

Self-determination Theory and the psychology of exercise

Martin Hagger^{a*} and Nikos Chatzisarantis^b

^a*School of Psychology, University of Nottingham, U.K.*; ^b*School of Psychology, University of Plymouth, UK*

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The purpose of the Self-determination Theory is to explain motivation and behaviour based on individual differences in motivational orientations, contextual influences, and interpersonal perceptions. The theory has shown utility in explaining the antecedents and processes that underpin exercise behaviour. This review will provide an overview of the theory and its application in explaining health-related exercise motivation, behaviour, and outcomes. Recent innovative research using the theory in exercise contexts will also be reviewed in two key areas: advances in measurement and theoretical integration. Based on this evidence, recommendations for future investigations will be made advocating the development instruments to measure self-determined motivation from first principles, the adoption of experimental and intervention designs to better infer causal links between self-determined motivation and behaviour, further investigation of the role of implicit self-determined motivation in predicting behaviour, and the integration of the Self-determination Theory with other theories of motivation, e.g. the Theory of Planned Behaviour and the Achievement Goal Theory, to provide complimentary explanations of self-determined motivation in exercise contexts. Based on the evidence, the Self-determination Theory demonstrates considerable efficacy in explaining exercise motivation and behaviour. Future research should adopt these recommendations to develop the theory further with a view to informing intervention and practice.

Keywords: self-determination theory; autonomy; intrinsic motivation; locus of causality; theoretical integration

The adverse health effects of low levels of exercise have been well-documented in large-scale reviews linking physical activity with health (US Department of Health and Human Services, 1996; Department of Health, 2004; World Health Organization, 2004). Specifically, physical inactivity has been implicated in the aetiology of many chronic illnesses, such as cancer (Byers *et al.*, 2002), cardiovascular disease (Hooper *et al.*, 2001), obesity (Ross *et al.*, 2000), and diabetes (Fritz *et al.*, 2006). However, despite well-publicised government campaigns, population surveys in Western Europe have indicated that people do not engage in sufficient exercise of the type, frequency, intensity, and duration believed to confer health benefits (Blair and Connelly, 1996; Martin *et al.*, 2000) and few meet the guidelines put forward by international organisations (e.g. World Health Organization, 2004).

*Corresponding author. Email: martin.hagger@nottingham.ac.uk

This has compelled behavioural scientists to examine the factors that contribute to the uptake and maintenance of regular exercise (Hagger & Chatzisarantis, 2005). Numerous factors have been identified including social, environmental, cultural and psychological (e.g. King, 2001; Burton *et al.*, 2005). Researchers in the domain of public health are particularly interested in the psychological influences on exercise behaviour because these are considered manipulable through intervention to change behaviour (NICE, 2007). Research examining the relative influence of these psychological factors aims to achieve three important outcomes: (1) identify the psychological predictors or *antecedents* of exercise behaviour; (2) identify the processes or *mechanisms* by which the predictors influence exercise behaviour; and (3) develop *interventions* to change or modify people's exercise behaviour based on the antecedents and mechanisms. This has led to the application of the Social Psychological Theory in exercise contexts to address these aims and guide interventions to increase exercise and ameliorate the risk factors associated with chronic illness.

Not surprisingly, theories of motivation and intention are at the forefront of research examining the psychological antecedents, mechanisms, and bases for intervention in exercise contexts. The Self-determination Theory is prominent among these theories and has received much attention in the literature on exercise behaviour (Ryan & Deci, 2007). The Self-determination Theory is actually a meta-theory comprising three sub-theories that seek to explain human motivation and behaviour based on individual differences in motivational orientations, contextual influences on motivation, and interpersonal perceptions. Central to the Self-determination Theory is the distinction between self-determined or *autonomous* forms of motivation relative and non-self-determined or *controlling* forms of motivation. The Cognitive Evaluation sub-Theory outlines the environmental or contextual contingencies that either support or thwart self-determined motivation. The Organismic Integration sub-Theory explains the processes by which people 'take in' or internalise behaviours that are initially performed for controlling or non-self-determined reasons and integrate them into their sense of self so that they are performed for more autonomous or self-determined reasons. Finally, the basic psychological needs sub-theory provides a framework for explaining the origins of self-determined forms of motivation based on innate psychological needs. This review will provide a detailed outline of the component theories of the Self-determination Theory, and evaluate the state of the literature, applying its hypotheses in the exercise domain. Subsequent sections will evaluate recent developments in the Self-determination Theory as applied to exercise in two key areas: measurement of motivation in exercise, and the integration of the Self-determination Theory with other leading theories of motivation, to provide complimentary explanations of exercise behaviour.

Self-determination Theory

Initial research on the effects of rewards and intrinsic motivation on behaviour led to the development of the Cognitive Evaluation Theory – the first sub-theory of the Self-determination Theory. The theory hypothesises that an individual performing a behaviour for external contingencies, such as money or fame, will persist provided the reward is omnipresent. The withdrawal of the reward probably results in desistance. This is known as the 'undermining effect', and occurs because the administration of

the reward significantly lowers the levels of intrinsic motivation. Deci and Ryan (1987) suggests that the mechanism responsible for this is that participants experience a shift in their perceptions as to the cause or control of their behaviour. The person no longer performs the behaviour for intrinsic reasons and their perception of the cause or 'origin' of the behaviour shifts from being motivated by intrinsic reasons and perceived as emanating from the self to being performed for extrinsic reasons and perceived as originating outside the self. In addition, the undermining effect of rewards can be offset by the informational function of the reward. Presenting the reward in such a way that it is merely informative of competence rather than contingent on the behaviour has been found to moderate the undermining effect.

The undermining effect and informational function of the reward in the Cognitive Evaluation Theory has a robust effect in social psychology across a number of behaviours. There are some applications to the field of sport (Ryan *et al.*, 1984; Valler & Reid, 1984; Frederick & Ryan, 1995; Frederick-Recascino & Schuster-Smith, 2003), but virtually none in the area of exercise for health. A probable reason for this is that exercise behaviour is unlikely to be performed solely for extrinsic rewards or contingencies. Rather, other forms of extrinsic or controlling forms of motivation may be implicated in the control of behaviour in health-related exercise contexts. These forms are outlined in the Organismic Integration Theory, the second sub-theory of the self-determination approach.

