THE ROLE OF AUTONOMY SUPPORT AND INTEGRATION IN PREDICTING AND CHANGING BEHAVIOUR: THEORETICAL AND PRACTICAL PERSPECTIVES ON SELF-DETERMINATION THEORY

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Abstract

This thesis reports six studies adopting a self-determination theory (SDT; Deci & Ryan, 1985) approach to understanding motivation and behaviour in health and social contexts. The research focuses on the internalisation and integration of goals and motives extrinsic to the individual and the effects of internalisation on psychological and behavioural outcomes. Two studies also explore the role of social agents in facilitating internalisation through provision of autonomy support.

The research addresses gaps in the SDT literature and contributes to the advancement of theory and practice. A meta-analysis of effects of autonomy support on health-related psychological and behavioural outcomes (Chapter 2), based on the methods of Hunter and Schmidt (1994), indicated the significance and consistency of adaptive effects of autonomy support across the literature. A path analysis was also used to test a modified representation of Williams et al.'s (2006) SDT process model of health-related behaviour. Results supported the motivational sequence postulated within the model, as the effect of autonomy support on behaviour was mediated by need satisfaction and autonomous motivation.

The studies reported in Chapters 3 and 4 make a novel contribution to the SDT health literature by employing measures of chronically-accessible physical activity outcomes and motives to represent spontaneous motivational influences on behaviour. The results presented in Chapter 3 indicated that chronically-accessible appearance-related outcomes are associated with controlling forms of motivation, while the findings reported in Chapter 4 showed that planning-based strategies to maintain physical activity under situations of success and failure in goal striving are differentially effective for chronically autonomous and controlled individuals. These studies also offer guidance for health practitioners in promoting physical activity, by highlighting the potentially maladaptive effects of appearance-related goals and

the importance of tailoring planning-based interventions to individuals' chronically-accessible motives.

The study reported in Chapter 5 substantiated a core theoretical assumption of SDT by providing empirical support for people's inclination to distinguish between intrinsic and extrinsic goals. Adopting methods from the literature on memory and attitudes, cluster analysis was performed on participants' self-generated and recalled physical activity goal data to determine the presence of clustering by goal type. Although findings supported individuals' ability to distinguish intrinsic and extrinsic goals at some level of representation, participants were not able to reliably code their goals at an explicit level. It was therefore concluded that differentiation between goal types may not occur consciously.

The scale-development study in Chapter 6 also supported a key tenet of SDT in establishing construct, nomological, and predictive validity of a scale measuring integrated regulation for physical activity. The factorial validity of the scale, developed through an extensive literature search, expert ratings, and confirmatory factor analyses, was supported in both a high and a lower-active sample. Consistent with predictions, latent means analysis indicated the high active sample reported significantly greater integrated regulation. The scale provides a valid and reliable tool that may be used to evaluate the process of integration following autonomy-supportive interventions in health-related contexts.

Finally, Chapter 7 details the development of a brief autonomy-supportive intervention and observational checklist system for ensuring fidelity to protocol that can be modified for use in a number of contexts requiring behaviour change. The intervention was implemented in a higher education setting over the duration of a single course module and significantly increased two autonomy-supportive teaching behaviours in postgraduate tutors. However, the intervention did not significantly increase the perceived autonomy support, self-determination, or coursework grades of the experimental tutors' students relative to the

control condition, although there was a trend towards a trend towards an interaction between time and experimental condition for level of self-determination towards studying. While students in the experimental group reported an increase in self-determination over time, students within the control condition reported a decrease in self-determination between the first and second, and first and third waves of data collection.

The thesis concludes with a general discussion of findings and directions for future research and practice.

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Chapter 1

Introduction

Introduction

Background to Thesis

Chronic health conditions and preventive health behaviour. Evidence suggests that the prevalence of people categorised as overweight and obese in the U.S.A. has increased significantly in children, adolescents, and men over recent decades (Ogden et al., 2006). Similar trends have been noted in Great Britain with 24 million adults classified as overweight or obese in 2004, and 16% of two to fifteen year-olds categorised as obese (Department of Health, 2004). The rise in the number of people who are overweight or obese is also a growing problem in developing countries that have adopted a ‘Westernised’ lifestyle (Hossain, Kawar, & El Nahos, 2007), and an estimated 1.7 billion people are overweight worldwide. The escalation of obesity has impacted upon the health of many Western nations through increases in various related chronic diseases. Approximately 90% of type 2 diabetes is linked with excess weight and the incidence of diabetes is expected to rise from 17 million in 2000 to 366 million by 2030 (Wild, Roglic, Green, Sicree, & King, 2004). Obesity has also been established as a major risk factor for coronary heart disease (Eckel & Krauss, 1998) and is associated with a higher probability of developing a variety of other conditions including asthma, arthritis, and high blood pressure (Mokdad et al., 2003).

Schroder (2007) has argued that the most promising route to the alleviation of chronic health problems and the reduction of premature mortality is through modifying behaviour. Moderate and vigorous physical activity have been associated with lower body mass index in adults (e.g., Dunton, Berrigan, Ballard-Barbash, Graubard, & Atienza, 2009) and reduced youth overweight and obesity across 34 countries (Janssen et al., 2005). Physical activity has been recommended as a key therapy for obese cardiovascular disease patients (Klein et al., 2004). Despite the importance of physical activity, the Department of Health (2004) reported that only 31% of adults engage in sufficient activity to confer health benefits. Further, this figure derives from self-reported physical activity and may therefore overestimate the percentage of adults who are sufficiently active. Behaviour change is therefore becoming critically important, not only in terms of increasing physical activity, but also initiating and maintaining other behaviours such as healthy eating, medication adherence, and blood glucose monitoring.

In recognition of the clear links between chronic disease and behaviour, theories of the social and motivational antecedents of behaviour are frequently adopted by health psychologists and behavioural medics in understanding, predicting, and changing behaviour. Hagger (in press) outlined three purposes of the application of these theories in the health domain. The first aim is to elucidate the psychological antecedents and correlates of health-related behaviour and the second is to indicate the causal mechanisms by which these correlates influence health-related behaviour. The third objective is to provide frameworks to be employed in the development of health behaviour-change interventions, by identifying targets for intervention and routes to changing behaviour (see also Michie, Johnston, Francis, Hardeman, & Eccles, 2008). One such theory is self-determination theory (SDT; Deci & Ryan, 1985, 2000), which has been extensively applied in the health domain and provides a framework for both understanding and changing the motivational antecedents of health-related behaviour (e.g., Fortier, Sweet, O'Sullivan, & Williams, 2007; Williams et al., 2006). SDT is particularly valuable because it identifies psychological constructs as targets for intervention and specifies causal mechanisms underlying behaviour change.

This thesis presents six studies based on SDT that examine the role of autonomy support in facilitating the internalisation of external contingencies for behaviour and the types of goals underlying autonomous motivation and behavioural engagement in health contexts. The research focuses particularly on the internalisation of goals and motives that originate outside the individual and how this affects subsequent motivation and the course of behaviour. Two studies also directly explore the role of social agents in the environment in catalysing the internalisation process and facilitating adaptive behavioural outcomes.

Overview of SDT

SDT is an organismic dialectic theory of motivation that posits that humans are innately predisposed towards psychological growth, the mastery of challenges, and the integration of experiences into a coherent sense of self (Deci & Ryan, 2000). Within the theory, the quality of an individual's motivation, subsequent behaviour and psychological well-being are affected by the interactions between an individual and his or her environment. It is postulated that the environment can optimise motivation, behaviour, and well-being through supporting three fundamental needs, for autonomy, competence, and relatedness, for optimal functioning and well-being. Autonomy refers to the need to perceive oneself as the initiator and regulator of behaviour, competence describes the feeling of being effective and capable in one's environment, and relatedness is the need to develop close relationships and a sense of connectedness with others (Deci & Ryan, 2000). Autonomy support, structure, and involvement are the contextual supports that are hypothesised to satiate each of these needs, respectively. However, empirical evidence has suggested that the mapping of supports to need satisfaction may be more complex, for instance autonomy support also serves to increase competence satisfaction (Williams, McGregor, King, Nelson, & Glasgow, 2005). Autonomy-supportive environments are those that facilitate a sense of choice, provide a meaningful rationale for behaviour, and acknowledge the perspective and feelings of the individual (Deci, Eghrari, Patrick, & Leone, 1994; Ntoumanis & Standage, 2009). Social agents that are autonomy-supportive are likely to deliver perspective-acknowledging statements such as "I understand that this may be difficult for you", and use language that conveys choice, for example "you <u>may</u> wish to participate in an exercise class", rather than controlling language, for instance "you <u>must</u> participate in an exercise class". Initiating structure involves the provision of positive competence-related feedback and promoting involvement refers to the fostering of a sense of belonging and acceptance.

SDT draws a broad distinction between intrinsic and extrinsic motivation. While the former describes participation in behaviour for the enjoyment, interest, and satisfaction inherent in the behaviour, the latter refers to behavioural engagement for external contingencies, such as rewards and social approval, or internal pressure, such as the avoidance of guilt and shame. Intrinsic motivation, relative to extrinsic motivation, has been consistently associated with a range of adaptive outcomes including enhanced performance, behavioural engagement, persistence, and psychological well-being (e.g., Black & Deci, 2000; Ferrer-Caja & Weiss, 2000; Pelletier, Fortier, Vallerand, & Briere, 2000; Standage, Duda, & Ntoumanis, 2005).

Organismic integration theory (Deci & Ryan, 1985), a sub-theory of SDT, provides a multidimensional conceptualisation of extrinsic motivation and proposes a continuum of behavioural regulation consisting of six forms of qualitatively different motivational orientations that vary in their degree of relative autonomy. An illustration of the continuum of behavioural regulation is provided in Figure 1.1. The sub-theory focuses on the processes of internalisation and integration, through which individuals move from being extrinsically motivated to engaging in behaviour for more autonomous reasons. Internalisation refers to the taking in of a behavioural regulation and integration describes the most complete form of internalisation, such that the behaviour emanates from the self and is fully consistent with one’s values, beliefs, and aspirations (Ryan & Deci, 2000). Movement along the continuum is achieved through the internalisation of goals and behaviours that were originally motivated by external contingencies such that they begin to service the three psychological needs and are integrated into a set of self-defining behaviours. Contextual supports play a key role in this process as the satisfaction of the needs for autonomy and competence is critical in facilitating integration (Ryan & Deci, 2000; Ryan, Patrick, Deci, & Williams, 2008). Internalisation and integration are very important for health-related behaviours because fostering autonomous forms of behavioural regulation tends to result in increased behavioural persistence in the absence of external contingencies. SDT is therefore valuable in providing health psychologists and other practitioners with methods for assisting individuals in the self-regulation of their behaviour.

Intrinsic motivation	**Integrated regulation**	**Identified regulation**	**Introjected regulation**	**External regulation**	**Amotivation**
Behaviour originates with and emanates entirely from the self.	Regulation for behaviour has been fully assimilated and is consistent with one's values, beliefs, and aspirations.	Behavioural engagement for valued outcomes associated with behaviour. Partial internalisation of regulation and some endorsement from the self.	Behavioural engagement to avoid shame and guilt or to gain conditional self-worth.	Behaviour driven entirely by external contingencies, for example tangible rewards and externally imposed deadlines. No sense of ownership over the behaviour.	The absence of intention or clear motives to engage in the behaviour.

Integration *Internalisation*

Autonomous ← *Controlling*

Figure 1.1: The SDT continuum of behavioural regulation, based on Deci & Ryan (2000).

Intrinsic motivation is situated at one extreme of the continuum and this form of behavioural regulation represents the prototypical form of autonomous or self-determined motivation where behaviour emanates wholly from the self. Intrinsically-motivated individuals engage in behaviours for the pursuit of the behaviour itself and in the absence of any external contingency. Extrinsic motivation is situated at the other extreme of the continuum and represents behavioural engagement entirely for external contingencies. Three qualitatively distinct forms of extrinsic motivation are situated between these extremes;

introjected regulation, identified regulation, and integrated regulation. Integrated regulation is located adjacent to intrinsic motivation on the continuum and is the most fully assimilated form of extrinsic motivation, which is evident when regulation for a behaviour is fully consistent with one's values, goals, and aspirations. Identified regulation is situated between integrated and introjected regulations and refers to participation in a behaviour to attain valued outcomes that are likely to service psychological needs, for example health and the development of social relationships. Although the regulation has been partly internalised here, it is not fully integrated into the self as the behaviour is still driven by external contingencies. Introjected regulation is situated adjacent to external regulation on the continuum and describes the regulation of behaviour by avoidance of guilt and shame, or the seeking of contingent self-worth. As such, introjection represents behaviour that is regulated by internal pressure and is associated with less of a sense of personal ownership of behaviour than is experienced with identified and integrated regulations. Finally, amotivation describes a lack of motivation and the absence of intention to engage in a behaviour.

Autonomous forms of regulation have been consistently associated with an enhanced sense of competence (e.g., Williams & Deci, 1996; Williams, Freedman, & Deci, 1998), behavioural quality, persistence, and enhanced well-being (e.g., Sheldon, Ryan, Deci, & Kasser, 2004; Thøgersen-Ntoumani & Ntoumanis, 2006; Williams et al., 2006) in the absence of external incentives and contingencies for behavioural participation. SDT and organismic integration theory are therefore valuable to health psychologists and other practitioners striving to understand individuals' self-regulation of their health-related behaviour.

The Application of SDT to Health and Social Behaviour

SDT has been successfully applied to a number of behavioural domains, including education (e.g., Black & Deci, 2000; Hardre & Reeve, 2003), the workplace (e.g., Deci et al., 2001), sport (e.g., Smith, Ntoumanis, & Duda, 2010), and health (e.g., Powers, Koestner, & Gorin, 2008; Williams, McGregor, Zeldman, Freedman, & Deci, 2004). Internalisation and integration are particularly pertinent to health-related behaviours as many of these are not likely to be intrinsically motivating or enjoyable (Ryan et al., 2008), For example, people tend to pursue behaviours like smoking cessation, medication adherence, and dental flossing for externally-referenced reasons that are unlikely to have been assimilated by the individual rather than for reasons inherent in the behaviour itself. Williams and colleagues (2006) developed an SDT process model to illustrate the internalisation and integration of regulation for health-related behaviour. The model serves as a framework to document the processes by which behavioural regulations are assimilated such that the behaviour becomes valued and self-defining for the individual. The model illustrates the links between autonomy support from health-care providers, perceived competence for behaviour change, autonomous motivation, and behaviour. A depiction of the process model applied to exercise behaviour is provided in Figure 1.2.

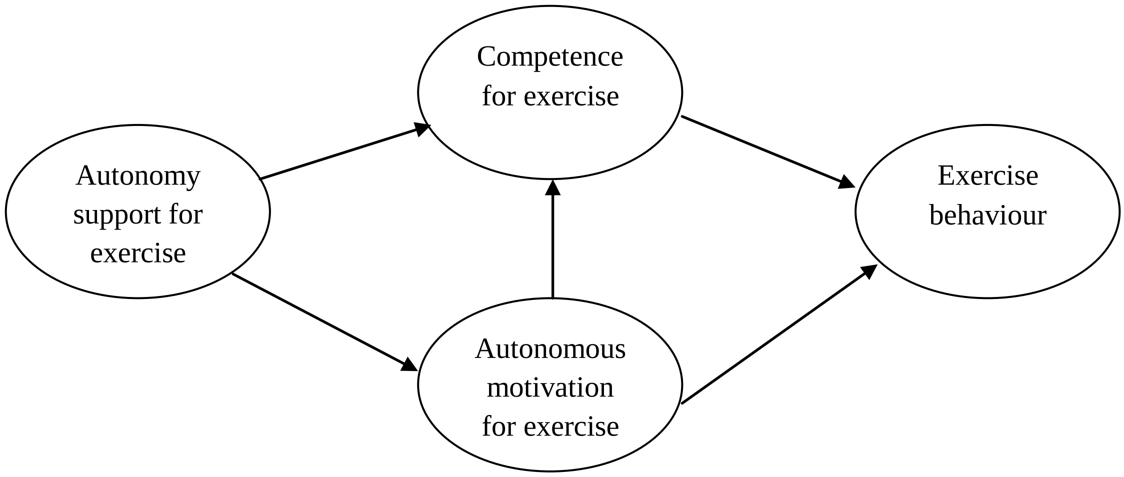

Figure 1.2: The SDT process model (Williams et al., 2006) applied to exercise behaviour.

