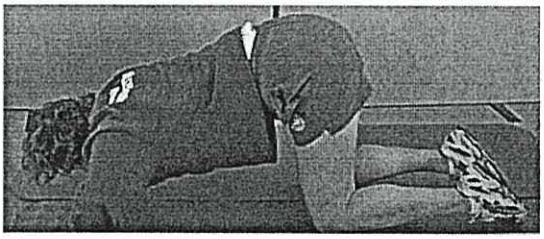
Squats

- Stand with your feet shoulder width apart, feet facing forward. Place you hands on your hips.
- Keeping your back straight, bending at the knee, slowly lower your body as if you were going to sit down. Keep your weight on your heels and you knees should be directly over your feet.
- Hold this position for 2 secs then slowly stand up again.
- Repeat 8-12 times.

Arms/Chest

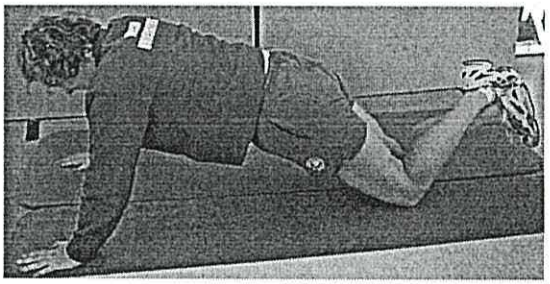
Push ups

- Get down on your hands and knees.
- Place your hands, palms down just outside shoulder width apart.
- Press down to the floor and then push yourself upwards, fully extending the arms.
- Keep your head in line with your spine.
- Do this exercise 8-10 times, rest for 1-2 mins then repeat if you feel able.



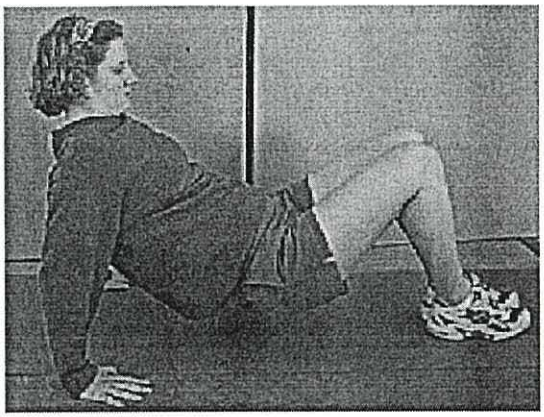
Important points

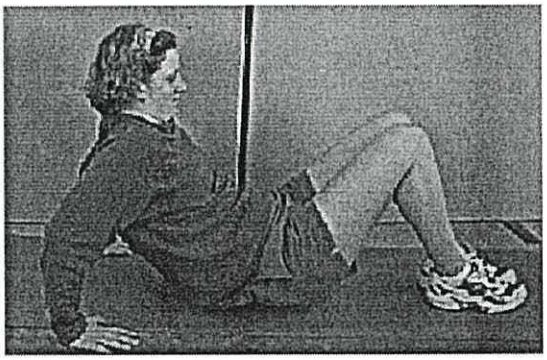
- The bigger the angle between your knees and your lower leg the harder the push up will be. Therefore, to begin with you might do push ups against a wall, then once you get stronger move onto your knees with them being directly underneath your buttocks. The next step is to move your knees further away from your buttocks.



Tricep dips

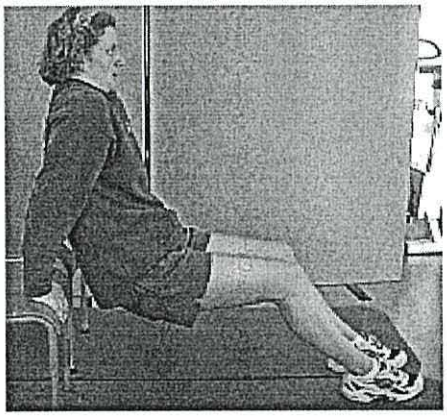
- Sit on the floor with your legs outstretched and place your hands on the floor behind you with your fingers pointing towards your feet.
- Lift your body off the floor by supporting your weight on your hands and heels.
- Lower yourself gently towards the ground (but don't rest on it), then push yourself back up.
- Repeat this 8-12 times. Rest for 1-2mins then repeat if you can.