The Organismic Integration Theory extends the essential distinction between intrinsic and extrinsic motivation made in the Cognitive Evaluation Theory, and seeks to provide an explanation for the processes by which people assimilate behaviours that are externally regulated, and incorporate them into their repertoire of behaviours that are self-determined and integrated into their personal system. Central to the Organismic Integration Theory is the perceived locus of causality, which represents a graduated continuum of motivational styles or *regulations*, rather than the bipolar distinction offered by the Cognitive Evaluation Theory. The continuum is characterised by two relatively autonomous forms of motivation: *intrinsic motivation* and *identified regulation*, and two relatively controlling forms of motivation: *external regulation* and *introjected regulation* (Ryan & Connell, 1989).

Intrinsic motivation represents the prototypical form of autonomous motivation and reflects engaging in behaviour for the intrinsic satisfaction of the behaviour itself, and for no external contingency. *Identified regulation* is also an autonomous form of motivation but is, strictly speaking, extrinsic in nature because behaviour is motivated by the pursuit of personally-valued outcomes rather than for the behaviour itself. Pursuing behaviours for external contingencies, such as gaining extrinsic rewards or avoiding punishment, characterises *external regulation*. *Introjected regulation* refers to an extrinsic form of motivation in which behavioural control arises from contingencies administered by the self, such as the pursuit of contingent self-worth or the avoidance of affective states, such as guilt or shame. Intrinsic motivation and identified regulation lie adjacent to each other at the autonomous extreme or *pole* of the perceived locus of causality continuum, while external regulation and introjected regulation are located alongside each other at the controlling pole of the continuum (Ryan & Connell, 1989). Importantly, research has supported the discriminant and construct validity of the taxonomy of motivational regulations offered by the perceived locus of causality. For example, intercorrelations among the constructs are ordered in a simplex-like pattern (Ryan & Connell, 1989).

In this pattern, the strongest correlations are exhibited by constructs immediately adjacent to each other on the continuum with correlations declining in size among constructs in proportion to their relative distance from the polar construct.

Research adopting the perceived locus of causality has shown that autonomous forms of regulation are positively related to adaptive behavioural and psychological outcomes in the domain of exercise. Autonomous motivation is associated with exercise behavioural engagement and adherence over time (Chatzisarantis *et al.*, 1997, 2002, 2003; Pelletier *et al.*, 2004; Vansteenkiste *et al.*, 2004; Fortier & Kowal, 2007), perceived competence (Goudas *et al.*, 1994), exercise intentions (Hagger *et al.*, 2003; Phillips *et al.*, 2003; Wilson & Rodgers, 2004; Standage *et al.*, 2005; Hagger & Chatzisarantis, 2007b), Csikzentmihalyi's (1990) flow state (Fortier & Kowal, 2007), and psychological well being (Wilson & Rodgers, 2007). Furthermore, environmental antecedents, such as autonomy support (Edmunds *et al.*, 2007) and people's perceptions that the motivational context is supportive of their autonomous motivation (Hagger *et al.*, 2003, 2005; Koka & Hein, 2003; Standage *et al.*, 2005; Hein & Koka, 2007), have also been linked with autonomous motivational regulations. Findings from previous research have been supported by a recent meta-analysis of the effects of perceived locus of causality on behaviour and outcomes in exercise settings (Chatzisarantis *et al.*, 2003). The analysis supported the simplex-like pattern of relations among the regulation styles, and the effects of the regulations on exercise behaviour and outcomes, such as perceived competence and exercise intentions across a set of 21 studies. Interestingly, autonomous forms of motivation mediated the effect of perceived competence on exercise intentions, suggesting that competence perceptions affect behaviour because competence perceptions tend to be self-determined in nature (Chatzisarantis *et al.*, 2003).

A final sub-theory of the self-determination approach is the Basic Needs Theory. Deci and Ryan (2000) suggest that the origins of self-determined motivation stem from individuals innate propensity to satisfy three basic psychological needs: *autonomy*, *competence*, and *relatedness*. These needs are perceived to be *fundamental* to all humans, and people approach behaviours in an intrinsically motivated fashion because they perceive it as being efficacious in satisfying psychological needs. The existence of these needs have been justified empirically and research has illustrated that these needs are pervasive across different cultures (Sheldon *et al.*, 2001). The Basic Needs Theory is linked with the Organismic Integration Theory because it charts the origins of autonomous or self-determined motivational regulations. The perceived locus of causality is proposed to reflect the degree to which behaviours have become internalised or 'taken in'. Behaviours that have the propensity to fulfil personally relevant goals that are valued by individuals (e.g. exercising to gain more energy for other activities in life or to increase fitness) are perceived as efficacious in satisfying psychological needs. Increased participation in such behaviours leads to the behaviour being internalised, and finally integrated into the person's repertoire of behaviours that can satisfy these needs. As a result, people may not perform exercise for the activity itself, as in the 'classic' definition of intrinsic motivation. Rather, they perform it to achieve an intrinsic 'outcome', which is highly valued and perceived as part of the person's 'true self'.

It is also important to note that the three basic needs are complementary-that is, optimal functioning and truly integrated behaviour can only result if all three psychological needs are supported. For example, competence alone, i.e. mastering a

technique or skilled action alone, is insufficient for the behaviour to be perceived as needing to be satisfied. Competence along with a perception that the behaviour is performed out of a true sense of self, without external contingency, perceived or real, and out of choice and volition (i.e. autonomously regulated) and that behavioural engagement is supported by others in an autonomous fashion (i.e. relatedness) is necessary for an action to be fully integrated and to support psychological needs. Research in the exercise domain has suggested that the basic needs tend to be strongly correlated (Ntoumanis, 2005; Standage *et al.*, 2005) and can be subsumed by a single global factor (Hagger *et al.*, 2006a). Further, interventions that provide synergistic support for the needs of autonomy, competence, and relatedness tend to result in greater behavioural engagement than support for each individual need alone (Deci *et al.*, 1994). Overall, the satisfaction of basic psychological needs has been shown to be related to autonomous forms of motivation from the perceived locus of causality consistent with the Self-determination Theory (Hagger *et al.*, 2006a; Edmunds *et al.*, 2007; Standage *et al.*, 2007), and interventions supporting autonomous motivation was found to increase psychological need satisfaction as well as motivational regulations (Edmunds *et al.*, 2007).