The crux of the model is the mediation of the association between autonomy support and health-related behaviour by autonomous motivation. Autonomy support is theorised to promote autonomous forms of motivation, which, in turn, drive health-related behaviour in the absence of extrinsic incentives. Autonomous motivation is also associated with perceived competence towards engaging in health-related behaviour. The model has been supported in a number of empirical tests (e.g., Fortier et al., 2007; Williams et al., 2006). However, the model is not comprehensive with respect to SDT as it omits the needs for autonomy and relatedness.

SDT has been applied to a diverse range of health-related behaviours, such as physical activity (Chatzisarantis, Hagger, Wang, & Thøgersen-Ntoumani, 2009), smoking cessation (Williams et al., 2006), medication adherence (Williams, Rodin, Ryan, Grolnick, & Deci, 1998), and dental flossing (Halvari & Halvari, 2006). In addition, the tenets of the theory have been shown to be consistent in samples from a number of nations including Singapore (Lim & Wang, 2009), the UK (Standage et al., 2005), Russia (Chirkov, Ryan, & Willness, 2005), Greece (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005), and the United States (Williams et al., 1998). Across behaviours and cultures, constructs from SDT have explained a substantial proportion of variance in health-related behaviour. Further, the hypothesised associations between need support, the satisfaction of autonomy, competence, and relatedness, and autonomous motivation are ubiquitous in the literature, as are the theorised associations between autonomous motivation and behavioural quality, persistence, and well-being (e.g., Fortier et al., 2007; Halvari, Ulstad, Bagøien, & Skjesol, 2009; Reinboth, Duda, & Ntoumanis, 2004; Williams et al., 1998).

SDT-Based Behaviour-Change Interventions

Although the majority of research adopting SDT to explain health-related and other behaviour has been cross-sectional or prospective in design, there is also a body of literature reporting behaviour-change interventions based on SDT. These interventions have primarily focused on the provision of autonomy support (e.g., Chatzisarantis & Hagger, 2009; Powers et al., 2008), but some have implemented additional SDT-based support alongside the autonomy-support components such as the provision of structure and involvement to bolster competence and relatedness, respectively (e.g., Edmunds, Ntoumanis, & Duda., 2008). Further, some have employed techniques derived from other theories of behaviour change alongside the autonomy-support components (e.g., Fortier et al., 2007). These interventions have largely been effective in promoting the adoption of autonomy-supportive behaviours by social agents (e.g., Edmunds et al., 2008; McLachlan & Hagger, 2010, see Chapter 7) and, most importantly, in changing the behaviour of recipients across a number of behavioural contexts (e.g., Reeve, Jang, Carrell, Jeon, & Barch, 2004; Tessier, Sarrazin, & Ntoumanis, in press). Significant changes in autonomous motivation and behaviour have been observed in the health domain and have been maintained over lengthy follow-up periods up to 18 months post-intervention (e.g., Williams et al., 2006). Evidence to date therefore supports the utility of SDT in the development of behaviour-change interventions, although not without exception (e.g., Mildestvedt, Meland, & Eide, 2007, 2008).

The Centrality of Autonomy and Autonomy Support

Although research has suggested that a balance between satisfaction of the three psychological needs from SDT is necessary in predicting distal outcomes such as behaviour (Perreault, Gaudreau, Lapointe, & Lacroix, 2007), autonomy is afforded a central role because it is inextricably linked to autonomous motivation (Ryan & Deci, 2000). Markland and Tobin (2010) reported that autonomy need satisfaction occupies a unique position amongst the three needs as it is essential to the development of autonomous motivation. For instance, the fostering of relatedness in the absence of autonomy satisfaction was associated with only partial internalisation of behavioural regulation, whereas autonomy satisfaction was related to more autonomous forms of regulation. Autonomy need satisfaction is also a key facilitator of perceived competence (Markland, Ryan, Tobin, & Rollnick, 2005; Williams, Grow, Freedman, Ryan, & Deci, 1996). This research suggests that, of the three needs, it is the satisfaction of the need for autonomy through autonomy support that is likely to confer the most benefits when it comes to promoting autonomous motivation and behavioural and psychological outcomes. The beneficial effects of autonomy support on the satisfaction of the three needs, the development of autonomous forms of behavioural regulation, and behavioural and well-being outcomes are consistent across the body of literature documenting the use of SDT in predicting health-related behaviour (see Chapter 2). These effects are consistent cross-culturally (e.g., Chirkov et al., 2005; Hagger et al., 2005) and have been replicated across diverse contexts including health (Williams et al., 2006) and education (Tessier et al., in press). Research has therefore underscored the role of autonomy as the strongest and most consistent predictor of health-related psychological outcomes and it is imperative that health-related behavioural interventions focus on enhancing autonomy through the provision of autonomy support in order to actuate behaviour change and improve well-being. The focus of this thesis will be primarily on the satisfaction of the need for autonomy through the provision of autonomy support. Despite substantial empirical support for the effects of autonomy support on health-related psychological and behavioural outcomes through the processes of internalisation and integration, there remain outstanding issues to be addressed. These issues will be outlined in the following sections and the contribution of the current research in addressing each will be identified and discussed.

Synthesis of the Autonomy Support Literature

Despite the robust findings on the effectiveness of autonomy support in promoting healthy behaviour, the variability in the forms of autonomy support provided, the providers and recipients, and research designs has led to a number of inconsistencies in the literature surrounding the effective provision of autonomy support. To illustrate, it is currently unclear as to which sources or providers of autonomy support (e.g., significant others, teachers, health care professionals), are associated with the largest effects of autonomy support on health-related autonomous motivation and behaviour (e.g., Brickell, Chatzisarantis, & Pretty, 2006; Chatzisarantis & Hagger, 2009; Williams, Gagne, Ryan, & Deci, 2002). Further, empirical research has not yet clarified the optimal degree of autonomy support provision, in terms of the manipulation of some or all of the core facets of the construct, in conferring the strongest positive effects on health-related outcomes, with few direct comparisons between the effects of complete and incomplete forms (e.g., Chatzisarantis, Hagger, & Smith, 2007). One objective of this thesis, therefore, was to synthesise the large body of research on autonomy support and health-related outcomes. It was intended that this synthesis would resolve ambiguities relating to the moderating effects of various forms, sources, and recipients of autonomy support on associations with health-related need satisfaction, motivational, behavioural, and well-being outcomes. Chapter 2 presents a comprehensive synthesis of 90 studies reporting 100 tests of the effects of autonomy support on these outcomes and provides recommendations for future research and practice regarding the implementation of autonomy support for health-related behaviour. This meta-analysis represents the first quantitative synthesis of this literature and also provides the first test of hypothesised associations in the SDT process model using meta-analytically derived corrected correlations.

The Integration of SDT with Other Social Psychological and Social Cognitive Models

SDT has been employed in extending and complementing other social psychological and social cognitive theories, particularly within the health context and largely in the domains of physical activity and exercise. Theoretical integration is useful in overcoming the limitations of individual theories and ensuring a more complete explanation of the antecedents of health-related behaviour. Mullan and Markland (1997) reported an integration of SDT and the transtheoretical model (TTM; Prochaska & DiClemente, 1983), such that relative autonomous motivation for exercise behaviour increased through the stages of change from precontemplation through to maintenance. A larger body of literature has incorporated key constructs from SDT within the theory of planned behaviour (TPB; Ajzen, 1991) to account for the motivational climate within which attitudes, subjective norms, perceived behavioural control, and intention develop. The integration of the TPB and SDT was formalised in the development of the trans-contextual model (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003), which incorporates perceived autonomy support from physical education (PE) teachers and autonomous motivation for PE and leisure-time physical activity. Hagger and Chatzisarantis (2009) conducted a meta-analysis of literature on the integration of the TPB and SDT and a meta-analytic path analysis based on the sample of integrative studies provided empirical support for the hypothesised sequence of positive associations between autonomous motivation and the TPB constructs of attitude, subjective norms, perceived behavioural control, and intention. Consistent with the trans-contextual model, the TPB variables also partially mediated the effects of autonomous motivation on intentions and behaviour. However, this work has been limited by the exclusive use of self-report scaled measures of behavioural regulation and the omission of measures of spontaneous motivational influences on behaviour.

Limitations of Scaled Self-Report Measures of Behavioural Regulation

One limitation of SDT-based research on health-related behaviour that was evident in the meta-analysis was the exclusive reliance of research on self-report scaled measures of SDT constructs derived from psychometric inventories, such as the Behavioural Regulation in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997) and the Academic Motivation Scale (Vallerand et al., 1992). While such instruments are likely to provide a good assessment of deliberative motivational influences underlying behavioural participation, these measures do not tap more spontaneous, non-conscious influences on behaviour. This is pertinent to recently-developed dual process approaches to human behaviour which specify that social behaviour is determined by both reflective and impulsive routes, and that the impulsive system is likely to be governed partly by motivational orientations (Hofmann, Friese, & Wiers, 2008; Strack and Deutch, 2004). In keeping with this approach, Levesque and Pelletier (2003) demonstrated empirically that while assessments of consciously-regulated behavioural regulation predicted the deliberative construct of intention, a measure of chronically-accessible motivation was more useful for the prediction of behaviour. It is therefore important to account for both reflective/deliberative and spontaneous/impulsive forms of regulatory influence on behaviour. Hofmann and colleagues (2008) have suggested that the validity of health behaviour models may be improved if both forms of influence are included. There is also some suggestion that the internalisation and integration of behavioural regulation may lead to automaticity of behaviour (Legault, Green-Demers, & Eadie, 2009), implicating involvement of an impulsive system and emphasising the importance of developing measures of spontaneous motives underlying behaviour.

Two studies in the present thesis therefore utilised measures of both deliberative and chronic impulsive motives underlying participation in physical activity behaviour. The spontaneous goal-generation paradigm developed by Levesque and Pelletier (2003) was employed in the study reported in Chapter 3 to assess the degree of internalisation of behavioural regulation associated with chronically-accessible appearance-related outcomes in physical activity. Determining the regulatory basis of this common goal within physical activity is important because research has established that striving for autonomously-oriented goals or outcomes is more conducive to behavioural persistence and well-being than striving for controlled-oriented goals (Schmuck, Kasser, & Ryan, 2000; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Consistent with Deci and Ryan’s (2000) proposed distinction between the ‘what’ or goal content and the ‘why’ or motivation underlying goal striving, Ingledew and Markland (2008) showed that various types of desired goal underlying behavioural engagement are differentially associated with autonomous and controlled forms of regulation. The study in Chapter 3, therefore, aimed to address ambiguity surrounding the type of behavioural regulation underlying pursuit of appearance-related outcomes, which has been highlighted in the literature (e.g., Hagger et al., 2009). In contrast to Ingledew and Markland's (2008) direct approach to this issue, which utilised the Exercise Motivations Inventory version 2 (EMI-2; Markland & Ingledew, 1997) to assess explicit and deliberative exercise participation motives, an indirect, chronically-accessible measure of physical activity outcomes was employed in the study to tap spontaneous rather than deliberative motives. It was expected that spontaneously-generated outcomes would represent chronic or impulsive influences on behaviour and that striving primarily for appearance-related outcomes would be associated with controlling forms of behavioural regulation on the deliberative scaled measure.

Findings from this study were then used to inform the coding of chronically-accessible motives in the study presented in Chapter 4. In the study, a measure of chronically-accessible motives for physical activity was developed based on the spontaneous goal-generation paradigm of Levesque and Pelletier (2003). This measure was incorporated alongside a traditional scaled measure of autonomous motivation within an extended TPB model. The extended model also included a conditional form of behavioural intentions, known as continuation intentions (Chatzisarantis, Hagger, Smith, & Phoenix, 2004), that indicate individuals' readiness to continue behavioural participation upon encountering either success or failure in goal striving in the future. The study explored the interaction of chronically-accessible motives with these conditional intentions in predicting physical activity behaviour. Chronically-accessible motives were hypothesised to be a moderating influence on the predictive utility of continuation intentions due to the spontaneous nature of effects of chronically-accessible motives on behaviour. This study also represented the first test of the integration of a measure of chronically-accessible motives within the TPB framework. It was intended that the application of the novel integrated model should provide an indication of how best to tailor planning-based physical activity behaviour-change interventions on the basis of chronically-accessible motives.

Differentiation between Intrinsic and Extrinsic Goals

While behavioural regulation or motivation relates to the “why” underlying behavioural engagement, goals describe the “what” or objective of behaviour. Kasser and Ryan (1996) drew a distinction between intrinsic and extrinsic goals. Intrinsic goals have been defined as those that are inherently rewarding to pursue, through the satisfaction of the three fundamental needs. Such goals contribute towards the development of personal aspirations and include social relationships, community contribution, and personal growth. In contrast, extrinsic goals have an outward focus and goal striving is directed towards outcomes such as fame, wealth, and a desirable image. A substantial section of literature in SDT suggests differential effects of intrinsic and extrinsic goals on the experience of autonomy and competence, motivational orientations, behaviour, and well-being (Ryan et al., 2008). Intrinsic goals have been shown to confer uniformly adaptive effects on these outcomes relative to extrinsic goals (e.g., Schmuck et al., 2000; Vansteenkiste, Simmons, Braet, Bachman, & Deci, 2007). Although this does not imply that participants will have an explicit awareness of the difference between intrinsic and extrinsic goals, it indicates that this distinction may be represented at some level, for example in separate schemata, such that reliable differences in responding occur. In the study reported in Chapter 4, individuals’ spontaneously generated goals were coded as autonomous or controlling in nature according to SDT and previous research findings (e.g., Ingledew & Markland, 2008; McLachlan & Hagger, 2010, see Chapter 4; Sebire, Standage, & Vansteenkiste, 2008). Although people’s ability to make this distinction is a theoretical assumption of SDT and inferred from the differential effects of the goal types on need satisfaction, motivational, behavioural, and well-being outcomes (e.g., Sebire, Standage, & Vansteenkiste, 2009), this issue has remained empirically unverified. The clustering of individuals' self-generated physical activity goals by goal type was therefore analysed and participants' explicit coding of the goals was examined to determine level of awareness regarding the distinction between intrinsic and extrinsic goals.

Dearth of Research Assessing Integrated Regulation

One further limitation of SDT research to date is the dearth of studies incorporating assessment of integrated regulation. This was confirmed in the meta-analysis as only three of 100 independent tests of the effects of autonomy support included the measurement of integrated regulation. This is an omission that should be rectified in future research, particularly considering that integrated regulation is postulated as the ultimate result of autonomy support provision and represents full assimilation of behavioural regulation with the self (Ryan & Deci, 2000). It is imperative that health behaviour-change interventions target manipulations that facilitate the process of internalisation. In addition, integrated regulation should be assessed routinely as a potential mediator of the effects of autonomy support manipulations and interventions on behavioural and psychological well-being outcomes. Currently, most of the measurement instruments developed to assess behavioural regulation, for instance the BREQ (Mullan et al., 1997), BREQ-2 (Markland & Tobin, 2004), Sport Motivation Scale (SMS; Pelletier et al., 1995), and AMS (Vallerand et al., 1992), omit a subscale for integrated regulation and do not, therefore, offer a full operationalisation of the regulatory constructs specified in organismic integration theory. Although some research has indicated that integrated regulation is not a salient factor in decisions to engage in physical activity (e.g., Pelletier et al., 1995) and that it may not be a concept that is fully developed in children or adolescents (Vallerand, 1997, 2001), its fundamental importance within organismic integration theory necessitates its inclusion within empirical studies.

The rare attempts at developing measurement instruments to tap integrated regulation have been met with difficulties in establishing discriminant validity with the neighbouring constructs of intrinsic motivation and identified regulation (e.g., Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson, 2007) and have resulted only in tentative conclusions regarding the psychometric properties of items (e.g., Li, 1999). For example, an integrated regulation scale developed by Wilson, Rogers, Loitz, and Scime (2006) was supported by confirmatory factor analyses and predicted exercise behaviour, but was limited by methodological factors in the process of scale development and did not fully reflect the essence of the construct. Consequently, the study reported in Chapter 6 details the development of a psychometric measure of integrated regulation for physical activity from first principles. The procedure content-analysed the definitions of the construct cited in the literature and previous measures to generate a large pool of items that was then refined through expert rating and confirmatory factor analyses. The validity of the scale was also tested in a dieting context (see Appendix 3) and it was adapted for use in a higher education setting (see Chapter 7).