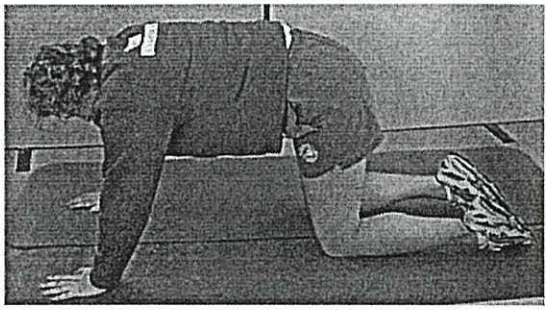
Tip!

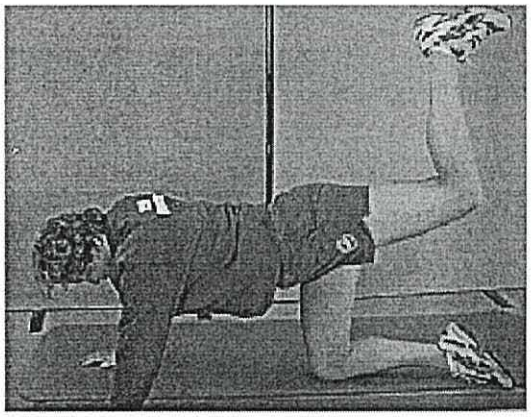
To make this exercise easier then perform the dips while holding onto the arms of a chair. Make sure the chair is placed firmly against a wall.



Hip/Buttock Exercises

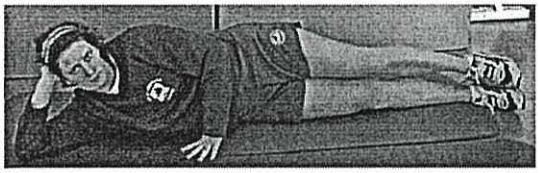
Gluteal kicks

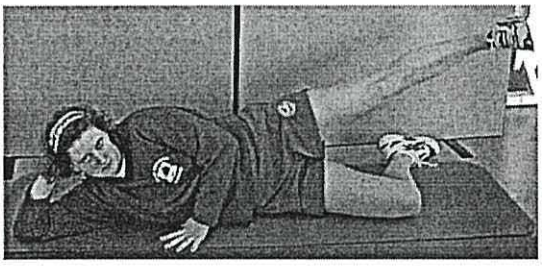




- Position yourself on the floor resting on your hands and knees.
- Bend and pull your right knee in to your chest.
- Straighten your leg, lifting it backwards and upwards extending your knee and hip as far as possible.
- Be careful to compete the movement carefully and deliberately.
- Do this 10 times on either leg.

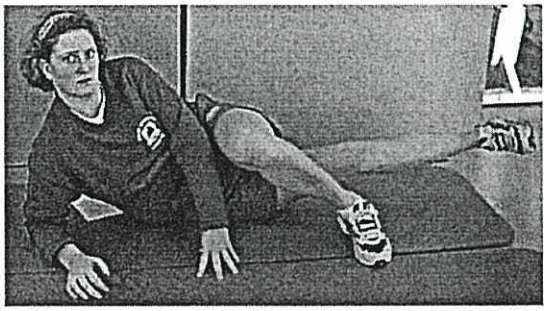
Leg lift (Abductors - outside of thigh)





- Lie on your right side on the floor with both legs in line with your body.
- Rest your head on your arm and place your right hand in front of the chest for support.
- Keeping your body stationary, lift your left leg off the floor until it is about 45° off the floor then lower towards left leg. Don't rest your 'working' leg on your 'resting' leg.
- Repeat 8-12 times with one leg then repeat with the other leg.

Leg lift (Adductors - inside of thigh)



- Lie on the floor on your right side with your left leg bent forward resting on the floor in front of your right leg.
- Keep your right leg straight and lift the right leg (lower leg) upwards.
- Return to starting position.
- Repeat 8-12 times with one leg then repeat with the opposite leg.