Recent research adopting the Self-determination Theory in exercise

The Self-determination Theory approach has provided a comprehensive explanatory system that has been effective in three key areas of motivation and behaviour. First, it charts the antecedents and predictors of exercise behaviour, including factors in the environment (e.g. rewards, informational feedback, instruction style), and in the person (e.g. basic psychological need satisfaction), that affect motivational style or regulation in exercise contexts, exercise behaviour, and key psychological outcomes, such as intentions and perceived competence. Second, it provides some explanation of the mechanisms by which the antecedent constructs influence behaviour and other key outcomes; these include mediation and moderation effects.¹ Finally, it provides useful guidelines on the exact constructs that psychologists and interventionists in the field of exercise promotion can target in order to change behaviour and motivate individuals to engage in more exercise.

Recent research in the exercise domain has provided some important innovations to the theories comprising the self-determination approach while simultaneously providing useful recommendations for practical intervention. Such research is extremely useful as it not only advances understanding of the influences and, more importantly, the *processes* that lead to exercise behaviour, but it also achieves one of the fundamental purposes of psychological inquiry into exercise, and health-related behaviour in general, the need to translate theory into practice. The next sections of this review will focus on two areas that have been the subject of much research in the application of the Self-determination Theory to exercise contexts: advances in measurement and theoretical integration. We will conclude that despite recent advances, there is considerable scope for further investigation and innovation in research adopting the Self-determination Theory in the exercise domain. These future avenues include the development of measures of self-determined constructs from first principles, conducting more experimental and intervention studies to better infer causality when predicting exercise on the basis of self-determined forms of motivation, adopting implicit as well as explicit measures of self-determined

motivation, and instigating further investigation into integrated approaches using the Theory of Planned Behaviour and the 2 × 2 achievement goal framework to provide complimentary explanations of self-determined motivation in exercise.

Advances in measurement of motivation constructs in exercise

Early research in the Self-determination Theory focused on the Cognitive Evaluation Theory, therefore measurement centred on establishing the means to assess the level of intrinsically motivated behaviour. This was largely conducted using the 'free choice paradigm'. However, great leaps have been made in the development and validation of self-report measures to tap key constructs from the sub-theories of the self-determination approach. Many of these studies have adopted rigorous hypothesis-testing approaches based on classic text theory and psychometrics, the development of item-pools from first principles, and adopting the sophisticated analytical techniques, such as latent variable approaches to evaluate subsequent psychological instruments. Such developments have been mirrored in the exercise literature, and today, using these principles, numerous inventories have been developed. This section will identify and review these measures and their utility in exercise research. However, there have also been recent developments in the field of social psychology examining the effects of implicit social psychological processes that lead to motivated action. Such implicit psychological processes aim to establish the boundary conditions of the intentional and deliberative social processes that tend to be the focus of many social psychological theories, including the sub-theories of the Self-determination Theory. The next section will review these developments and suggest how they might be incorporated into the existing Self-determination Theory framework, and how it might assist in further enriching knowledge of motivated behaviour.

Traditional approaches

For many, health-related exercise is a behaviour that is seldom regulated or performed for intrinsic reasons alone (i.e. for the sake of the behaviour itself), instead it is a behaviour that is usually performed to attain an extrinsic outcome, and these outcomes vary across people in the degree to which they are regulated autonomously. Consequently, a substantial body of research has adopted the Organismic Integration Theory as the appropriate theoretical paradigm to establish the regulatory influences on exercise behaviour. Researchers have adopted various forms of the original instrument of Ryan and Connell (1989) for measuring motivational orientations from the perceived locus of causality. Ryan and Connell's development of the original inventory was a useful guide in that it established the qualitatively different reasons for engaging in exercise based on the Organismic Integration Theory. Further, this seminal work pioneered the requirement for intercorrelation among the Organismic Integration Theory constructs of intrinsic motivation, identified regulation, introjected regulation, and external regulation to conform to a simplex-like pattern. In the exercise domain, researchers have tended to adopt this inventory and applied it to exercise settings by merely rewording the items to incorporate exercise as the appropriate context or domain (Chatzisarantis *et al.*, 1997; Chatzisarantis & Biddle, 1998; Hagger *et al.*, 2002a). However, these inventories were not validated in a systematic or rigorous manner, and they did

not conform to classical test theory or adopt approaches that provided unequivocal support for the validity of the inventories.

Mullan *et al.* (1997) sought to develop a measure of the regulations from the perceived locus of causality for use in exercise contexts, and subject it to a rigorous validation process. They adopted items based on previous research, including Ryan and Connell's measure, and used confirmatory factor analysis and latent variables to support the construct and discriminant validity of a set of scales, collectively known as the Behavioural Regulations in Exercise Questionnaire (BREQ) measuring the behavioural regulations from the perceived locus of causality. They also included a scale to tap *amotivation*, which represents an absence of motivation or regulation for the behaviour, and is an additional form of non-self-determined motivation. The factor structure, including the amotivation measure, did not adequately represent data for the item set collected from sports centre attendees. However, a revised model that excluded amotivation was satisfactory and was cross-validated in a further sample. Furthermore, no differences were found in the factor structure across males and females. Overall, the results supported the validity of the BREQ as a measure of perceived locus of causality regulations in exercise contexts. The measure has been successfully used to tap motivational orientations on numerous occasions (e.g. Mullan & Markland, 1997; Markland, 1999; Ingledew *et al.*, 2004; Hagger *et al.*, 2005, 2006b, in submission; Markland & Ingledew, 2007).

Limitations of the BREQ include the lack of incorporation of a measure of *integrated regulation*, which should be the most autonomous or self-determined form of extrinsic motivation, the lack of development from first principles (i.e. from a pool of items derived from the literature and open-ended questionnaire methods), and inadequacies of the amotivation scale. In response to these criticisms, a revised version of the scale (BREQ-2), which included a newly-specified amotivation scale, was developed (Markland & Tobin, 2004). This recent version of the scale has yet to be adopted and used widely, but preliminary validation supported the fit of the model with data from exercise referral scheme patients (Markland & Tobin, 2004). Future developments should aim to incorporate a scale tapping integrated regulation as other scales in the competitive sport domain have sought to do (Mallett *et al.*, 2007; Pelletier & Sarrazin, 2007; Pelletier *et al.*, 2007a,b), in order to tap the full complement of behavioural regulations in this domain.