Autonomy-Supportive Behaviour-Change Interventions and Evaluating Intervention Fidelity

A large proportion of the research adopting SDT is cross-sectional or prospective in nature. The meta-analysis reported in Chapter 2 indicated the need for more intervention studies delivering autonomy support in the health domain. An important observation regarding the sample of studies in the meta-analysis was the lack of clear reporting of the fidelity to the intervention protocol used to specify exactly how the intervention is implemented by the social agents providing the autonomy support, and the absence of instruments with which to assess fidelity. In the academic context, one such instrument was developed by Reeve and colleagues (2004), but it employed relatively rudimentary bipolar category descriptors for the rating of a limited range of autonomy-supportive behaviours. It is imperative to determine accurately whether providers of autonomy support implement the behaviours targeted by interventions. A failure to do so means that any significant behavioural changes found in the study cannot be unequivocally attributed to the autonomy-supportive intervention.

In response to this need, Chapter 7 documents the novel implementation of an autonomy-supportive intervention in a higher education setting. The intervention focused on increasing the autonomy-supportive behaviours of postgraduate tutors and assessing the tutors' fidelity to intervention protocol. This was achieved through the use of an observational checklist system to record the frequency of a range of micro-level behaviours displayed by the tutors. The effects of the intervention on student perceived autonomy support, autonomous motivation, and achievement behaviour were also assessed. The intervention protocol and checklist provide a framework that may be adapted for use in a number of different applied contexts that require behaviour change.

Summary of the thesis

This thesis presents a series of six empirical studies aiming to support the effects of autonomy support, internalisation, and autonomous or integrated forms of motivation on health and social behaviour. The studies focus on addressing gaps in the extant literature through the development of methods and measures for the advancement of theory and SDT-based behaviour-change interventions. There were six main objectives in the present research. The initial objective was to determine the overall effects of autonomy support on health-related psychological and behavioural outcomes, to explore potential moderators of these effects, and to test the SDT process model for health-related behaviour across the literature. The second was to determine the regulatory basis of chronically-accessible appearance-related outcomes in physical activity and, in particular, to test the hypothesis that these would be associated with controlling forms of deliberative behavioural regulation. The third was to develop a measure of chronically-accessible motives for physical activity to reflect spontaneous motivational influences on behaviour and to examine their interplay with deliberative regulatory constructs, while the fourth was to empirically verify the theorised distinction between intrinsic and extrinsic goals in a physical activity context. The fifth objective was to develop a valid and reliable measure of integrated regulation to be used in autonomy-supportive behaviour-change interventions, and the final aim was to develop an autonomy-supportive intervention and an observational checklist to evaluate intervention fidelity. The thesis concludes with a general discussion of findings and recommendations for future research and practice.

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Chapter 2

A meta-analysis of the effects of autonomy support on health-related need satisfaction, motivational, behavioural, and well-being outcomes

Abstract

Objective. The present meta-analysis aimed to provide a comprehensive synthesis of research on the effects of manipulated and perceived autonomy support from self-determination theory (SDT; Deci & Ryan, 1985a) on health-related psychological and behavioral outcomes, determine the influence of six methodological and demographic moderators on the effects, and test a modified SDT process model for health-related behavior (Williams et al., 2006). *Methods.* A literature search identified 98 articles providing 109 independent tests of the effects of autonomy support. Hunter and Schmidt's (1994) meta-analytic methods were employed and the zero-order correlation coefficient was adopted as the metric for effect sizes. Hypotheses of the modified SDT process model, including mediation of effects of autonomy support on behavior by need satisfaction and autonomous motivation, were tested using correlations derived from the meta-analysis. *Results.* Analyses supported the theorized importance of manipulated and perceived autonomy support in promoting adaptive psychological and behavioral outcomes in the health context. Study design, age of sample, provider of autonomy support, and the degree of perceived autonomy support assessed were significant moderators of the effects of autonomy support on these outcomes. Data were consistent with the hypothesized mediation of the overall effect of autonomy support on behavior within the SDT process model. *Conclusions.* The meta-analysis supported the adaptive effects of manipulated and perceived autonomy support on health-related psychological and behavioral outcomes. Recommendations for future research include determining the mechanisms of behavior change in complex multifaceted autonomy-supportive interventions and employing measures that provide operationalisation of all three core facets of perceived autonomy support.

Keywords: autonomy support, autonomous motivation, health-related behavior.

A Meta-Analysis of the Effects of Autonomy Support on Health-Related Psychological and Behavioral Outcomes

Chronic health conditions are increasing in prevalence across both industrialized and developing nations. These conditions include obesity (e.g., Hossain, Kawar, & El Nahos, 2007; Ogden et al., 2006), type 2 diabetes (Wild, Roglic, Green, Sicree, & King, 2004), cardiovascular disease (Eckel & Krauss, 1998), and arthritis (Mokdad et al., 2003). Epidemiological research has demonstrated that many of these illnesses and diseases can be ameliorated or their onset prevented by engagement in health-related behavior (e.g., Knowler et al., 2002; Shepard & Balady, 1999). This has led to increased interest in personal behavior change and research has indicated that this is the most promising route to health promotion and disease prevention, particularly when accompanied by social and environmental support (Schroeder, 2007). The management and prevention of diseases such as diabetes and cardiovascular disease also necessitates adherence to preventive behavioral regimens such as frequent exercise, taking medication, and monitoring blood glucose (e.g., Clark, 2008; Funnell et al., 2009; Klein et al., 2004). This poses a significant challenge for health psychologists and other health practitioners in terms of assisting people in self-regulating their behavior to prevent or manage chronic disease and promote health.

Developing an understanding of the determinants of health-related behavior and behavior change is therefore important, particularly with regard to the development and design of effective behavior-change interventions to improve health status. Rothschild (1999) identified motivation as a critical mediator of behavior change and asserted that the success of behavior change interventions is partly dependent on altering motivation. Social psychological theories have been applied in health-behavioral contexts to understand the role of motivation in predicting behavior and have been adopted as a basis for the development of behavior-change interventions (e.g., Phillips & Wilbur, 1995; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Thøgersen-Ntoumani & Ntoumanis, 2006; Williams et al., 2006). Self-determination theory

(SDT; Deci & Ryan, 1985a; 2000) is an example of a motivational approach that has been extensively applied to the uptake and maintenance of health-related behavior. SDT posits that support from social agents for three fundamental needs facilitates the development of adaptive forms of motivation, referred to collectively as *autonomous* motivation. Autonomous motivation is associated with increased behavioral engagement and persistence and enhanced psychological well-being. The fundamental need for autonomy has assumed particular importance in the development of autonomous forms of motivation (Markland & Tobin, 2010) and is fostered through the provision of autonomy support (Deci & Ryan, 2000). Autonomy support consists of three core components, namely, the provision of choice, the offering of a meaningful rationale for behavioral engagement, and the acknowledgment of the individual's perspective and feelings.

The manipulation of autonomy support has been used effectively in behavior change interventions across a range of contexts, conferring significant positive effects on outcomes such as need satisfaction, motivation, and behavior (e.g., Edmunds, Ntoumanis, & Duda, 2008; Reeve, Jang, Carrell, Jeon, & Barch, 2004). Individuals' perceptions of autonomy support have also been shown to be effective in predicting motivational and behavioral outcomes in a variety of contexts, including health (e.g., Halvari, Ulstad, Bagøien, & Skjesol, 2009). However, despite a substantial body of empirical support for the utility of autonomy support, there exists considerable variability in the magnitude of effects, and several null effects have also been found in the health domain (e.g., Levy & Cardinal, 2004; Mildestvedt, Meland, & Eide, 2007). It is therefore important to synthesize this body of literature to determine whether autonomy support has been consistently effective in modifying psychological and behavioral outcomes and whether null findings may be attributable to methodological artifacts such as sampling and measurement error. It is also necessary to elucidate the potential role of moderator variables in determining the magnitude of the effects of autonomy support on health-related outcomes.

The purpose of the present meta-analysis was therefore to provide the first quantitative synthesis of the literature on autonomy support in the health domain and to determine the role of several potential moderators of reported effects of autonomy support on psychological and behavioral outcomes. A further aim was to test the mediation of the effects of autonomy support on health-related behavior and well-being by need satisfaction and autonomous motivation as postulated in the SDT process model proposed by Williams et al. (2006). The meta-analysis will advance knowledge and theory on the role of motivation from the SDT perspective on health behavior by quantifying the overall effect of autonomy support on health-related behavior across the literature, identifying the salient moderators of these effects, and providing a robust test of the theorized mediation by need satisfaction and autonomous motivation variables. The analysis will also make a unique contribution to practice by increasing knowledge and understanding of the motivational influences on health behavior and demonstrating the utility of autonomy support in health-related behavior-change interventions.

Self-Determination Theory (SDT)

SDT is a global theory of human motivation that specifies the nutriments provided by the social context that are essential for optimal behavioral engagement, psychological functioning, and well-being. SDT proposes that the satisfaction of three fundamental needs for autonomy, competence, and relatedness underlies individuals' motivational orientations and subsequently the quality and persistence of their behavior and their psychological well-being. Autonomy refers to the experience of action or behavior as self-initiated and regulated, competence describes the perception of effective functioning in one's environment, and relatedness is defined as perceiving that one has established close and fulfilling interpersonal relationships (Ryan & Deci, 2000).

Central to SDT is a broad distinction between intrinsic and extrinsic motivation, which relates directly to the experience of autonomy. Intrinsic motivation is characterised by behavioral engagement for reasons perceived to originate from the self, such as for the enjoyment and satisfaction inherent in the activity, while extrinsic motivation describes behavioral participation that is reinforced by external contingencies and a sense of pressure, for example obtaining tangible rewards or meeting externally-imposed deadlines. Intrinsic motivation has consistently been shown to be associated with beneficial psychological and behavioral outcomes such as behavioral quality and persistence, and psychological well-being (e.g., Black and Deci, 2000; Standage, Duda, & Ntoumanis, 2005; Ferrer-Caja & Weiss, 2000), while extrinsic motivation results in less adaptive consequences such as behavioral desistence (e.g., Pelletier, Fortier, Vallerand, & Briere, 2001).

Theorists in SDT (e.g., Deci & Ryan, 1985a) have progressed beyond the intrinsic-extrinsic motivation dichotomy to make a finer-grained distinction between the types of motivation underlying behavior. Organismic integration theory (Deci & Ryan, 1985a), a sub-theory of SDT, was developed to account for the assimilation of behaviors initially motivated by external contingencies, such that they come to be perceived as satisfying the needs for autonomy, competence, and relatedness. The theory proposes a continuum of behavioral regulation that specifies qualitatively different forms of motivation falling between the extremes of intrinsic and extrinsic motivation. Each of these types of behavioral regulation differs in the extent to which they are autonomous, or how much of a sense of 'personal ownership' an individual perceives with respect to a given behavior. Integrated regulation falls adjacent to intrinsic motivation and describes a state in which a previously externally-regulated behavior has been internalized or assimilated by the self, such that the behavior is consistent with one's values, beliefs, and aspirations. Identified regulation sits alongside integrated regulation and refers to participation in a behavior that stems from the recognition of its value. For instance, one may engage in exercise behavior because of the importance of the health benefits conferred, rather than for a sense of enjoyment derived from the activity itself. This represents a less-autonomous or self-originating form of behavioral regulation. Introjected regulation lies alongside identified regulation and represents the governing of behavior by contingencies imposed by the individual, such as the avoidance of guilt or shame. Deci and Ryan (2000) illustrate this form of regulation with a description by Perls (1973), suggesting that introjection consists of “swallowing regulations whole without digesting them” (p. 236). The sense of self-determination or personal ownership of a behavior is relatively lower for individuals whose behavior is regulated by introjection compared with those motivated to act for identified reasons. External regulation represents the prototypical form of extrinsic motivation whereby a behavior is perceived to be controlled wholly by contingencies external to the self and is not accompanied by a sense of personal ownership. This is the most heteronomous or controlling form of regulation and action is perceived to be controlled or reinforced solely by contingencies that lie outside the individual. Finally, amotivation describes a state characterized by the absence of any intention to engage in a behavior (Deci & Ryan, 2000).

Research has consistently indicated, across a variety of domains, that autonomous forms of behavioral regulation are associated with more adaptive behavioral and well-being outcomes than introjected and external regulations (Pelletier et al., 2001; Thøgersen-Ntoumani & Ntoumanis, 2006). It is theorized that autonomously-motivated activities result in adaptive psychological and behavioral outcomes because they satisfy the fundamental psychological needs for autonomy, competence, and relatedness. The focus of organismic integration theory is to outline how individuals are able to accommodate or *internalize* behaviors that are performed for external reasons so that they come to be perceived as behaviors that service autonomous goals and satisfy psychological needs. A shift in an individual’s perceived regulation of their behavior from controlling to more autonomous on the continuum is achieved through a process of internalization (Ryan & Deci, 2000). Internalization represents the process by which the regulation of a behavior is adopted and taken in by the self as an action that services the psychological need for autonomy. The most complete form of internalization is integration, whereby the behavior is perceived to emanate from the self rather than from external sources. Socio-contextual support from social agents is crucial in initiating and sustaining integration (Deci, Eghrari, Patrick, & Leone, 1994; Ryan & Deci, 2000).

Autonomy Support, Internalization, and Integration

While the satisfaction of all three needs is proposed to be important in facilitating adaptive forms of motivation, behavioral persistence, and well-being, the need for autonomy occupies a unique position in that satisfaction of this need is critical in internalization and the development of autonomous forms of motivation (Markland & Tobin, 2010). Support for autonomy from social agents in the actor's environment can serve to satisfy the need for autonomy, and this support is also valuable in ensuring optimal satisfaction of the needs for competence and relatedness (Markland & Tobin, 2010; Ryan & Deci, 2008). For example, Markland and Tobin reported that the need for relatedness could be satisfied through non-autonomy supportive strategies but this tended to lead to less autonomous forms of motivation, while fostering this need through autonomy supportive techniques facilitated more autonomous forms of motivation. This indicates that support for autonomy is important to promote autonomous forms of motivation and concomitant satisfaction of all psychological needs. Satisfaction of the need for autonomy arising from environmental support is therefore extremely important in promoting internalization, integration, and autonomous forms of motivation (Hagger & Chatzisarantis, 2009; Hardre & Reeve, 2003; Taylor & Ntoumanis, 2007).

The development of autonomy-supportive techniques has been directed towards fostering individuals' inner endorsement of their behavior and ultimately aims to foster the development of integrated regulation. SDT posits that both contextual (e.g., rewards, choice) and interpersonal factors (e.g., fundamental needs, motivation) are central to the processes of internalization and integration, and autonomy support from social agents represents an important contextual factor. Deci and colleagues (1994) showed that the experimental manipulation of the three core contextual supports for autonomy, namely the provision of choice, the provision a meaningful rationale, and the acknowledgement of an individual's perspective and feelings, facilitated the integration process. Deci and colleagues' experiment also demonstrated that controlling interpersonal contexts resulted in less internalization and a state of introjection. Contextual supports for relatedness and competence have also been reported to be associated with internalization (e.g., Ryan, Stiller, & Lynch, 1994), but autonomy support plays a more fundamental role (Markland & Tobin, 2010). Autonomy support has also been implemented at the micro level, for instance through the avoidance of controlling language, the use of encouragement, and the offering of hints towards goal progress (Reeve & Jang, 2006). However, the general consensus in the literature is that the provision of choice, the acknowledgement of feelings and perspective, and the delivery of a meaningful rationale are the core components of autonomy support that facilitate autonomous motivation (Chatzisarantis, Hagger, & Smith, 2007; Williams, Cox, Hedberg, & Deci, 2000; Zeldman, Ryan, & Fiscella, 2004).