In response to the increasing body of research examining the effects of contexts that support self-determined forms of motivation in promoting exercise (Williams 2002), researchers have recognised the importance of assessing people's perceptions of autonomy support and its effects on behaviour (Williams & Deci, 1996; Pelletier *et al.*, 2001) including exercise (Hagger *et al.*, 2003, 2005; Wilson & Rodgers, 2004; Edmunds *et al.*, 2007). Perceived autonomy support is the degree to which individuals perceive the motivational context or 'climate' engendered by salient others is supportive of their autonomy (Deci & Ryan, 1987). Perceived autonomy support is a vital barometer of the degree to which individuals in applied settings, such as schools and the workplace, perceive significant others support self-determined motivation (Reeve *et al.*, 1999). It is an important perception as it not only illustrates the importance of environmental factors on perceptions, but can also act as an essential means to evaluate the effectiveness of experimental manipulations or interventions aimed at changing perceived autonomy support and, in doing so, self-determined motivation and actual behaviour.

Few studies have formally developed measures of perceived autonomy support. Therefore, we sought to develop such a measure that would not only capture the meaning and essence of the construct, but also set a precedent in rigorous development of inventories to measure constructs in the Self-determination Theory in the exercise domain. We developed the perceived autonomy support scale for exercise settings (PASSES) from first principles by initially generating a pool of items, systematically eliminating items, and testing construct validity using the confirmatory factor analysis, validating it in independent samples from different cultures, and testing its discriminant and nomological validity with constructs from the perceived locus of causality. The resulting inventory was developed with respect to key supportive agents (e.g. parents, peers, and teachers) and supported across cultures and demonstrated associations with autonomous forms of motivation, as expected. We concluded that the PASSES was a useful instrument to measure perceived autonomy support, but further work needs to be done for different demographic groups (Hagger *et al.*, 2007).

The development and validation of these instruments using the rigorous methods outlined here are essential to the progression of research adopting the self-determination approach in the exercise domain for two reasons. First, they tightly define the construct under scrutiny and provide a frame of reference as to the precise essence of the constructs from the theory and their key components. Second, they not only provide researchers with means to tap these constructs in subsequent research with confidence, but also to evaluate the effectiveness of experimental manipulations and interventions aimed at changing these constructs. Researchers are encouraged to adhere to the principles of psychometrics and classical test theory when developing self-report measures. This will assist in the development of high-quality measures of Self-determination Theory constructs that assist researchers by yielding valid and reliable data.

The need for experimental and intervention designs and inference of causality

It is clear that much of the research adopting the Self-determination Theory approach in the exercise domain have adopted correlational designs in either a single- or multiple-wave prospective or longitudinal approach (Chatzisarantis *et al.*, 2003). While such studies have their merits in identifying the antecedent motivational variables of exercise behaviour and associated mechanisms, they have important limitations. First, relations among variables in correlational designs are 'static' in that they represent links based on perceptions at a given point in time and do not account for 'change' in outcome variables, such as exercise behaviour. Longitudinal studies using panel designs allow for the prediction of interindividual change across time while controlling for the covariance stability, but still do not address a key limitation: the inference of causality. In studies adopting correlational designs, the researcher can only infer causality based on the well-conceived theory and its application to data collected to test hypothesised relations among Self-determination Theory constructs. Experimental designs are the method of choice to establish the direction of causality of a variable or a set of variables on a dependent or outcome variable. This is because experiments require the manipulation of independent variables that are proposed to effect a change on behaviour or other outcome variables. Interventions are also useful to this end, but seek to use a broader, wide-ranging set of theory-based manipulations

to effect a change in the dependent variables usually in a field rather than laboratory setting. Both techniques are considered more effective in testing causal relations, but are costly in terms of resources and time, and are only as effective as the care taken in designing the manipulation or intervention.

There is a relative dearth of experimental and intervention studies aimed at testing the tenets of the Self-determination Theory in the exercise context. Until recently, the majority of experimental studies have been confined to the sport domain (Vallerand & Reid, 1984; Cury *et al.*, 2002a; 2003). However, researchers have begun to adopt experimental methods focusing on specific variables and their effects on exercise behaviour. For example, research has illustrated that manipulations designed at changing self-determined motivation result in concomitant changes in exercise intentions and behaviour (Chatzisarantis & Hagger, *in press*; Chatzisarantis *et al.*, *in press*). These studies have tended to adopt autonomy-supportive techniques and the recommendations advocated by researchers in experimental social psychology (Deci & Ryan, 1987; Deci *et al.*, 1994) as well as in applied contexts, such as education (e.g. Reeve, 2002; Reeve & Jang, 2006). There has also been considerable advance in the development of interventions in applied settings that have sought to adopt the recommendations from the Self-determination Theory to changing behaviour (Williams *et al.*, 1996, 1998a,b, 1999, 2002, 2004), including exercise (Wallhead & Ntoumanis, 2004; Edmunds *et al.*, 2007; Edmunds *et al.*, *in press*). These interventions have shown that the Self-determination Theory is viable and effective in producing increases in exercise behaviour among numerous population groups.

Despite these relative successes, there is still considerable scope for further research examining the role of autonomy supportive techniques to change self-determined motivation and exercise behaviour. Most importantly, little research has examined the effects of such manipulations and interventions on behaviour on exercise adherence. This is important given that the health benefits conferred by exercise behaviour can only be maintained by a continued participation. This is also important because campaigns and interventions cannot be omnipresent, and the best hope for continued adherence is to confer the regulation of exercise behaviour to the individual. Self-determination Theory is ideally placed for such an endeavour as it focuses on promoting autonomous reasons for engaging in exercise, which are personally-salient and viewed as emanating from the self. This will compel individuals to self-regulate and continue to form intentions to exercise in order to fulfil their autonomous motives. Future research will therefore involve multiple follow-up measurements of post-intervention behaviour in order to establish the longevity of the effects and the mechanisms involved by measuring key psychological constructs, such as perceived autonomy support and motivational regulations.

Shift toward implicit processes

Over the past 10 years, research in social psychology has started to shift from models that focus solely on deliberative, intentional and explicit influences on behaviour, and has sought to develop theories that account for the non-conscious, impulsive and implicit influences on human behaviour (Bargh & Chartrand, 1999; Greenwald *et al.*, 2002; Kehr 2004; Strack & Deutsch, 2004; Nosek *et al.*, 2007). Such approaches have given rise to so-called *dual route* models of motivation that recognise that behaviour is a function of deliberative, volitional and planned inferences, as well as those that

are automatic, non-conscious and unplanned (Strack & Deutsch, 2004). Interest in these automatic and implicit processes has been mirrored by concomitant advances in methods to measure implicit processes. Research adopting implicit processes alongside more traditional self-report measures of cognition has illustrated that behaviour is influenced by both explicit and implicit social cognitive variables, and these effects are relatively independent (Perugini, 2005; Spence & Townsend, 2007).

Given the increasing attention being paid to implicit processes, recent research has endeavoured to examine the role of implicit processes in self-determined motivation and behaviour. This is based on theoretical premises that suggest that people have an implicit bias or propensity to approach behaviours in a self-determined or non-self-determined manner. For example, Deci and Ryan (1985a) proposed that people have a generalised capacity to be oriented towards and interpret situations as supportive of their self-determination. Therefore, people exhibit inter-individual differences in their generalised causality orientations, which are global and relatively enduring, developed through experience, and affect motivation and behaviour in a variety of contexts. In addition, it has been supposed that these causality orientations may affect behaviour independent of conscious decision-making (Elliot *et al.*, 2002), in much the same way as personality constructs tend to influence behaviours independent of intentional processes (Conner & Abraham, 2001; Rhodes *et al.*, 2002). Indeed, recent evidence examining mediational models of motivation adopting the Organismic Integration Theory and Basic Needs Theory have indicated that generalised constructs such as basic need satisfaction predict exercise behaviour directly independent of contextual motivational orientations and intentions (Hagger *et al.*, 2006a). These processes, therefore, transcend the deliberative route by which these psychological constructs lead to behaviour and suggest that people's global causality orientations may affect behaviour directly, and the process is likely to be one which the person is unaware, and therefore implicit in nature.

Recent research has included implicit motivational constructs in the prediction of behaviour adopting a Self-determination Theory approach. Levesque and Pelletier (2003) adopted priming techniques used in previous studies examining implicit processes to activate either autonomous or non-autonomous (termed *heteronomous*) motivational orientations. Using this method, they found that priming autonomous and heteronomous motivation influenced participants' perceptions of intrinsic motivation, choice and competence, as well as persistence with subsequent problem-solving tasks consistent with explicit, consciously regulated motivational orientations. Similarly, Burton *et al.* (2006) used a lexical decision task to measure implicit autonomous motivation, and found that this measure predicted psychological well-being and academic performance independent of explicit measures of autonomous motivation. Together these studies suggest that the motivational influences from the Self-determination Theory can influence behaviour and other outcomes implicitly, and these effects are independent of explicit motivational orientations.

Given the recent attention paid to implicit processes in the Self-determination Theory, we sought to extend this research to an exercise context and adopt recently-developed measures of implicit motivational orientations (Harris & Hagger, in preparation). The study aimed to develop an implicit measure of self-determined motivational orientations based on the Implicit Association Test (IAT), and then evaluate the extent to which the implicit motives tapped by the new measure account for variance in exercise and dieting behaviour. The IAT is essentially a sorting task

which requires individuals to sort items from two pairs of contrasted categories into logical sets, and in doing so measure the strength of association between mental constructs that are bipolar in nature. The IAT was developed with the distinction between 'intrinsic' and 'extrinsic' as categories of motivation and 'pleasant' or 'unpleasant' as the associated attributes. The words that represented the category were derived from a pilot study in which participants were required to write down words associated with intrinsic and extrinsic categories.

Once the measure had been developed, a subsequent study required participants to complete the IAT measure of motivation, explicit measures of motivational orientations in the exercise domain, and intentions to perform exercise in the future. Scores on the IAT were such that higher scores represented a strong link between the positive attribute and autonomous motivation. Two weeks later, participants completed a self-report of actual exercise behaviour. Results indicated that the implicit measure of autonomous motivation was significantly and negatively related to explicit measures of controlling forms of motivation. However, the IAT measure was unrelated to explicit autonomous motivational orientations. The explicit measures of autonomous and controlling motivation both significantly predicted exercise intentions, and there was a mediated effect from the implicit motivational orientation to intentions via the mediation of explicit controlling forms motivation.

This preliminary evidence suggests that the implicit measure of autonomous motivation is useful in determining exercise intentions. It also indicates that implicit processes may be more appropriately aligned with a *lack* of explicit autonomous forms of motivation rather than self-determined motives. However, research using this instrument is in its infancy and requires further validation work and research examining the independent prediction of implicit self-determined motives on motivation and exercise. Future research should aim to evaluate the relations between the IAT measure and other implicit measures, such as the lexical decision task developed by Burton *et al.* (2006).

In addition, research needs to establish whether the IAT is the most appropriate means to tap implicit motivational orientations from the Self-determination Theory. The IAT measures the degree of association between a bi-polar category and attributes in order to establish the implicit measure. However, it remains to be seen whether it is appropriate to reduce autonomous motivation to a bipolar intrinsic-extrinsic distinction. It may be that other implicit measures that use only a single contrast category (e.g. intrinsic versus non-intrinsic) may be more appropriate. Tasks such as the go/no-go association task (GNAT) may be more efficacious in this regard, and may provide independent intrinsic/autonomous and extrinsic/controlling forms of implicit motivational orientations. It may also address the finding identified in the previous study, where there were negative relations between the implicit measure and explicit measures of controlling motivation, but no relations for the explicit measure of autonomous motivation. Separate measures may support this distinction.