It is important to distinguish between manipulated autonomy support and perceived autonomy support. While the former refers to the direct manipulation of autonomy support by a social agent, the latter refers to individuals' perceptions of autonomy support from social agents in their environment. In the current article, explicit manipulations of autonomy support within interventions and experiments will be referred to as 'manipulated autonomy support' while individuals' perceptions of autonomy support will be termed 'perceived autonomy support'. For those analyses combining the two forms of the construct, the term 'overall autonomy support' will be used to indicate this. Manipulated autonomy support and perceived autonomy support have been associated with a range of desirable outcomes, including basic need satisfaction, self-determined forms of motivation, effort, engagement, behavioral intentions, behavioral persistence, positive emotion, and physical and psychological well-being across a variety of contexts (Deci & Ryan, 1987; Ntoumanis, 2001; Reeve et al., 2004). Koestner (2008) has stated that both autonomy support and autonomous motivation appear to exert an important influence over the achievement of health-related goals. A large body of literature has also supported the effects of manipulated autonomy support on engagement in, and persistence with, health-related behaviors in contexts as diverse as exercise (Chatzisarantis & Hagger, 2009), smoking cessation (Williams, Gagne, Ryan, & Deci, 2002), and dental flossing (Halvari & Halvari, 2006). Perceived autonomy support has also been shown to be significantly associated with health-related autonomous motivation and behavior. For example, a recent meta-analysis demonstrated that perceived autonomy support was significantly related to autonomous motivation as well as several health-related behaviors (Hagger & Chatzisarantis, 2009).

Autonomy Support as a Target for Intervention

SDT also provides information on the psychological variables that need to be targeted to modify health behavior and the associated techniques that are effective in changing those variables. The provision of guidance on eliciting behavior change represents an important advantage of SDT over other theories (see Brug, Oenema, & Ferreira, 2005; Michie, Johnston, Francis, Hardeman, & Eccles, 2008). Interventions that have trained social agents in the provision of autonomy-supportive techniques have been successful in modifying their behavior to become more autonomy-supportive (Edmunds et al., 2008; McLachlan & Hagger, 2010, see Chapter 7; Tessier, Sarrazin, & Ntoumanis, 2008). Autonomy-supportive interventions have also shown significant and desirable effects on need satisfaction, motivational, behavioral, and well-being outcomes in recipients across a range of contexts and in a number of behavioral contexts such as exercise (Chatzisarantis & Hagger, 2009), medication adherence (Williams, Rodin, Ryan, Grolnick, & Deci, 1998), and smoking cessation (Williams et al., 2006).

Variability in the Provision and Assessment of Autonomy Support

There has been considerable variability in the implementation of manipulated autonomy support and assessment of perceived autonomy support across studies. For example, research has manipulated autonomy support in different ways, with some experimental studies focusing solely on choice (e.g., Thompson & Wankel, 1980) and others manipulating all facets of the construct (e.g., Williams et al., 2002). There is some empirical evidence to suggest that the degree of autonomy support provision is of importance in determining the magnitude of effects. For instance, Chatzisarantis and colleagues (2007) demonstrated that participants who received a choice, a meaningful rationale, and acknowledgement of their perspective reported significantly more positive attitudes toward a bench-stepping task than those who received lesser degree of autonomy support. However, there appears to be no clear consensus in the literature regarding the optimal degree of manipulated autonomy support in terms of the components that should be included in interventions, or which facets are of paramount importance in facilitating autonomous motivation and behavioural engagement and persistence.

Several experimental and intervention studies have incorporated the manipulation of autonomy support with the manipulation of other constructs, such as competence and relatedness (Edmunds et al., 2008) and goal setting (Fortier, Sweet, O’Sullivan, & Williams, 2007), while others have allowed the observation of independent effects of manipulated autonomy support (e.g., Williams et al., 2002). Further, the effects of manipulations of autonomy support have been evaluated against different comparison conditions, including neutral controls and controlling contexts that actively seek to undermine or thwart autonomy. There is also considerable variability in the providers and recipients of manipulated autonomy support across the literature, for instance interventions delivered to patients by health care professionals (e.g., Williams et al., 2002) and those delivered by specialist facilitators such as exercise instructors presenting an aerobics class (Edmunds et al., 2008). The present analysis will therefore explore the moderating role of degree of autonomy support, presence of additional support, comparison condition, provider of autonomy support, and recipients on the effects of manipulated autonomy support on health-related psychological and behavioral outcomes. This will identify the conditions under which the manipulation of autonomy support is most effective.

Similarly, some correlational studies have not assessed all three core components of perceived autonomy support (e.g., Conroy & Coatsworth, 2007), while others have employed a more comprehensive operationalization (e.g., Vierling, Standage, & Treasure, 2007). Perceived autonomy support has been measured as an independent construct (e.g., Conroy & Coatsworth, 2007) or in conjunction with other constructs, i.e., as "basic need support" (e.g., Markland & Tobin, 2010). The provider(s) of manipulated and perceived autonomy support have also varied widely across studies such as coaches (Amorose & Anderson-Butcher, 2007) and parents (e.g., Chirkov & Ryan, 2001). It is therefore important to resolve the ambiguity surrounding the diverse forms of operationalization of perceived autonomy support. The current meta-analysis will address this need by providing a comprehensive synthesis of the available data on autonomy support and health-related psychological and behavioral outcomes and exploring the role of the moderating variables of provider and recipient of perceived autonomy support, degree of assessment, and the assessment of additional support.

A Process Model of Perceived and Manipulated Autonomy Support

Williams et al. (2006) proposed a process model of autonomy support which importantly identified the mediators or mechanisms by which overall autonomy support from social agents in the environment affects individuals' health-related autonomous motivation, competence, and behavioral outcomes. The model makes a valuable contribution to the SDT literature by indicating how interventions adopting an SDT approach to behavior change lead to adaptive behavioral outcomes (see Michie, 2008). In the empirically-verified model, autonomy support positively predicts both competence and autonomous motivation, which in turn predict adaptive behavioral outcomes in the health domain (e.g., Fortier et al., 2007; Williams et al., 2006). This means that the provision of autonomy support promotes behavioral engagement by promoting individuals' perceived competence and autonomous motivation. Although Williams and colleagues' model has received empirical support, it is important to evaluate whether this model holds when applied to data testing these relationships across the literature on overall autonomy support and associated health-related psychological and behavioral outcomes. In the current meta-analytic review, we propose to test this model by quantitatively synthesizing the extant research and subjecting the corrected, averaged relationships to a meta-analytic path analysis to test the proposed network of relations among the key variables in Williams and colleagues' model. We expect this to provide further evidence in support of the proposed model and provide robust tests of the proposed mediators of the effects of overall autonomy support on health-related outcomes.

The Present Study

There has been, to our knowledge, no complete synthesis of the literature on autonomy support and health-related behavior to date, despite the proliferation of research in this area over recent years. Patall, Cooper, and Robinson (2008) meta-analyzed studies that tested the effects of choice manipulations on intrinsic motivation and reported that the provision of choice was reliably related to intrinsic motivation, effort, performance, and behavioral persistence. However, their analysis was confined to the effects of choice, which is only one facet of autonomy support. In contrast, the purpose of the present meta-analysis is to test the effects of autonomy support, both manipulated and perceived, on a range of need satisfaction, motivational, behavioral, and well-being outcomes in the health domain. It is intended that this synthesis of research will quantify the overall effect of autonomy support on health-related behavioral and psychological outcomes, and test the influence of potential moderators of these effects. In addition, a path model based on Williams et al.'s (2006) SDT process model will be specified using meta-analytically derived effect sizes. The model will test the effects of overall autonomy support on behavioral and well-being outcomes, and explore the mediating effects of need satisfaction, autonomous motivation, and intentions.

Six moderating variables will be examined with the aim of determining methodological and demographic factors expected to systematically affect the magnitude of the effects of manipulated and perceived autonomy support on outcomes and behavior. Study design is the first of these moderating variables and was selected because the common method variance associated with cross-sectional and prospective studies may serve to inflate the associations of perceived autonomy support with psychological and behavioral outcomes (Lindell & Whitney, 2001). Consistent with the belief that health-related behavior may be more malleable in children and adolescents (Singer, Moore, Garrahie, & Ellison, 1995), it was hypothesized that children and adolescents would be more receptive to autonomy support and age of the recipients of overall autonomy support was therefore explored as a potential moderator. Provider of overall autonomy support was also included as a moderator variable as the literature includes studies examining the provision of autonomy support from a wide variety of sources.

The moderating role of the presence of additional support within studies was tested. This analysis was conducted because interventions often augmented autonomy-supportive manipulations with other forms of support for health behavior change. Further, cross-sectional studies also incorporated the assessment of additional forms of support within measures that tapped perceived autonomy support. This moderator was therefore defined as representing the type of manipulation of autonomy support (autonomy support only or additional manipulations) and the type of measure of perceived autonomy support (perceived autonomy support alone or with additional support). It was expected that additional support may increase the effectiveness of autonomy-supportive interventions by providing more strategies to assist behavior change. The degree of both manipulated autonomy support and perceived autonomy support in terms of more or less facets was also included as a moderator variable. For manipulated autonomy support, it was predicted that manipulation of all core components of the construct would result in larger effects on psychological and behavioral outcomes (e.g., Chatzisarantis et al., 2007). In terms of perceived autonomy support, it was hypothesized that measures tapping all core facets would better represent the construct and result in stronger associations with outcome variables than measures providing an assessment of only one or two of the core components. Finally, within experimental and intervention studies, the comparison condition against which autonomy-supportive manipulations were evaluated was explored as a potential moderator. Consistent with SDT, it was predicted that using a controlling comparison condition intended to undermine autonomy would yield larger effect sizes than employing a standard autonomy-neutral control (Deci & Ryan, 2000).

Method

Literature Search

An exhaustive literature search was conducted to identify relevant studies. Electronic databases (e.g., PubMed, PsycINFO, ISI Web of Science) were searched from the earliest entry to March 2010 for the keywords *autonomy support*, *acknowledge perspective, acknowledge feelings, meaningful rationale*, and *choice* paired with each of the terms *self-determination, need satisfaction, intrinsic motivation,* and *autonomy*. It was expected that some literature incorporating facets of autonomy support may not explicitly refer to the term, thus databases were also searched for the individual components of the construct. Studies pertaining to health-related behavior were then identified via a thorough manual search of the articles identified in the initial search. Health-related behaviors included physical activity, smoking cessation, healthy eating, and adherence to medication. Literature from the sport domain was also included because many studies targeted young athletes rather than professionals (e.g., Conroy & Coatsworth, 2007) and health may therefore have been a pertinent reason for sport engagement. The reference sections of the review and empirical articles located in the search were also checked for additional articles to be considered for inclusion in the meta-analysis. Finally, manual searches of recent editions of key journals publishing health-related research such as *British Journal of Health Psychology, Health Psychology, Health Education Research, Journal of Behavioral Medicine, International Journal of Behavioral Medicine,* and *Annals of Behavioral Medicine* were conducted to identify any additional articles eligible for consideration for inclusion.

Inclusion Criteria

Published studies appearing in peer-reviewed scholarly periodicals were included in the meta-analysis[1]. Studies were included if they incorporated the manipulation of autonomy support within an experiment or intervention, or a measure of perceived autonomy support in a correlational design. It was also necessary that studies manipulated or measured at least one of the three core components of overall autonomy support, and that they reported one or more psychological (e.g., need satisfaction, autonomous motivation, intention, well-being) or behavioral (e.g., physiological indices of adherence or self-reported behavioral engagement) outcomes in the health-related behavior domain. Health-related psychological outcomes pertained directly to health rather than measures of adjustment in other domains such as social and educational.

Studies relating to the provision of positive feedback were excluded unless the feedback was a clear vehicle used to deliver autonomy support (e.g., Pihu, Hein, Koka, & Hagger, 2008). An intervention study conducted by Fortier and colleagues (2007) supports this decision. In this intervention, the autonomy-supportive manipulations were distinguished from the components of support for competence and relatedness, and provision of positive feedback was directly mapped to patients' competence. Further, Deci and Ryan (1987) asserted that the overall findings of studies examining positive competence feedback on intrinsic motivation indicate that it neither supports autonomy nor controls behavior. These authors asserted that the ambivalent effect of positive competence feedback suggests that such feedback needs to be accompanied by perceptions of self-determination in order to enhance intrinsic motivation. Deci and Ryan acknowledged that feedback can enhance intrinsic motivation by affirming competence (e.g., Harackiewicz, Sansone, & Manderlink, 1985) but that it can also undermine intrinsic motivation if it is experienced as controlling (Ryan, Mims, & Koestner, 1983).

Studies located within the motivational interviewing (Rollnick & Miller, 1995) literature were also excluded (e.g., Resnicow et al., 2004). Although it is recognised that there are parallels between motivational interviewing and SDT (Markland, Ryan, Tobin, & Rollnick, 2005; Vansteenkiste & Sheldon, 2006), the correspondence between autonomy-supportive manipulations within interventions and motivational interviewing techniques was not deemed sufficiently close. For example, motivational interviewing is characterized as a “directive” technique, which ensures that client resistance is minimized, which does not sit well with the key tenets of autonomy support. Markland et al. (2005) suggested that the principal motivational interviewing technique of developing discrepancy between a client’s current behaviors and their wider goals could give rise to the pressurised state of introjection. Further, motivational interviewing is not a theory-based technique and, as such, is not based on a process model of how autonomy support may bring about behavior change (Williams et al., 2002). It is, however, acknowledged that techniques of motivational interviewing are compatible with the need support component of SDT, but the former complements rather than links directly to the latter. One fundamental difference between the two approaches is that motivational interviewing is a therapeutic technique designed for one-on-one delivery to clients whereas SDT interventions tend to focus on group-level changes in clinical and public health contexts.

The present meta-analysis included only research specified according to the tenets of SDT as we wanted to develop a process model that could account for the effects of overall autonomy support on psychological and behavioral outcomes (Williams et al., 2002). Importantly, components of autonomy-supportive intervention manipulations have been explicitly ‘mapped’ on to the key theoretical constructs (e.g., autonomous motivation and competence) that are hypothesized to be involved in the process or mechanism by which the components affect behavior (e.g., Fortier et al., 2007; Reeve et al., 2004; Williams et al., 2006). This is essential if researchers are to identify with precision the intervention components that target the psychological mediators proposed in theory to evoke changes in behavior (see Michie et al., 2008).

A second criterion for inclusion was that studies explicitly adopted a self-determination perspective. We therefore content analyzed the method sections of intervention/experimental studies that manipulated individual components of autonomy support (e.g., choice, acknowledgement of perspective, rationale provision) or associated manipulations (e.g., basic needs support) and studies that measured perceived autonomy support to ensure that the components were consistent with SDT. Research reporting the effects of choice on pertinent outcomes was checked to confirm that the choice provided was autonomous as controlled choice is likely to serve to undermine, rather than promote, autonomy (Moller, Deci, & Ryan, 2006; Patall et al., 2008; Ryan, 1982). Studies manipulating basic psychological need support, rather than conducting an independent manipulation of autonomy support, were included. Similarly, those assessing need support rather than perceived autonomy support only were included. However, because manipulations of need support and measures of perceived need support incorporated elements of autonomy support alongside other manipulations or constructs, these studies were also included in a separate moderator group. Effect sizes for studies manipulating or assessing perceived autonomy support alone were compared with those for studies that manipulated or assessed perceived autonomy support in conjunction with other manipulations or variables. Although such studies did not allow the isolation of the effects of manipulated autonomy support and perceived autonomy support from other variables, they enabled the comparison of the effects of studies manipulating or assessing perceived autonomy support exclusively with the effects of autonomy support manipulations or perceived autonomy support combined with other intervention components or variables, respectively.

In terms of the design characteristics of studies eligible for inclusion, cross-sectional, prospective, experimental, and intervention studies were included. Experimental studies manipulated autonomy support within an artificial, laboratory-based environment and assessed immediate behavior within that context, while intervention studies were field-based and assessed effects of autonomy support on longitudinally-measured behavior. The majority of articles meeting inclusion criteria reported correlational designs assessing the perceived autonomy support construct, but there were also a number of experimental and intervention studies that manipulated autonomy support. The main analyses tested the effects of overall autonomy support on health-related psychological and behavioral outcomes across cross-sectional, prospective, experimental, and intervention studies, while a moderator analysis compared the effects of autonomy support on psychological and behavioral outcomes between these designs.