Theoretical integration and advancement

One of the key developments in the Self-determination Theory in the exercise domain has been the integration of the Self-determination Theory with other theories of motivation. Such theoretical integrations have three aims. The first is to identify commonalities in motivational constructs across theories and eliminate redundancy

by reducing the psychological predictors of exercise behaviour to a restricted set of constructs that have minimal conceptual and empirical overlap. The second aim is to utilise hypotheses and premises from each theory in order to address any limitations and boundary conditions that may be inherent in each theory. In doing so, the theories are complimentary, each explaining a process that the other does not. Finally, the third aim is to provide an optimal explanation of behaviour and identify the target variables and mechanisms for interventions aimed at increasing exercise behaviour. This section will outline recent developments in which researchers have integrated the tenets of the Self-determination Theory with two other motivational theories in the exercise domain: the Theory of Planned Behaviour and the Achievement Goal Theory. The section will outline the rationale behind the integration, studies that have tested hypotheses from the integrated theories, and outline the implications and avenues for future research for such theoretical integration.

Self-determination Theory and theories of intention

One leading theoretical perspective on motivation in the social cognitive tradition is the Theory of Planned Behaviour (Ajzen, 1991). Central to the theory is the link between intention, a motivational construct reflecting the level of planning and effort an individual is prepared to invest in engaging in a specific behaviour at a given future time and context, and actual behaviour. Intentions are a function of a set of belief-based social cognitive variables that are personal (attitudes), social (subjective norms), and control-related (perceived behavioural control) in nature. Attitudes reflect a person's overall evaluation of the behaviour, subjective norms are the perceived influences of significant others regarding behavioural engagement, and perceived behavioural control reflects the level of resources a person possesses with regard to performing the behaviour. The theory should be contrasted with the *organismic* approach offered by the Self-determination Theory that examines the role of context and dispositional motivational constructs on motivation and actual behaviour.

While the hypotheses of both theories of motivation have been supported in meta-analytic reviews across a variety of social behaviours (Deci *et al.*, 1999; Armitage & Conner, 2001) including exercise (Hagger *et al.*, 2002b; Chatzisarantis *et al.*, 2003), both have limitations. The Theory of Planned Behaviour explains considerable variance in intentions and exercise behaviour, but fails to identify the origins of core constructs that give rise to intentions, namely, attitudes, subjective norms, and perceived behavioural control (Hagger & Chatzisarantis, 2007c). The Self-determination Theory, on the other hand, is successful in explaining the interpersonal and contextual influences on motivated behaviour, but does not provide a detailed explanation of how motivational orientations are converted into specific bouts of behaviour (Elliot *et al.*, 2002).

Chatzisarantis and coworkers (Chatzisarantis *et al.*, 1997; Chatzisarantis and Biddle, 1998; Chatzisarantis *et al.*, 2002) pioneered an investigation into the premise that the Theory of Planned Behaviour and the Self-determination Theory provide complimentary explanations and may assist in resolving their respective limitations. The integration of these theories is supported through the theorising of Deci and Ryan (1985b) and Vallerand (1997) who state that motivational theories, such as the Self-determination Theory, may provide a basis to explain the origins of the social cognitive predictors of intention and behaviour in the Theory of Planned Behaviour.

Specifically, Deci & Ryan, (1985b) state that: “Cognitive theories [such as the Theory of Planned Behaviour] begin their analysis with . . . a motive, which is a cognitive representation of some future desired state. What is missing, of course, is the consideration of the conditions of the organism that makes these future states desired” (p. 228). Chatzisarantis *et al.* recognised that individuals may form intentions to perform exercise behaviour, but the quality of those intentions may vary because some may be incongruent with their true sense of self. Their studies revealed that intentions formed based on autonomous motives were predictive of exercise behaviour.

Subsequently, researchers have suggested that intentions are formed based on autonomous forms of motivation (Sheeran *et al.*, 1999), and research has revealed links between autonomous forms of motivation and intentions to participate in exercise behaviour (e.g. Hagger *et al.*, 2002a; Wilson & Rodgers, 2004). Theoretically, individuals reporting an autonomous motivational orientation toward a particular behaviour domain will form attitudes, perceptions of control and, thereby, intentions to engage in behaviours congruent with that orientation. In addition, the Theory of Planned Behaviour suggests that the immediate antecedents of intentions will mediate the effects of autonomous forms of motivation on intention in a motivational sequence, i.e. autonomous motivation → attitudes/perceived control → intentions → behaviour (e.g. Chatzisarantis *et al.*, 2002, 2006; Hagger & Armitage, 2004; Hagger *et al.*, 2003, 2005, 2006a).

Considerable research has supported the role of autonomous motivational orientations, that is, motivation to engage in behaviours that fulfil psychological need-satisfying outcomes, as an influence on intentions and behaviour in a number of behavioural domains (e.g. Chatzisarantis *et al.*, 2002; Phillips *et al.*, 2003; Standage *et al.*, 2003a; Wilson & Rodgers, 2004; Hagger & Armitage, 2004; Hagger *et al.*, 2006a; Brickell *et al.*, 2006; Edmunds *et al.*, in press). A recent meta-analysis of the extant research examining the effect size of autonomous forms of motivation on intentions, and the antecedents of intentions, found a remarkable degree of consistency in the links between autonomous forms of motivation and the Theory of Planned Behaviour variables (Hagger & Chatzisarantis, 2007b). In addition, a path analytic model using the meta-analytically derived correlations provided support for the mediational model supporting the motivational sequence (Hagger & Chatzisarantis, 2007b).

Recent research has sought to extend this integration to include perceptions of the extent to which salient others support the autonomy of people, and how this influences motivational orientations. For example, we have developed a trans-contextual model that integrates the Theory of Planned Behaviour with the Self-determination Theory, but also includes perceived autonomy support (Hagger *et al.*, 2003, 2005, in submission). The model is unique because it provides an illustration of how promoting autonomous forms of motivation in a physical education context may influence autonomous motivation and intentions to engage in exercise outside of school in a leisure-time context. A meta-analysis has supported the hypothesised relations in the model suggesting that perceived autonomy support in PE influences autonomous motivation in physical education (Hagger & Chatzisarantis, 2007c). Autonomous motivation in physical education predicts autonomous motivation in a leisure-time context which subsequently predicts attitudes, perceived behavioural control, intentions, and actual exercise behaviour (Hagger & Chatzisarantis, 2007c). In addition, recent research has illustrated that an intervention based on the trans-contextual model is useful in increasing exercise behaviour in leisure-time,

illustrating the practical utility of the theory in designing interventions using existing networks, such as physical education (Chatzisarantis & Hagger, in press).

Self-determination Theory and Achievement Goal Theory

Early in the development of the Self-determination Theory, researchers recognised parallels with another prominent social psychological theory of motivation, Achievement Goal Theory. Achievement Goal Theory was developed by researchers interested in examining the effects of young people's concepts of success and failure on motivation in education contexts (Nicholls, 1989; Ames, 1992). An important tenet of the theory is that cues from the social context, known as the *motivational climate*, have a pervasive effect on motivation and behaviour. Two dimensions have emerged from research examining the effects of motivational climate on motivation in educational settings: a task or *mastery-oriented* climate and an ego or *performance-oriented* climate. A mastery-oriented motivational climate tends to promote hard work, effort, co-operation, and personal development among individuals acting in that climate, while a performance-oriented climate tends to engender comparisons with others, competition, success based on ability, and reward and punishment schedules for success and failure. Research in education has suggested that a mastery-oriented climate tends to engender adaptive motivational patterns and is linked to increased psychological well-being and persistence in behaviour (Ames, 1995; Ntoumanis & Biddle, 1999).

The concepts of motivational climate and intrinsic motivation have been viewed as providing complimentary explanations of motivation. A mastery-oriented motivational climate, in supporting effort, personal improvement, and self-references improvement, is directly compatible with autonomous motivation because such contexts have been shown to enhance intrinsic motivation (Butler, 1987). In contrast, performance-oriented climates have not been associated with autonomous forms of motivation, and may even undermine autonomous motivation given its focus on external contingencies for success. Recently, Deci and Ryan (2000) explicitly linked a mastery-oriented motivational climate with the development of intrinsic motivation, stating that "both [theories] suggest that the use of salient performance-based rewards, social comparisons, and normatively based goal standards as motivational strategies yield manifold hidden costs [and] that environments that are less evaluative and more supportive of the intrinsic desire to learn provide the basis for enhanced achievement and well-being" (p. 260). These theoretical links have been supported empirically across many achievement-related behaviours (Rawsthorne & Elliot, 1999). A burgeoning body of literature in the exercise domain has also supported these theoretical links, and it seems a mastery motivational climate promotes exercise adherence and is attributable to the context enhancing intrinsic motivation and competence (Goudas & Biddle, 1994; Cury *et al.*, 1996, 2002b, 2003; Kavussanu & Roberts, 1996; Escarti & Gutierrez, 2001; Treasure & Roberts, 2001; Papaioannou, 2004; Hein & Hagger, 2007).

Recent research has sought to examine the role of motivational climate in physical education contexts in promoting or thwarting autonomous forms of motivation (Ntoumanis, 2001; Standage *et al.*, 2003b). Such studies adopt a longitudinal approach, similar to those examining the effect of perceived autonomy support on motivation and intention (Hagger & Chatzisarantis, 2007b,c), and there

is considerable congruence in the motivational sequences put forward in these models. However, these models have tended to focus on participation within physical education rather than exercise outside of school. Importantly, these authors make explicit the links between a mastery-oriented motivational climate and contexts that support psychological needs, and recognise the congruences between the features of the social context that support autonomous forms of motivation from both theoretical perspectives (Ntoumanis, 2005; Standage *et al.*, 2005, 2007).

The achievement goal perspective has also been adopted alongside constructs from the Self-determination Theory in terms of dispositional orientations that reflect perceptions about success and failure (Standage *et al.*, 2003b; Ntoumanis, 2005). Until recently, research in achievement goal perspectives had identified two pervading achievement goal orientations: task-oriented and ego-oriented. A task-oriented motivational orientation means an individual will tend to view success and failure in exercise contexts relative to personal improvement, effort, self-referenced goals, learning and improvement. Analogously, ego-oriented persons will tend to view their success and failure relative to their performance compared to others, fulfilling normative standards, other-referenced goals, and competition and normative comparison. Research in the exercise context has suggested that individuals who attach high value to task-oriented goals tend to have more adaptive motivational patterns and, in particular, report high levels of intrinsic motivation in tasks (Brunel, 1996; Newton & Duda, 1999; Boyd *et al.*, 2002; Standage *et al.*, 2003b; Wang & Biddle, 2003; Hein & Hagger, 2007). This is irrespective of whether they also endorse an ego-oriented goal perspective, and it is only when task orientation is comparatively low that maladaptive motivational patterns, such as avoiding evaluative situations and low intrinsic motivation, arise (Goudas *et al.*, 1994, 1995).

A recent development in the field of achievement goal perspectives is the inclusion of approach and avoidance motivational dimensions concurrent with the task and ego achievement goal dichotomy (Elliot & Harackiewicz, 1996; Elliot & Covington, 2001; Elliot & McGregor, 2001). Elliot and Harackiewicz, (2001) developed a 2×2 conceptualisation of achievement goals that incorporates an approach-avoidance valence alongside the mastery-performance achievement goal dichotomy. Approach goals are characterised by a generalised tendency to be attracted to and approach success. Approach-mastery goals reflect orientations to engage in tasks in order to master skills, improve technique, and enhance self-referenced competency, while approach-performance goals reflect the tendency to approach activities in order to compete and test competency relative to others. Avoidance goals, on the other hand, reflect a generalised motive to avoid situations where the outcome may be failure. Avoidance-performance goals reflect generalised tendencies to avoid situations where an individual will fail to succeed by winning or achieving a normative standard, while avoidance-task goals outline the tendency to avoid failure to master personal skills and self-referenced competencies.

Research with the 2×2 model has illustrated that mastery-approach goals are most strongly related to salient outcomes and behaviours (e.g. exam performance, health center visits) and are a better predictor than performance-avoidance goals. Importantly, the new conceptualisation has been aligned explicitly with intrinsic motivation and the Self-determination Theory (Elliot & Harackiewicz, 1996). This is because intrinsic motivation, by definition, reflects the spontaneous attraction of individuals to behavioural domains that are viewed as satisfying psychological needs. As mastery

orientations reflect high perceived competence, it is likely that such approach orientations are precursors to intrinsic motivation, while performance-avoidance orientations are likely to be related to extrinsic motivational orientations as these perceptions are incongruent to the actors true sense of self, and therefore are unlikely to service personally-salient goals and be instrumental in satisfying psychological needs.