An additional criterion for inclusion within the meta-analysis was that sufficient data were provided, in the form of means and standard deviations, *F*-ratios, chi-square statistics, or zero-order correlations, to compute effect sizes. Studies were included if data were present for the calculation of one or more effect sizes of manipulated or perceived autonomy support on an appropriate dependent variable. In cases of incomplete provision of data within articles, authors were contacted for this information. Attempts were also made to obtain Cronbach's alpha coefficients for scaled measures to enable the correction of measurement error within the meta-analysis. Articles were also screened for duplicate data sets to remove any potential for bias arising from the repetition of effect sizes.

This search and inclusion process resulted in the identification of 98 eligible articles providing 109 tests of the effects of autonomy support on psychological (e.g., need satisfaction, motivation, intention, well-being) and behavioral (e.g., adherence to medication, self-reported physical activity) outcomes in health-related behavior contexts. Two articles included in the analysis were translated from Spanish to English (Balaguer, Castillo, & Duda, 2008; Murcia, Rojas, & Coll, 2008). Eight articles were excluded prior to analysis because authors did not respond to requests for additional data necessary for the calculation of effect sizes or due to the duplication of data in the included articles. Details of study characteristics are provided in Appendix 1.

Meta-Analytic Procedure

The meta-analytic strategy adopted was based on Hunter and Schmidt's (1994) methods. The Hunter and Schmidt method equates to a random effects model and was adopted in the present study in accordance with the recommendations of Field (2001) and Hagger (2006). Field (2001) argues that random-effects meta-analytic models are likely to be more realistic than the fixed-effects models, particularly when the researcher's aim is to reach general conclusions about the overall field of research rather than limiting findings to the set of studies included within the meta-analysis. This is because fixed-effects models assume that studies are drawn from the same population and that the true effect size will be equal for all studies included (i.e., a homogenous case), while random-effects models assume that studies are drawn from one of a universe of possible population effect sizes (i.e., a heterogeneous case). In the latter case, variation in effects arises not only from sampling and measurement error but also from variations in the population effect across studies. Random-effects models are therefore more suitable for cases in which studies are not believed to represent all possible tests of the effect but are rather a sample of all possible studies (Field, 2001). Hunter and Schmidt (2000) have also warned against the use of fixed-effects models as this tends to greatly inflate the Type I error rate.

The zero-order correlation coefficient (*r*) was used as the metric for all effect sizes as this was the most commonly-employed measure of effect size within the identified literature. The *r* is statistically equivalent to the frequently-used standardized mean difference coefficient (Cohen's *d*) (Field, 2001), but *r* was the more appropriate metric for the current analyses as the majority of studies reported correlations rather than standardized difference statistics. Furthermore, *r* is the appropriate raw data statistic for use in meta-analytic path analysis (Hunter & Schmidt, 1994), which was employed to test Williams et al.'s. (2006) SDT process model.

For correlational studies that reported effect sizes from both cross-sectional and prospective analyses between perceived autonomy support and a dependent variable, only the prospective effect sizes were included within the meta-analysis. For experimental and intervention studies reporting more than one follow-up, effect sizes were averaged across the follow-up occasions for each dependent variable in order to provide a more conservative estimate of effects. In the case of studies for which the exact number of participants providing data for each effect was unavailable, the smallest sample size was used in the calculation of effect sizes in order to provide the most conservative estimate. Sampling error was corrected for in all analyses and Cronbach's alpha reliability coefficients were used, where available, to correct for measurement error. Where reliability data were unavailable, reliability was substituted for by the averaged reliability statistics from studies for which reliability statistics were available (Hunter & Schmidt, 1994).

Analyses yielded two corrected effect size statistics for each effect; one representing the mean effect size across the sample of studies corrected for sampling error only (r_{+}) and the other corrected for both sampling and measurement error (r_{++}). The 95% confidence intervals (CI_{95}) were calculated for each effect size and permitted a formal test of the statistical significance of the effect. To the extent that the confidence intervals of the effect size do not encompass zero, the effect can be considered present in the population and non-random in nature. The 90% credibility intervals were also calculated to indicate the variability in effect sizes across studies. Credibility intervals are based on the corrected standard deviation for r_{++} and can be used to infer the degree to which moderator variables might account for unexplained variance in effects (Whitener, 1990). The fail-safe N value was obtained in order to determine the number of studies reporting null results that would be required to reduce the effect sizes to a trivial value (Rosenberg, 2005). Rosenberg suggested that a fail-safe N is considered robust if it exceeds 5N + 10, where N represents the original number of studies. The amount of variance in the effect size across studies attributable to the statistical artifacts corrected for in the meta-analysis was also provided as a percentage of the total variation in the effect size across the sample of studies. A χ^2 statistic and its associated probability value was also calculated and provided a formal test of the proportion of studies for which variance had been accounted for by the sampling and/or measurement artifacts relative to the total variance. A significant χ^2 would indicate that an effect size is heterogeneous and the methodological artifacts did not account for a significant proportion of the total variance in the effect. It is likely that this unexplained variance was due to the influence of extraneous (moderator) variables on the effects across the studies, which catalyzed a search for possible moderators. A non-significant χ^2 value suggests that the majority of the variance in the effect is accounted for by the methodological artifacts and the case can be considered homogenous. Due to the excessive stringency of the χ^2 test, Hunter and Schmidt (1994) proposed a critical cut-off value of 75% of the variance attributable to the statistical artifacts for a case to be considered homogenous.

Coding of Dependent Variables

The large number of dependent variables necessitated the coding of outcomes into discrete categories. The coding of dependent variables resulted in the inclusion of seventeen independent outcomes pertaining to overall autonomy support, considered to belong to one of two global categories. Psychological outcomes comprised the three forms of need satisfaction (autonomy, competence, and relatedness), four types of behavioral regulation (intrinsic motivation, identified regulation, introjected regulation, and external regulation) and amotivation, autonomous motivation, composite controlled motivation, positive and negative affect, psychological well-being, ill-being, and intention. These psychological variables were included because of their theorized association with autonomy support. The need satisfaction variables and motivational variables are key proposed mediators of the effects of autonomy support on behavioral outcomes within SDT, and autonomy support has also been linked with the experience of a positive emotional tone and various facets of well-being (Deci & Ryan, 1987). Intention represents a motivational variable reflecting effort and planning for behavioral engagement and is a proximal predictor of behavior (Ajzen, 1991). This variable was included as an outcome because there is a substantial body of empirical evidence to indicate that intention also acts as a mediator of the effect of autonomy support and other motivational variables from SDT on behavior (Hagger et al., 2003; Hagger & Chatzisarantis, 2009). Interest, choice, enjoyment, and preference for challenge were included within the outcome category of intrinsic motivation because these are characteristic outcomes observed among people acting for intrinsic reasons (e.g., Ommundsen & Kvalo, 2007; Standage et al., 2005). Integrated regulation, self-efficacy, planning, patient satisfaction, quality of life, and learning were excluded because of less than five reported effect sizes between overall autonomy support and each of these variables. Although five is a relatively small number of studies upon which to calculate an average effect, Hunter and Schmidt (1990) argue that meta-analysis should not just be confined to cumulating studies arising from an exhaustive search across a large body of literature but is also acceptable for convenience samples of studies that are to hand. Behavioral outcomes comprised physiological indicators of behavioral adherence, such as body mass index (BMI), and behavior.

Several of the identified health-related psychological outcomes require clarification. Composite autonomous motivation constituted both composite autonomous motivation variables consisting of the average of intrinsic motivation and identified regulation scores (e.g., Williams et al., 2006) and the relative autonomy index, which refers to a weighted index of relative autonomy or self-determination that takes into account both autonomous and controlled forms of motivation (e.g., Standage, Duda, & Ntoumanis, 2006). The composite controlled motivation category describes a variable comprising the average score for introjected and external regulations (e.g., Julien, Senecal, & Guay, 2009). The negative affect category included the outcomes of emotional problems, depression, boredom, anxiety, and distress, while ill-being subsumed fatigue, emotional and physical exhaustion, self-blame, and disability status. Psychological well-being included all subjective assessments of adaptive wellness including self-esteem and self-worth, subjective vitality, and life satisfaction (Ryan & Deci, 2000). For studies that assessed individual components of behavioral regulation from the motivational continuum in organismic integration theory as well as providing a composite measure of autonomous motivation (e.g., relative autonomy index) calculated from the separate behavioral regulation constructs, only the effect sizes for the separate behavioral regulations were included in the main meta-analysis (e.g., Standage et al., 2006). However, the effect sizes for the composite measures of autonomous motivation were used in place of the separate forms of behavioral regulation when it came to estimating the network of relations within Williams et al.'s (2006) process model using path analysis. This was to provide a more parsimonious model than would be afforded through specification of effect sizes for each type of regulation.

Studies tended to adopt standardized psychometric inventories to measure psychological variables. Perceived autonomy support tended to be measured using versions of the 'climate' questionnaires developed in the Rochester SDT labs, for example the Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Ryan, & Deci, 1996). Autonomy need satisfaction was frequently assessed on forms of the Psychological Needs Satisfaction scale (Tobin, 2003), while competence satisfaction tended to be measured on variants of the perceived competence subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) and relatedness on the acceptance subscale of the Need for Relatedness Scale (Richer & Vallerand, 1998). Motivational constructs were usually measured using adapted versions of the Perceived Locus of Causality scale (PLOC, Goudas, Biddle, & Fox, 1994; Ryan & Connell, 1989). The Treatment Self-Regulation Questionnaire (TSRQ; Williams, Freedman, & Deci, 1998) was also frequently adopted to measure autonomous and controlled forms of motivation. Measures of composite autonomous motivation by relative autonomy or self-determination indexes were calculated through the use of a weighted formula (e.g., Vallerand, 1997). It is important to note, however, that formulae for the calculation of relative autonomy differed slightly across studies, dependent upon whether integrated regulation was assessed. Behavioral intentions were exclusively measured in accordance with Ajzen's (2003) guidelines. Intervention and experimental studies used conventional methods to manipulate autonomy or basic need support through written or verbal communications that promoted autonomy, competence, and relatedness (e.g., Edmunds et al., 2008).

In terms of behavioral outcomes, for the categories of physiological indicators of health-related behavioral adherence and health-related behavior, effects for which the hypothesized direction of the manipulated or perceived autonomy support effect were negative, for example glycosylated hemoglobin (HbA1c), which reflects illness status for diabetics, effect sizes were transformed to a positive value to align with the adaptive effects of autonomy support on health-related outcomes (e.g., Williams, Lynch, & Glasgow, 2007). In cases in which effect sizes indicated a maladaptive effect of manipulated or perceived autonomy support on physiological indicators of health-related behavioral adherence (e.g., a positive effect of autonomy support on HbA1c), effect sizes were converted to a negative value to reflect this.

Coding of Moderators

A series of moderator analyses were carried out for the effects of overall autonomy support on identified psychological and behavioral outcomes in groups of studies for which a sufficient number of effect sizes ($k \geq 5$) were available. Groups of studies for which fewer than ten effect sizes were available were therefore omitted from the moderator analyses because there would have been insufficient data to conduct a meaningful moderator analysis. This resulted in the exclusion of tests of the effects of autonomy support on the following outcomes: perceived autonomy support, composite controlled motivation, ill-being, and positive affect.

Studies were categorized into discrete moderator groups on the basis of level of the moderator variable and individual meta-analyses conducted on the effect for each moderator group. The moderating variables of interest were: study design (cross-sectional, prospective, or experimental/intervention); age of sample (younger or older); provider of overall autonomy support (parent, friend, family, significant others, health care provider, experimenter, exercise instructor, coach, teacher, or written communication); provision or measurement of additional support (manipulated autonomy support or perceived autonomy support only versus combined interventions or additional support); degree of manipulated autonomy support or perceived autonomy support (all three core facets or less); and, for experimental/intervention studies only, type of comparison condition used as the control group (standard control condition characterized by the absence of autonomy support manipulations or a controlling condition intended to undermine autonomy).

The study design moderation analysis effectively made the distinction between experimental or intervention studies (manipulations of autonomy support) and cross-sectional or prospective designs (measures of perceived autonomy support from social agents). For the moderator variables of degree of autonomy support and provision of additional support, analyses were conducted separately for experimental or intervention (i.e., manipulated autonomy support) and correlational (i.e., perceived autonomy support) studies. The degree of autonomy support moderator variable for manipulated autonomy support distinguished between those studies that manipulated all components of autonomy support and those that implemented only one or two components. To illustrate, Williams et al. (2002) implemented autonomy support that provided choice and a meaningful rationale, while acknowledging the feelings and perspective of the individual. Parfitt and Gledhill (2004), however, manipulated only the choice facet of autonomy support, thereby providing a lesser degree of the construct. We also included a degree of autonomy support moderator analysis among correlational studies by distinguishing between studies that assessed all of the core components of perceived autonomy support (provision of choice, provision of a meaningful rationale, and acknowledgement of the individual’s perspective and feelings) and those that measured only one or two of the components. For instance, the measure employed by Conroy and Coatsworth

(2007) did not assess the provision of a meaningful rationale, while Vierling, Standage, and Treasure (2007) used a modified version of the Sport Climate Questionnaire that provided a full operationalization of the construct. Two independent raters coded studies for the degree of autonomy support moderator variable with a 98% level of agreement. Differences in the coding of two studies were resolved through discussion.

For the moderator analysis examining the presence of additional support (i.e., combined interventions), studies that manipulated autonomy support in isolation represented one category, and studies that manipulated variables additional to autonomy support constituted the other. Similarly, for the moderator analysis for measurement of additional support, the effects of perceived autonomy support alone were compared against measures that captured perceived autonomy support alongside other variables in a single measure.

Criteria used to define young and older samples in previous research were followed, with samples comprising adults over 18 years old categorized as older, and samples comprising participants less than 18 years old categorized as younger (see Hagger & Chatzisarantis, 2009; Sheeran & Orbell, 1998). In some cases, it was not possible to allocate studies into the moderator categories. For example, some studies included participants who were both under and over the age of 18 and therefore had to be excluded from the age of sample moderator (e.g., Amorose and Anderson-Butcher, 2007). An analysis exploring the interaction between additional support and degree of autonomy support was planned to test the potential synergistic effect of providing additional support alongside all facets of autonomy support on health-related outcomes. There was, however, an insufficient number of effect sizes to conduct this analysis. Each of these moderators was therefore analyzed separately.

Significant moderation was evidenced by an absence of overlap in the CI_{95} between average effect sizes in each moderator group. The χ^2 statistic and Hunter and Schmidt 75% rule were also employed to determine whether the variance attributable to methodological artifacts accounted for a sufficiently large proportion of the total variance across studies at each level of the moderator. This would indicate whether the moderator had produced a homogenous effect size.

Associations between Moderators

Associations between moderator variables were examined to explore any potentially confounding effects among moderators (Lipsey, 2003). As all of the moderator variables in the present study were categorical in nature, chi-square analyses were employed to test the presence of significant associations between the moderators. Independence of the effect of a moderator on a dependent variable was inferred if the chi-square statistic was non-significant. A p value of .01 was used to reduce the risk of an inflated Type I error rate associated with multiple tests. In cases where a significant association between moderator variables was evident, the categorical tables were checked to determine the basis of the covariation and, if possible, separate meta-analyses were conducted on the moderator groups determined by the crossing of the two moderators.

Development of a Process Model

Meta-analytically derived corrected zero-order correlations were used to develop and test the process model of health-related behavior based on Williams and colleagues' (2006) proposed model. The model was augmented to include the autonomy and relatedness need satisfaction variables in addition to competence as mediators of the effect of autonomy support on behavior. Path analysis was employed to construct a path model representing associations between overall autonomy support, satisfaction of the needs for autonomy, competence, and relatedness, autonomous motivation, behavior, and psychological well-being. As the meta-analytically derived correlations used as input for the model were computed from various subgroups of studies, the lowest combined sample size contributing to a correlation (N = 537) was used to ensure a conservative test (Hagger & Chatzisarantis, 2009; Viswesvaran & Ones, 1995). The analysis tested for the mediating effects of autonomy, competence, relatedness and relative autonomous motivation on the association between overall autonomy support and behavior. The mediation of the association between overall autonomy support and well-being by autonomous motivation was also modelled. The model was conducted by simultaneous process using the EQS version 6.1 structural equation modelling software (Bentler, 2004). A maximum likelihood method of estimation was employed in order to protect against violations of the assumption of normality in the data. Goodness-of-fit of the model to the correlation matrix was tested against an independent model. The indices used to assess goodness-of-fit were the Comparative Fit Index (CFI), the Normed Fit Index (NFI), the Root Mean Square Error of Approximation (RMSEA), the 90% confidence intervals of the RMSEA, and the Standardized Root Mean Squared Residuals. A well-fitting model is evident when the CFI and NFI exceed .95, the RMSEA is near 0.08 with narrow confidence intervals, and the SRMSR is close to .05 (Hu & Bentler, 1999).

Consistent with the SDT process model proposed by Williams and colleagues (2006), it was expected that overall autonomy support would relate positively and significantly to the satisfaction of the needs for autonomy, competence, and relatedness, relative autonomous motivation, behavior, and well-being. Further, it was hypothesized that the path model would show that perceived need satisfaction for autonomy and competence mediates the effects of overall autonomy support on relative autonomous motivation and behavior, and that relative autonomous motivation would mediate the effects of autonomy support on behavior and well-being. Thus autonomy-supportive behaviors from social agents were expected to map directly to increases in need satisfaction and autonomous motivation, and autonomous motivation was hypothesised to directly predict adaptive health-related behavioral and well-being outcomes. Autonomous motivation therefore represents an important hypothesized mediator of the effects of autonomy support on behavior by effecting change in people's motivational orientations and promoting engagement in preventive and protective health-related behaviors.

Results

Main Analyses

Summary statistics for the overall results of the meta-analyses for each effect can be found in Table 2.1. Significant effect sizes in the directions predicted by SDT were evident for all associations between overall autonomy support and the outcome variables, except for composite controlled motivation and ill-being. The CI_{95} for the latter outcomes encompassed zero indicating relatively trivial effect sizes for the relationships of overall autonomy support with these outcome variables. The effects of overall autonomy support on behavior (r_{++} = .20), well-being (r_{++} = .23), intention (r_{++} = .32), composite autonomous motivation (r_{++} = .36), and competence (r_{++} = .30) were small while those for autonomy (r_{++} = .50) and relatedness (r_{++} = .47) were moderate in magnitude (Cohen, 1992). The largest effect sizes were observed for the relationship between overall autonomy support and positive affect (r_{++} = .57) and the effect of manipulated autonomy support on perceived autonomy support (r_{++} = .74).

Fail-safe N values indicated the majority of reported effects to be robust, exceeding Rosenberg's (2005) threshold value of 5N + 10. For most effects, a substantial number of null findings would therefore need to exist in order to attenuate the significant findings. Exceptions to this were the effects of overall autonomy support on composite controlled motivation, ill-being, introjected regulation, and physiological indicators of behavioral adherence. The CI_{95} included zero for effects on controlled motivation and ill-being, and the total number of effect sizes contributing to these effects was relatively small (k = 7 and k = 9, respectively).

Moderator Analyses

Moderator analyses were conducted for design type (cross-sectional, prospective, or experimental/intervention), age of sample (younger or older), provider of overall autonomy support (parent, friend, family, significant others, health care provider, experimenter, exercise

Table 2.1

Results of Meta-Analysis of Effects of Autonomy Support on Health-Related Psychological and Behavioral Outcomes

					CI_{95}		CI_{90}						
Effect	K	N	r+	r++	LB	UB	LB	UB	χ^2	SD	SE	Var	N_{FS}
Autonomy support-Behaviour	117	31193	0.17	0.20	0.17	0.24	-0.08	0.49	755.38***	0.17	0.02	15.49	7692
Autonomy support-Autonomy	33	10397	0.40	0.50	0.41	0.60	0.05	0.96	489.64***	0.27	0.05	6.74	3771
Autonomy support-Competence	50	16286	0.26	0.30	0.25	0.36	-0.02	0.63	506.66***	0.20	0.03	9.87	3591
Autonomy support-Relatedness	27	7514	0.39	0.47	0.41	0.54	0.21	0.73	168.63***	0.16	0.03	16.01	3591
Autonomy support-Autonomous motivation	65	14951	0.31	0.36	0.32	0.39	0.14	0.57	280.36***	0.13	0.02	23.18	6875
Autonomy support-Controlled motivation[a]	9	1872	-0.00	0.00	-0.08	0.08	-0.13	0.12	15.01	0.08	0.04	59.95	0
Autonomy support-Intrinsic motivation	34	11637	0.37	0.43	0.48	0.38	0.22	0.64	195.69***	0.13	0.02	17.37	3685
Autonomy support-Identified regulation	26	9512	0.38	0.45	0.40	0.51	0.22	0.69	165.15***	0.14	0.03	15.74	2253
Autonomy support-Introjected regulation	23	7774	0.11	0.14	0.07	0.21	-0.12	0.40	140.99***	0.16	0.04	16.31	100
Autonomy support-External regulation	25	9406	-0.21	-0.25	-0.36	-0.15	-0.69	0.18	476.16***	0.26	0.05	5.25	2361
Autonomy support-Amotivation	23	8386	-0.30	-0.36	-0.43	-0.29	-0.63	-0.09	188.32***	0.17	0.04	12.21	1034
Autonomy support-Perceived autonomy support[a]	8	1365	0.70	0.74	0.59	0.89	0.38	1.00	215.51***	0.22	0.08	3.71	193
Autonomy support-Physiological index	27	7092	0.07	0.07	0.03	0.11	-0.06	0.20	68.83***	0.08	0.02	39.23	44
Autonomy support-Intention	41	9032	0.27	0.32	0.26	0.37	0.04	0.60	255.06***	0.17	0.03	16.07	2361
Autonomy support-Well-being	16	4310	0.19	0.23	0.17	0.28	0.09	0.36	38.15***	0.08	0.03	41.94	50
Autonomy support-Ill-being[a]	7	1543	-0.07	-0.09	-0.20	0.02	-0.30	0.12	24.03***	0.13	0.06	29.13	0
Autonomy support-Positive affect[a]	5	1285	0.51	0.57	0.40	0.73	0.27	0.87	63.53***	0.18	0.08	7.87	50
Autonomy support-Negative affect	18	5581	-0.24	-0.28	-0.32	-0.22	-0.41	-0.15	46.12***	0.08	0.02	39.03	321

Note. k = number of effect sizes contributing to average effect size; N = total sample size contributing to average effect size; r+ = bare bones averaged correlation coefficient corrected for sampling error only; r++ = averaged correlation coefficient corrected for sampling and measurement error; 95% CIs = 95% confidence intervals for averaged correlation coefficient corrected for sampling and measurement error; 90% CIs = 90% credibility intervals for distribution of correlations in the population; LB = lower bound of confidence/credibility interval; UB = upper bound of confidence/credibility interval; χ^2 = chi-square analysis; SD = standard deviation of averaged correlation corrected for sampling and measurement error; SE = standard error of averaged correlation corrected for sampling and measurement error; Var = variance in averaged correlation corrected for sampling and measurement error accounted for by the statistical artifacts of sampling and measurement error. [a]Effect size estimate is likely to be unreliable due to the small number of studies according to the N_{FS} criteria proposed Rosenberg (2005). * $p < .05$; ** $p < .01$; *** $p < .001$.

instructor, coach, teacher, or written communication), additional support (autonomy-supportive manipulations alone or combined interventions and perceived autonomy support alone or assessment of additional support within the perceived autonomy support measure), degree of manipulated autonomy support or perceived autonomy support (all three core facets or less), and comparison condition for experimental and intervention studies (standard control or a controlling condition intended to undermine autonomy). For the moderators of degree of autonomy support and additional support, analyses were conducted separately for correlational and experimental/intervention studies. Separate analyses were appropriate for these moderators as the number of facets of autonomy support manipulated within experimental studies is not directly comparable to the number of facets of autonomy support captured within a measurement instrument, as the use of additional techniques alongside autonomy support in intervention is not directly comparable to the assessment of other forms of support (e.g., competence and relatedness) within an autonomy support measure. Summary statistics for moderator analyses can be found in Table 2.2.

Design. Study design significantly moderated the effect of overall autonomy support on external regulation and composite autonomous motivation. For external regulation, the negative effect of manipulated autonomy support in experimental or intervention studies (r_{++} = -.53, CI_{95} = -.75, -.32) was significantly greater than the effect of perceived autonomy support in cross-sectional studies (r_{++} = -.18, CI_{95} = -.27, -.09), which was non-significant. There was an insufficient number of effect sizes to include prospective studies for this particular dependent variable. For composite autonomous motivation, the effect size of perceived autonomy support in both cross-sectional (r_{++} = .38, CI_{95} = .33, .43) and prospective (r_{++} = .39, CI_{95} = .34, .44) designs was significantly greater than for manipulated autonomy support in experimental studies (r_{++} = .19, CI_{95} = .08, .30).

Age. For all outcomes for which sufficient data were available to conduct moderator analyses for age, effect sizes for overall autonomy support were greater in younger samples (<18 years of age) than older samples (>18 years of age). Age significantly moderated the effects of overall autonomy support on satisfaction of the need for autonomy (younger samples, r_{++} = .72, CI_{95} = .59, .85; older samples, r_{++} = .28, CI_{95} = .18, .38), external regulation (younger samples, r_{++} = -.34, CI_{95} = -.47, -.21; older samples, r_{++} = -.06, CI_{95} = -.19, .06), identified regulation (younger samples, r_{++} = .48, CI_{95} = .43, .53; older samples, r_{++} = .37, CI_{95} = .31, .42), intention (younger samples, r_{++} = .35, CI_{95} = .28, .42; older samples, r_{++} = .17, CI_{95} = .08, .27), and behavior (younger samples, r_{++} = .34, CI_{95} = .27, .40; older samples, r_{++} = .13, CI_{95} = .10, .16).

Provider. The provider or source of overall autonomy support significantly moderated the effect of overall autonomy support on behavior and intention. For behavior, the effects of manipulated autonomy support provided by the experimenter (r_{++} = .38, CI_{95} = .25, .51), and overall autonomy support provided by significant others (r_{++} = .27, CI_{95} = .21, .32) and teachers (r_{++} = .27, CI_{95} = .18, .36), were significantly greater than that provided by counsellors (r_{++} = .12, CI_{95} = .09, .15). The effects of overall autonomy support from the former three sources was also significantly greater than the effect of overall autonomy support from health care providers (r_{++} = .11, CI_{95} = .05, .16). For intention, the effect of overall autonomy support was significantly greater when provided by friends (r_{++} = .50, CI_{95} = .42, .58) than by teachers (r_{++} = .25, CI_{95} = .19, .32).

Additional support. There were only two moderator analyses calculable for this moderator. For experimental and intervention studies, the two effects for which there were sufficient data (autonomy support on behavior and physiological indices of behavioral adherence) were not moderated by the presence of additional support. For correlational studies, there were insufficient data to conduct the analysis on any outcome.

Degree of autonomy support. For experimental studies, the only effect for which sufficient data was available to conduct this moderator analysis was that for manipulated autonomy support on behavior and no significant moderation was found. The measurement of all three versus less than three facets of perceived autonomy support in correlational studies significantly moderated the effect of perceived autonomy support on behavior. The average effect size for assessment of all three facets of perceived autonomy support ($r_{++} = .30$, $CI_{95} = .24, .37$) was significantly greater than that for assessment of less than three facets of autonomy support ($r_{++} = .16$, $CI_{95} = .12, .20$).

Comparison group. There were only sufficient experimental data to examine the moderation of the effect of autonomy support on behavior by comparison group, and there was no significant effect for this moderator.

Relations between Moderators

Studies were coded according to their level for each moderator and a series of chi-square analyses was conducted to determine whether moderator variables were independent or significantly associated. This analysis was not conducted for the association between the comparison condition and design moderator variables because the comparison condition was only pertinent to experimental and intervention studies so there was no variability in design at the different levels of comparison condition. Results are presented in Table 2.3. Seven pairs of moderator variables were significantly associated. The age of sample and study design moderators co-occurred as prospective studies tended to adopt younger samples, and rarely used older participants, while experimental studies adopted mainly older samples and rarely used younger participants. Age of sample and provider of autonomy support were also significantly related. Age of sample was also associated with the provision of additional support moderator. This is likely to be linked to the finding that experimental designs frequently provided additional support alongside autonomy support, while correlational

Table 2.2

Results of Analyses for Moderating Effects of Design Type, Age of Sample, Provider of Autonomy Support, Additional Support, Degree of Autonomy Support, and Comparison Condition

							CI_{95}		CI_{90}					
Moderator	Effect	Level	K	N	r+	r++	LB	UB	LB	UB	χ^2	SD	SE	Var
Design	Autonomy Support-Amotivation	CS	16	7038	-0.28	-0.35	-0.43	-0.27	-0.60	-0.09	132.66***	0.16	0.04	12.06
		E	5	1282	-0.36	-0.39	-0.55	-0.22	-0.68	-0.09	50.51***	0.18	0.09	9.90
	Autonomy Support-Autonomy	CS	23	9026	0.39	0.50	0.41	0.59	0.14	0.85	248.69***	0.22	0.05	9.25
		E	6	920	0.61	0.63	0.29	0.97	-0.06	1.32	286.10***	0.42	0.17	2.10
	Autonomy support-Behavior	CS	26	6783	0.14	0.18	0.14	0.22	0.05	0.31	53.02***	0.08	0.02	49.04
		E	36	10424	0.16	0.17	0.10	0.24	-0.15	0.49	394.91***	0.20	0.03	9.12
		P	53	13846	0.18	0.22	0.17	0.27	-0.05	0.49	306.63***	0.16	0.02	17.28
	Autonomy support-Competence	CS	30	10197	0.25	0.31	0.25	0.37	0.06	0.56	196.84***	0.15	0.03	15.24
		E	8	2270	0.36	0.37	0.13	0.61	-0.18	0.93	312.70***	0.34	0.12	2.56
		P	12	3819	0.20	0.23	0.18	0.28	0.11	0.35	27.43**	0.07	0.03	43.75
	Autonomy support-External Regulation	CS	17	7318	-0.14	-0.18	-0.27	-0.09	-0.47	0.12	172.88***	0.18	0.05	9.83
		E	5	1727	-0.52	-0.53	-0.75	-0.32	-0.93	-0.14	173.37***	0.24	0.11	2.88
	Autonomy support-Identified Regulation	CS	18	7424	0.38	0.46	0.39	0.54	0.22	0.70	127.97***	0.14	0.04	14.07
		E	5	1727	0.37	0.39	0.26	0.52	0.17	0.61	42.27	0.14	0.06	11.83
	Autonomy support-Intention	CS	15	4203	0.27	0.33	0.23	0.43	0.03	0.63	120.57***	0.18	0.05	12.44
		E	9	1295	0.19	0.21	0.07	0.35	-0.11	0.53	54.62***	0.19	0.07	16.48
		P	18	3765	0.32	0.35	0.28	0.43	0.12	0.59	93.24***	0.14	0.04	19.30
	Autonomy support-Intrinsic motivation	CS	22	8562	0.38	0.45	0.39	0.50	0.25	0.65	125.90***	0.13	0.05	13.94
		E	8	2315	0.36	0.37	0.27	0.47	0.15	0.59	57.38***	0.13	0.05	13.94
	Autonomy support-Physiological Index	CS	9	2205	0.07	0.07	0.03	0.12	0.00	0.15	13.33	0.05	0.02	67.51

Table 2.2 (Continued)