Research adopting approach and avoidance motivation and achievement goal perspectives in the exercise domain has been relatively sparse and have largely focused on competitive sport settings (Halvari & Kjormo, 1999; Cury *et al.*, 2002a; Conroy *et al.*, 2003; Conroy, 2004; Conroy & Elliot, 2004), with only two focusing on the health-related exercise domain (Cury *et al.*, 2003; Ommundsen, 2004). Findings from these studies have generally indicated that mastery-approach goals tend to be associated with the most adaptive behavioural patterns and outcomes. However, Elliot & Conroy (2005) point out that there is a relative dearth of literature in this field, and many questions remain unanswered: "Although the value of the expanded 2×2 conceptual framework [of achievement goals] in sport and exercise domains is a relatively open empirical question, we are optimistic of its potential for enhancing our understanding of achievement motivation in these contexts and eagerly await further investigation" (p. 21). At the forefront of this future research should be the development of exercise-specific inventories. The achievement goal questionnaire for sport (AGQ-S) by Conroy *et al.*, (2003) has been shown to be a useful and valid instrument in measuring constructs from the 2×2 framework in sport contexts, but is not likely to be applicable to non-competitive, health-related exercise contexts. In addition, future research in the exercise domain should be directed towards establishing the links between the achievement goals from the 2×2 framework and the degree of internalisation of exercise behaviours using the perceived locus of causality. It may be that the graded conceptualisation of motivational regulations in the exercise domain may discriminate the different goal perspectives.

Conclusions

The present review had a dual purpose. The first was to review the theories and evaluate the state of the literature with respect to the Self-determination Theory in health-related exercise contexts. In doing so, we provided an overview of the sub-theories that comprise the Self-determination Theory approach, provided some historical context as to the development of the theory and its application to the health-related exercise domain. We also provided a brief summary of research examining the antecedents of self-determined motivation and the role of self-determined motivation in predicting adaptive outcomes and exercise behaviour. Importantly, we have identified two areas that have been subject to substantial research intensity among investigators adopting the Self-determination Theory approach: measurement issues and theoretical integration. Specifically, we have highlighted the need for researchers developing psychometric instruments aimed at tapping motivational constructs from the Self-determination Theory perspective to adhere consistently to classical test theory, development from first principles using an exhaustive item pool, and the adoption of rigorous analytic methods, such as confirmatory factor analysis. This will ensure that measurement error and bias are minimised in research on the Self-determination Theory in exercise contexts that will

assist in enhancing researchers' confidence that their findings in research using the theory reflect a true test of the hypothesised relationships or differences.

In addition, we have outlined the need for researchers to further investigate implicit processes in research examining the effects of self-determined motivational orientations on exercise behaviour and other salient outcomes. This will advance knowledge by establishing the extent to which self-determined motivation and behaviour in exercise is subject to deliberative or explicit and non-conscious or implicit influences. Finally, we outline research that is aimed at providing complimentary explanations of motivation in exercise using the Self-determination Theory integrated with other theories of motivation, such as the Theory of Planned Behaviour and the Achievement Goal Theory. Such integrations have been shown to be useful in understanding the process by which self-determined motivational orientations are converted into exercise intentions and behaviour and the extent to which dispositional goal orientations and contexts that enhance mastery-oriented achievement orientations affect intrinsic motivation in exercise contexts.

Overall, research in the field of the Self-determination Theory applied to health-related exercise contexts is expanding rapidly. Much of this proliferation is due to the relative simplicity of the fundamental tenets of the theory and, of course, the success of the theory in accounting for substantial variance in health-related exercise behaviour, as well as associated salient outcomes. However, as mentioned previously, there are very little experimental and intervention studies adopting the principles of the Self-determination Theory to effect change in exercise behaviour. The theory is ripe for further application of its principles to practice, and recent research has illustrated its potential for use in clinical and health promotion settings with respect to health-related exercise (Markland *et al.*, 2005; Vansteenkiste and Sheldon 2006; Markland & Vansteenkiste, 2007). The level of interest in the theory is also illustrated by the increasing number of meta-analytic reviews (Ntoumanis & Biddle, 1999; Chatzisarantis *et al.*, 2003), narrative reviews (Vallerand & Rousseau, 2001; Ryan and Deci 2007; Vallerand 2007), special issues (Hagger & Chatzisarantis, 2007a), and compendiums of research (Hagger & Chatzisarantis, 2007d) on the theory and its associated propositions in the field of exercise. In conclusion, the Self-determination Theory is rapidly becoming a leading theoretical perspective in the field of exercise, and the future looks bright for researchers and practitioners alike as the theory has much to offer in terms of predicting behaviour, understanding behavioural mechanisms, and designing interventions.

Note

1. We have identified two mechanisms or processes that are prevalent in research that has applied the Self-determination Theory to exercise behaviour: mediation and moderation. Mediation refers to the transfer of the effect of one variable (usually called a predictor or *independent* variable) on another (usually referred to as the outcome or *dependent* variable) by a third variable (the *mediator*). A series of conditions must be met for a variable to qualify as a mediator. The independent variable must be significantly correlated with the dependent variable and the mediator must be significantly correlated with the independent variable. The mediator must also have an independent effect on the dependent variable. Most important, the inclusion of the mediator as a predictor of the dependent variable must reduce or *attenuate* the effect of the independent variable on the dependent variable for mediation to occur. For a clear explanation of mediation effects, the reader

is directed to Baron and Kenny, (1986). Moderators refer to variables that interact with, or alter, the effect of one variable on another. Therefore, a moderator *changes* the effect that one variable has on another. There are numerous ways that a moderator can be evaluated in psychological research. The most prominent is testing for interaction effects using multifactorial designs and analysed using ANOVA models or moderated multiple regression analysis. Another approach would be to split a sample based on the high and low values on a moderator variable and analyse the relationship or system to be moderated in each subsample using regression or correlation analysis. Further reading on moderation and interaction effects can be gleaned from Aiken and West's (1991) classic treatment on this subject.

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