Moderator	Effect	Level	K	N	r+	r++	CI95 LB	CI95 UB	CI90 LB	CI90 UB	χ^2	SD	SE	Var
Design	Autonomy support-Physiological index	E	13	2502	0.08	0.08	0.00	0.16	-0.12	0.29	50.17***	0.13	0.04	25.91
		P	5	2385	0.05	0.05	0.01	0.09	0.05	0.05	4.39	0.00	0.02	100.00
	Autonomy support-Autonomous motivation	CS	30	6401	0.32	0.38	0.33	0.43	0.21	0.55	82.44***	0.10	0.02	36.39
		E	9	2116	0.17	0.19	0.08	0.30	-0.07	0.44	53.63***	0.15	0.06	16.78
		P	25	6360	0.35	0.39	0.34	0.44	0.22	0.56	90.23***	0.10	0.02	27.71
	Autonomy support-Negative Affect	CS	9	3579	-0.24	-0.28	-0.36	-0.21	-0.44	-0.13	31.39***	0.09	0.04	28.67
		E	7	230	-0.19	-0.20	-0.33	-0.06	-0.20	-0.20	4.81	0.00	0.07	100.00
Age	Autonomy support-Amotivation	AD	8	1577	-0.19	-0.23	-0.33	-0.12	-0.43	-0.02	27.05***	0.13	0.05	29.58
		CH	12	5659	-0.33	-0.41	-0.50	-0.31	-0.66	-0.16	100.56***	0.15	0.05	11.93
	Autonomy support-Autonomy	AD	13	4411	0.24	0.28	0.18	0.38	-0.01	0.57	115.45***	0.18	0.05	11.26
		CH	16	4470	0.55	0.72	0.59	0.85	0.32	1.12	137.85***	0.24	0.06	11.61
	Autonomy support-Behavior	AD	67	19640	0.11	0.13	0.10	0.16	-0.04	0.30	220.89***	0.10	0.02	30.33
		CH	42	10046	0.27	0.34	0.27	0.40	0.00	0.67	332.01***	0.20	0.03	12.65
	Autonomy support-Competence	AD	29	10155	0.26	0.29	0.21	0.37	-0.06	0.64	412.53***	0.21	0.04	7.03
		CH	17	4615	0.30	0.37	0.34	0.41	0.20	0.55	54.26***	0.11	0.03	31.33
	Autonomy support-External regulation	AD	7	1527	-0.05	-0.06	-0.19	0.06	-0.31	0.18	31.84***	0.15	0.06	21.99
		CH	15	6729	-0.28	-0.34	-0.47	-0.21	-0.76	0.08	302.88***	0.25	0.07	4.95
	Autonomy support-Identified regulation	AD	7	1527	0.31	0.37	0.31	0.42	0.09	0.64	43.56***	0.17	0.07	16.07
		CH	15	6729	0.40	0.48	0.43	0.53	0.35	0.62	47.46***	0.08	0.03	31.60
	Autonomy support-Introjected regulation	AD	6	1226	0.06	0.06	-0.05	0.18	-0.12	0.25	17.21**	0.11	0.06	34.86
		CH	15	5947	0.11	0.15	0.06	0.24	-0.12	0.41	105.02***	0.16	0.04	14.28
	Autonomy support-Intention	AD	8	1546	0.14	0.17	0.08	0.27	-0.01	0.36	21.71**	0.11	0.05	36.84
		CH	29	6293	0.31	0.35	0.28	0.42	0.07	0.63	182.72***	0.17	0.03	15.87
	Autonomy support-Intrinsic motivation	AD	9	1968	0.36	0.40	0.28	0.51	0.12	0.67	66.71***	0.17	0.06	13.49

Table 2.2 (Continued)

Moderator	Effect	Level	K	N	r+	r++	CI_{95} LB	CI_{95} UB	CI_{90} LB	CI_{90} UB	χ^2	SD	SE	Var
Age	Autonomy support-Intrinsic motivation	CH	20	8133	0.39	0.44	0.39	0.50	0.27	0.62	92.34***	0.10	0.03	21.66
	Autonomy support-Autonomous motivation	AD	23	6341	0.26	0.30	0.23	0.36	0.06	0.53	129.27***	0.14	0.03	17.79
		CH	38	7404	0.34	0.38	0.34	0.42	0.22	0.54	107.41***	0.10	0.02	35.38
	Autonomy support-Relatedness	AD	8	1718	0.44	0.50	0.38	0.63	0.25	0.76	44.42***	0.16	0.06	18.01
		CH	15	4280	0.41	0.51	0.43	0.59	0.29	0.73	75.91***	0.14	0.04	19.76
	Autonomy support-Well-being	AD	11	2942	0.18	0.21	0.14	0.28	0.05	0.38	33.86***	0.10	0.04	32.49
		CH	5	1368	0.22	0.26	0.20	0.32	0.26	0.26	3.25	0.00	0.03	100.00
Provider	Autonomy support-Autonomy	CO	9	2493	0.43	0.51	0.39	0.63	0.22	0.80	89.87***	0.18	0.06	10.01
		T	9	3519	0.50	0.69	0.58	0.80	0.43	0.95	47.72***	0.16	0.06	18.86
	Autonomy support-Behavior	CN	7	5176	0.12	0.12	0.09	0.15	0.09	0.15	8.83	0.02	0.01	79.29
		E	7	2223	0.38	0.38	0.25	0.51	0.11	0.66	89.69***	0.17	0.07	7.80
		F	7	1285	0.25	0.31	0.13	0.50	-0.07	0.70	57.86***	0.23	0.09	12.10
		HCP	29	7192	0.09	0.11	0.05	0.16	-0.11	0.32	111.61***	0.13	0.03	25.98
		P	9	1915	0.22	0.28	0.15	0.41	-0.02	0.58	49.58***	0.18	0.07	18.15
		SO	13	2539	0.25	0.27	0.21	0.32	0.16	0.38	23.38*	0.07	0.03	55.61
		T	21	5277	0.22	0.27	0.18	0.36	-0.04	0.58	145.47***	0.19	0.04	14.44
		CO	5	930	0.18	0.20	0.13	0.28	0.20	0.20	4.60	0.00	0.04	100.00
	Autonomy support-Competence	CO	10	2612	0.18	0.22	0.08	0.35	0.08	0.35	22.39**	0.08	0.02	44.66
		HCP	10	4328	0.37	0.40	0.24	0.55	-0.002	0.79	252.95***	0.24	0.08	3.95
		T	11	4193	0.28	0.35	0.26	0.45	0.11	0.60	74.95***	0.15	0.05	14.68
	Autonomy support-Intention	F	5	1072	0.45	0.50	0.42	0.58	0.39	0.61	10.73*	0.07	0.04	46.58
		SO	7	1201	0.34	0.40	0.28	0.51	0.17	0.62	26.94***	0.14	0.06	25.99
		T	17	4839	0.22	0.25	0.19	0.32	0.06	0.45	68.64***	0.12	0.03	24.77
	Autonomy support-Autonomous motivation	F	10	2082	0.32	0.37	0.30	0.44	0.22	0.52	25.31**	0.09	0.04	39.51
		HCP	13	3500	0.36	0.41	0.35	0.47	0.26	0.56	37.89***	0.09	0.03	34.31
		P	8	1680	0.34	0.35	0.31	0.39	0.26	0.44	14.07	0.06	0.02	56.85
		T	22	4407	0.33	0.38	0.32	0.44	0.18	0.58	77.74***	0.12	0.03	28.30

Table 2.2 (Continued).

Moderator	Effect	Level	K	N	r+	r++	CI95 LB	CI95 UB	CI90 LB	CI90 UB	χ^2	SD	SE	Var
Provider	Autonomy support-Relatedness	CO	9	2493	0.42	0.49	0.39	0.59	0.27	0.72	45.47***	0.14	0.05	19.79
		T	10	3977	0.39	0.48	0.37	0.60	0.21	0.76	91.91***	0.17	0.06	10.88
Add supp[b]	Autonomy support-Behavior	AS	16	6281	0.22	0.23	0.13	0.32	-0.08	0.54	228.04***	0.19	0.05	7.02
		ADS	20	4143	0.07	0.08	0.00	0.16	-0.19	0.35	107.12***	0.16	0.04	18.67
	Autonomy support-Physiological index	AS	10	2386	0.09	0.10	0.00	0.20	-0.13	0.33	51.31***	0.14	0.05	19.49
		ADS	5	388	-0.02	-0.02	-0.12	0.08	-0.02	-0.02	1.56	0.00	0.05	100.00
Degree[a]	Autonomy support-Autonomy	CAS	5	1179	0.41	0.51	0.33	0.70	0.19	0.84	34.50***	0.20	0.10	14.49
		IAS	18	6532	0.38	0.49	0.37	0.61	0.08	0.90	249.00***	0.25	0.06	7.23
	Autonomy support-Behavior	CAS	29	5077	0.25	0.30	0.24	0.37	0.04	0.57	127.70***	0.16	0.03	22.71
		IAS	45	14485	0.13	0.16	0.12	0.20	-0.05	0.37	217.10***	0.13	0.02	20.73
	Autonomy support-Competence	CAS	6	1369	0.25	0.30	0.21	0.38	0.17	0.43	13.37*	0.08	0.04	44.87
		IAS	28	9779	0.24	0.29	0.24	0.34	0.09	0.48	124.83***	0.12	0.03	22.43
	Autonomy support-Extrinsic regulation	CAS	5	2157	-0.10	-0.12	-0.30	0.06	-0.44	0.20	62.39***	0.20	0.09	8.01
		IAS	13	4560	-0.17	-0.21	-0.31	-0.11	-0.49	0.07	101.96***	0.17	0.05	12.75
	Autonomy support-Identified regulation	CAS	5	2157	0.39	0.46	0.32	0.61	0.20	0.72	46.31***	0.16	0.07	10.80
		IAS	14	4666	0.40	0.49	0.43	0.54	0.35	0.63	40.73***	0.09	0.03	34.38
	Autonomy support-Intention	CAS	17	3302	0.37	0.41	0.33	0.48	0.17	0.65	91.11***	0.15	0.04	18.66
		IAS	14	3886	0.24	0.28	0.21	0.36	0.07	0.49	59.99***	0.13	0.04	23.34
	Autonomy support-Intrinsic motivation	CAS	6	2351	0.38	0.42	0.34	0.51	0.27	0.58	26.71***	0.09	0.04	22.46
		IAS	17	5744	0.39	0.47	0.41	0.53	0.29	0.65	73.74***	0.11	0.03	23.05
	Autonomy support-Autonomous motivation	CAS	35	6576	0.31	0.36	0.32	0.40	0.21	0.51	84.90***	0.09	0.02	41.22
		IAS	15	5376	0.37	0.44	0.38	0.49	0.29	0.58	47.98***	0.09	0.03	31.26
	Autonomy support-Relatedness	CAS	5	1384	0.38	0.45	0.27	0.63	0.14	0.76	44.64***	0.19	0.09	11.20

Table 2.2 (Continued).

Moderator	Effect	Level	K	N	r+	r++	CI_{95} LB	CI_{95} UB	CI_{90} LB	CI_{90} UB	χ^2	SD	SE	Var
Degree[a]	Autonomy support-Relatedness	IAS	15	4242	0.43	0.53	0.45	0.60	0.30	0.75	75.66^{***}	0.14	0.04	19.82
Degree[b]	Autonomy support-Behavior	CAS	9	5531	0.12	0.15	0.10	0.20	0.05	0.25	23.73^{**}	0.06	0.03	37.93
		IAS	27	4893	0.20	0.21	0.11	0.32	-0.23	0.66	369.12^{***}	0.27	0.05	7.31
Control gp	Autonomy support-Behavior	CTL	35	13505	0.14	0.15	0.09	0.22	-0.14	0.45	399.78^{***}	0.18	0.03	8.75
		CLG	7	2418	0.35	0.35	0.20	0.49	0.04	0.66	116.59^{***}	0.19	0.07	6.00

Note. CS = cross-sectional; P = prospective; E = experimental; AD = adults; CH = children and adolescents; CN = counsellor; CO = coach; T = teacher; E = experimenter; F = friends; HCP = health care professional; P = parents; SO = significant other; AS = autonomy support only; ADS = additional support; CAS = all three facets of autonomy support; IAS = less than three facets of autonomy support; Add suppb= additional support analysis for experimental studies only; Degreea = degree of autonomy support for correlational studies only; Degreeb = degree of autonomy support for experimental studies only; Control gp = comparison group (experimental studies only); CTL = control condition; CLG = controlling condition; K = number of effect sizes contributing to average effect size; N = total sample size contributing to average effect size; r+ = bare bones averaged correlation coefficient corrected for sampling error only; r++ = averaged correlation coefficient corrected for sampling and measurement error; 95% CIs = 95% confidence intervals for averaged correlation coefficient corrected for sampling and measurement error; 90% CIs = 90% credibility intervals for distribution of correlations in the population; LB = lower bound of confidence/credibility interval; UB = upper bound of confidence/credibility interval; χ^2 = chi-square analysis; SD = standard deviation of averaged correlation corrected for sampling and measurement error; SE = standard error of averaged correlation corrected for sampling and measurement error; Var = variance in averaged correlation corrected for sampling and measurement error accounted for by the statistical artifacts of sampling and measurement error. * $p < .05$; ** $p < .01$; *** $p < .001$

studies tended to measure perceived autonomy support independently of other variables. The study design and provider of autonomy support moderators were significantly related, largely resulting from the preponderance of teacher-based perceived autonomy support provision in cross-sectional and prospective designs, and the experimenter-based autonomy support provision being unique to experimental designs. The study design and provider of autonomy support moderators were also each related to the provision of additional support moderator.

Table 2.3

Results of Chi-Square Analyses for Associations Between Moderators

	1	2	3	4	5
1. Study design	-				
2. Age of sample	**χ^2 (2, N = 85) = 10.82, *p* < .01**	-			
3. Provider of autonomy support	**χ^2 (20, N = 87) = 61.31, *p* < .001**	**χ^2 (8, N = 74) = 52.73, *p* < .001**	-		
4. Additional support	**χ^2 (2, N = 99) = 25.89, *p* < .001**	**χ^2 (1, N = 86) = 8.60, *p* < .01**	**χ^2 (10, N = 87) = 28.19, *p* < .01**	-	
5. Degree of autonomy support	χ^2 (2, N = 89) = 0.82, *p* = .66	χ^2 (1, N = 76) = 0.79, *p* =. 37	χ^2 (10, N = 80) = 14.15, *p* = .16	χ^2 (1, N = 90) = 0.13, *p* = .72	-
6. Comparison group	-	χ^2 (1, N = 25) = 0.16, *p* = .68	χ^2 (5, N = 27) = 6.48, *p* = .26	χ^2 (1, N = 27) = 4.36, *p* < .05	χ^2 (1, N = 27) = 1.42, *p* = .23

Note. Statistics shown in bold typeface indicate significant association at *p* < .01.

As previously discussed, cross-sectional and prospective designs were more likely to assess perceived autonomy support as an independent construct, while experimental studies often supplemented the provision of autonomy support with other manipulations, for instance support for competence and relatedness. The significant association between the provider of autonomy support and additional support moderators appeared to be clustered with associations between age and provider and between age and additional support. Teacher-based autonomy support tended to be used in correlational designs with younger samples and correlational designs mainly assessed the effects of perceived autonomy support independently of other constructs. Experimental studies, on the other hand, often incorporated additional forms of support with autonomy-supportive manipulations. Finally, provision of additional support was significantly associated with comparison condition. Within experimental studies, only those manipulating autonomy support alone employed comparison conditions that aimed to undermine autonomy. All experiments and interventions incorporating autonomy support alongside other forms of support evaluated effects against a standard control. There were insufficient data (cells with $k < 5$) to conduct further moderator analyses on sub-groups defined by the related moderators. It is important to note that although the co-occurrence of moderators suggests the potential for interactive effects on associations between autonomy support and psychological and behavioural outcomes, the present data do not permit these analyses.

Process Model of SDT and Health-Related Behavior

Averaged corrected correlations and associated statistics among the variables involved exclusively in the proposed meta-analytic path analysis testing the SDT process model of health-related behavior are shown in Table 2.4. The corrected correlations for associations between overall autonomy support and need satisfaction, autonomous motivation, behavior, and well-being were derived from the main analyses reported in Table 2.1. The proposed model included constructs pertinent to the SDT process model, based on Williams et al.'s (2006) theorizing, and also incorporated satisfaction of the needs for autonomy and relatedness. Fail-safe N values for effects represented in the path model exceeded Rosenberg's (2005) criterion for robustness with only two exceptions. Although the CI_{95} did not encompass zero for the correlation between autonomous motivation and psychological well-being, the fail-safe N indicated that only 26 null findings would need to be identified in order to overturn the significant effect. The correlation between well-being and behavior also exhibited a small fail-safe N, but the CI_{95} for this correlation encompassed zero indicating that the effect is likely to be relatively trivial.

The model showed acceptable fit to the data, $\chi^2 = 62.98$, $df = 6$, $p < .01$; CFI = .95; NFI = .95; SRMSR = .06; RMSEA = .13; RMSEA CI_{90} = .10, .16. The model accounted for 40.30% of the variance in autonomous motivation, 15.10% of the variance in health-related behavior, and 14.00% of the variance in psychological well-being. Standardized regression coefficients among the variables in the path model are provided in Figure 2.1. Error covariances were freely estimated between autonomy, competence, and relatedness need satisfaction variables, and between behavior and well-being (Autonomy $\Leftrightarrow$ competence, $\phi = .40$; autonomy $\Leftrightarrow$ relatedness, $\phi = .44$; competence $\Leftrightarrow$ relatedness, $\phi = .40$; behavior $\Leftrightarrow$ well-being, $\phi = .04$).

Table 2.4

Results of Meta-Analysis of Effects for Path Analysis of the Modified SDT Process Model of Health-Related Behavior

					CI_{95}		CI_{90}						
Effect	K	N	r+	r++	LB	UB	LB	UB	χ^2	SD	SE	Var	N_{FS}
Autonomy-Behavior	10	3487	0.22	0.29	0.19	0.39	0.05	0.52	49.35^{***}	0.14	0.05	20.26	101
Autonomy-Competence	23	8131	0.37	0.48	0.39	0.56	0.16	0.80	201.76^{***}	0.20	0.04	11.40	2155
Autonomy-Autonomous Motivation	7	2794	0.48	0.58	0.46	0.69	0.33	0.82	73.29^{***}	0.15	0.06	9.55	332
Autonomy-Relatedness	19	6437	0.45	0.57	0.47	0.66	0.24	0.89	154.60^{***}	0.20	0.05	12.29	2019
Autonomy-Well-Being	7	2035	0.26	0.31	0.26	0.35	0.31	0.31	6.41	0.00	0.02	100.00	71
Competence-Behavior	24	7509	0.32	0.37	0.29	0.46	0.02	0.73	300.20^{***}	0.21	0.05	7.99	1113
Competence-Autonomous Motivation	17	7028	0.40	0.46	0.39	0.52	0.24	0.67	131.98^{***}	0.13	0.03	12.88	1359
Competence-Relatedness	20	6690	0.40	0.48	0.39	0.57	0.16	0.80	207.71^{***}	0.19	0.05	9.63	1783
Competence-Well-Being	6	1735	0.34	0.42	0.37	0.47	0.42	0.42	2.87	0.00	0.03	100.00	96
Autonomous Motivation-Behavior	43	10980	0.22	0.28	0.22	0.33	0.01	0.55	251.33^{***}	0.17	0.03	17.11	2073
Autonomous Motivation-Well-Being[a]	6	744	0.30	0.36	0.28	0.43	0.36	0.36	4.16	0.00	0.04	100.00	26
Relatedness-Behavior	8	2266	0.22	0.26	0.18	0.34	0.11	0.41	21.63^{**}	0.09	0.04	36.98	60
Relatedness-Autonomous Motivation	7	2853	0.44	0.50	0.38	0.62	0.25	0.75	84.39^{***}	0.15	0.06	8.29	282
Relatedness-Well-Being	7	2035	0.29	0.36	0.30	0.41	0.36	0.36	2.41	0.00	0.03	100.00	94
Well-Being-Behavior[a]	4	567	0.19	0.21	-0.02	0.44	-0.14	0.56	27.21^{***}	0.21	0.12	14.70	1

Note. Effects of AS on endogenous variables within the path model are presented in Table 2.1; k = number of effect sizes contributing to average effect size; N = total sample size contributing to average effect size; r+ = bare bones averaged correlation coefficient corrected for sampling error only; r++ = averaged correlation coefficient corrected for sampling and measurement error; 95% CIs = 95% confidence intervals for averaged correlation coefficient corrected for sampling and measurement error; 90% CIs = 90% credibility intervals for distribution of correlations in the population; LB = lower bound of confidence/credibility interval; UB = upper bound of confidence/credibility interval; χ^2 = chi-square analysis; SD = standard deviation of averaged correlation corrected for sampling and measurement error; SE = standard error of averaged correlation corrected for sampling and measurement error; Var = variance in averaged correlation corrected for sampling and measurement error accounted for by the statistical artifacts of sampling and measurement error. [a]Effect size estimate is likely to be unreliable due to the small number of studies according to the N_{FS} criteria proposed Rosenberg (2005). * $p < .05$; ** $p < .01$; *** $p < .001$

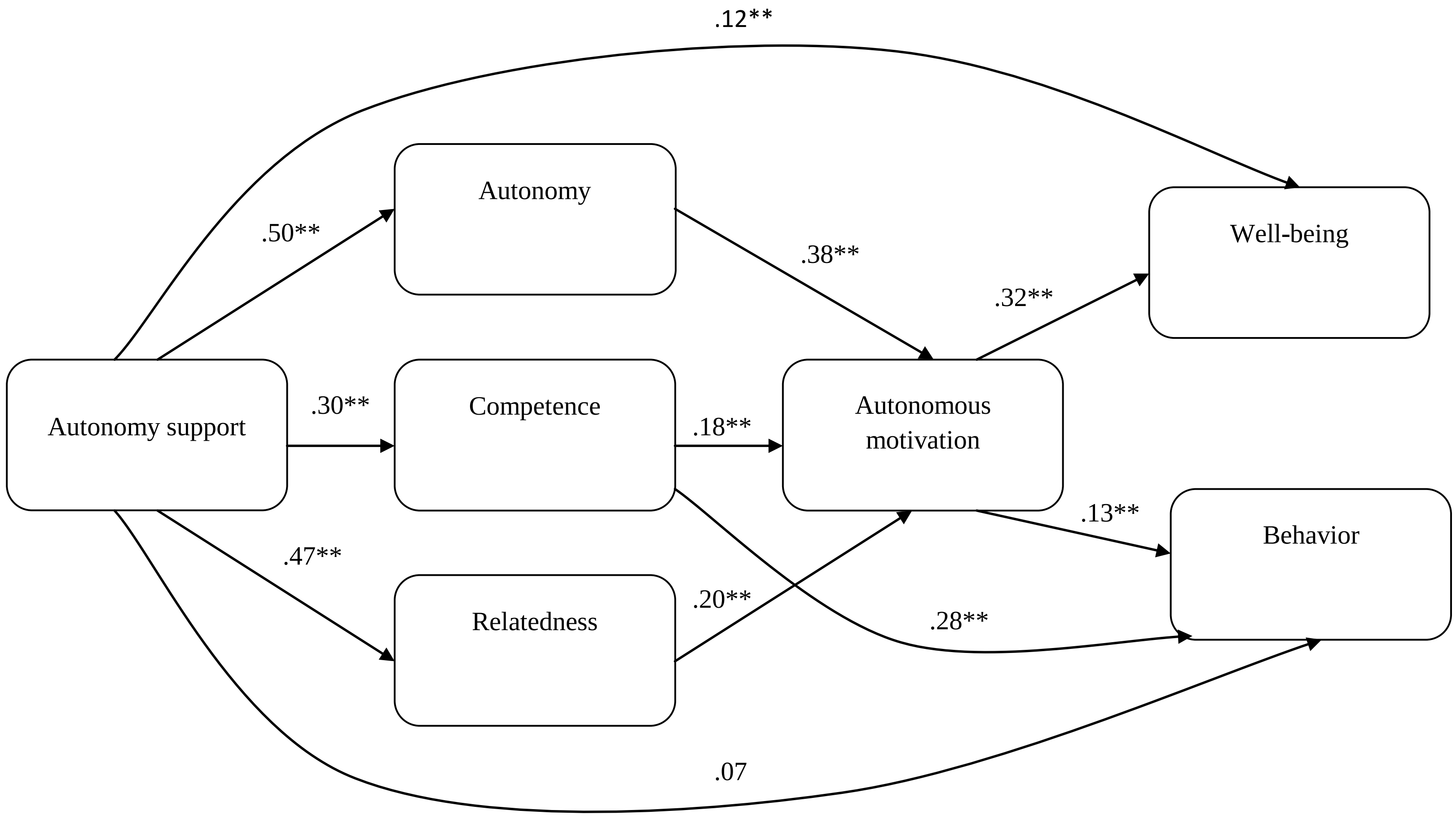

Figure 2.1. Path model of meta-analytically derived correlations between constructs in a modified representation of the SDT process model of health-related behavior, based on Williams and colleagues (2006). Standardized regression coefficients and associated significance levels are shown. Autonomy = satisfaction of need for autonomy; Competence = satisfaction of need for competence; Relatedness = satisfaction of need for relatedness. Covariances between autonomy, competence, and relatedness need satisfaction variables, and between behavior and well-being and are not shown in the Figure for clarity. * p <.05; ** p < .01.

Consistent with the hypothesized associations, there were significant direct effects of overall autonomy support on satisfaction of autonomy ($\beta = .50$, $p < .01$), competence ($\beta = .30$, $p < .01$), and relatedness ($\beta = .47$, $p < .01$) needs. Also consistent with the hypothesized model were the significant direct effects determined for the satisfaction of needs for autonomy ($\beta = .38$, $p < .01$), competence ($\beta = .18$, $p < .01$), and relatedness ($\beta = .20$, $p < .01$) on autonomous motivation, and for competence ($\beta = .28$, $p < .01$), and autonomous motivation ($\beta = .13$, $p < .01$) on behavior. The direct effect of overall autonomy support on behavior was non-significant ($p < .05$), while the direct effect of overall autonomy support on well-being was significant ($\beta = .12$, $p < .01$). Well-being was also significantly and positively predicted by autonomous motivation ($\beta = .32$, $p < .01$). In accordance with the mediation effects specified in the model, a significant indirect effect of overall autonomy support on behavior was found ($\beta = .13$, $p < .01$), mediated by the autonomy, competence, and relatedness need satisfaction variables, and autonomous motivation. Significant indirect effects were also found for the effect of satisfaction of the needs for autonomy ($\beta = .05$, $p < .01$), competence ($\beta = .02$, $p < .05$), and relatedness ($\beta = .02$, $p < .05$) on behavior, mediated by autonomous motivation. A significant indirect effect of overall autonomy support on autonomous motivation was revealed ($\beta = .34$, $p < .01$), mediated by the autonomy, competence, and relatedness need satisfaction variables. Finally, significant indirect effects were present for each of overall autonomy support ($\beta = .11$, $p < .01$), and the need satisfaction variables of autonomy ($\beta = .12$, $p < .01$), competence ($\beta = .06$, $p < .01$), and relatedness ($\beta = .06$, $p < .01$) on well-being. For all indirect effects, significant zero-order correlations were present between the independent and dependent variables, the independent and mediator variables, and the mediator and dependent variables. This provided confirmation of mediation according to the criteria specified by Baron and Kenny (1986). Findings were consistent with the hypothesized mediational sequence represented in the model and, as expected, no direct effects of overall autonomy support on behavior were evident due to full mediation by the need satisfaction and autonomous motivation variables. It should be noted, however, that the association between competence and behavior was more than twice the size of the association between autonomous motivation and behavior, suggesting that perceived competence may be a more powerful direct determinant of health-related behavior than autonomous motivation.

Discussion

The present meta-analysis aimed to provide a quantitative synthesis of research on the effects of manipulated and perceived autonomy support on health-related psychological and behavioral outcomes. A second objective of the meta-analysis was to identify the role of six moderator variables, namely study design, age of recipients, provider of autonomy support, presence of additional support, degree of manipulated autonomy support or perceived autonomy support, and the nature of the comparison group within experimental and intervention studies, on the effects of overall autonomy support on health-related psychological and behavioral outcomes. We also aimed to test a modified representation of Williams and colleagues' (2006) process model of health-related behavior using the meta-analytically-derived effect sizes among the component variables of the model. Ninety-eight articles met inclusion criteria providing 109 independent tests of the effects of autonomy support on health-related psychological (e.g., need satisfaction, autonomous motivation, intention, well-being) and behavioral (e.g., physiological indexes of behavioral adherence, self-reported behavior) outcomes. Overviews and discussion of the main findings, the moderator analyses, and the meta-analytically derived path analysis for the process model of SDT are provided in the following sections.

Main Findings

Results of the meta-analysis revealed that overall autonomy support (i.e., the combined effects of manipulated and perceived autonomy support) was significantly related to numerous salient adaptive health-related psychological and behavioral outcomes including satisfaction of the needs for autonomy, competence, and relatedness, autonomous forms of behavioral regulation, intention, persistence of healthy behavior, and psychological well-being. The importance of overall autonomy support in facilitating need satisfaction, autonomous motivation, adaptive health behavior, and psychological well-being has been supported in the present sample of studies that have manipulated autonomy support, or measured perceived autonomy support, across diverse contexts and samples. These findings are consistent with the associations of overall autonomy support with health-related outcomes found in individual studies from a number of national and cultural groups and lends support to the generalizability and the universality of the beneficial effects of autonomy support (e.g., Chirkov & Ryan, 2001). There is also some indication that overall autonomy support impacts positively on physical well-being through increasing behavioral adherence, for instance to weight loss programmes (Williams et al., 1996) and diabetes self-care regimens (Williams, McGregor, King, Nelson, & Glasgow, 2005).

The present findings have therefore supported the theorized universal importance of both manipulated and perceived autonomy support and have indicated the value of the former in the development of health-related behavior change interventions. Importantly, manipulated autonomy support was strongly related to perceived autonomy support in the current analysis, suggesting that the two are highly correlated and that perceived autonomy support is reflective of environmental support for individuals' autonomy. Findings were generally consistent with theoretical predictions from SDT. However, effects were not homogenous for any outcome according to Hunter and Schmidt's (1994) recommended 75% criterion. This heterogeneity implied the presence of moderating variables and an analysis of the effects of salient moderators on effect sizes for the relations between overall autonomy support and salient outcomes was therefore conducted.

Findings of Moderator Analyses

Results of the moderator analyses revealed several significant moderators of the effects of manipulated, perceived, and overall autonomy support on the health-related psychological and behavioral outcomes. The implications of these findings are discussed in the following sections. Importantly, the magnitude of some effects of the moderators on associations between autonomy support and the psychological and behavioral outcomes was comparable in size to the average effect of autonomy support itself. This suggests that the role of moderator variables should assume central importance in future research rather than being regarded as a secondary issue.

Study design. Study design moderated the effects of autonomy support on external regulation and composite autonomous motivation. In the case of external regulation, the negative effect of autonomy support was greater in experimental/intervention studies than the effect of perceived autonomy support in cross-sectional studies. This is contrary to the premise that common method variance may artificially inflate associations within cross-sectional research and is inconsistent with previous research suggesting that correlational designs may overestimate effects in relation to experimental work (e.g., Hagger & Chatzisarantis, 2009). However, findings were consistent with expectations for composite autonomous motivation as the effect of perceived autonomy support was significantly larger in both cross-sectional and prospective designs relative to that of manipulated autonomy support in experimental studies. The preponderance of correlational studies in the literature highlights the need for more randomized controlled experimental and intervention designs in order to provide a more robust determination of the true effectiveness of autonomy support interventions in health-related settings.

Age. The general trend across all moderator analyses conducted for age of sample was that the effects of overall autonomy support were greater in samples of participants younger than 18 years of age than in adult samples. Age significantly moderated the effects of overall autonomy support on autonomy satisfaction, behavior, external regulation, identified regulation, and intention. The implication of this finding is that children and adolescents may be more receptive to autonomy support than adults and that autonomy support for health-related behaviors is likely to be most effective when implemented at an early age. Autonomy-supportive interventions may therefore be differentially effective in children and adults. Future research may benefit from implementing a standardized autonomy-supportive behavior change intervention using a randomized controlled design with independent samples of adults and children simultaneously and drawing direct comparisons between effects.

Provider. The provider or source of autonomy support significantly moderated the effects of overall autonomy support on behavior and intention. In the case of behavior, overall autonomy support yielded a significantly larger effect on these outcomes when delivered by an experimenter, significant others, or teachers in comparison to counsellors and health-care professionals. This is encouraging in terms of the potential for autonomy-supportive interventions to modify health-related behavior but suggests that counsellors and health care professionals may need to work in conjunction with others in order to change health-related behavior. Alternatively, research could explore the methods of provision of autonomy support from these providers to determine whether other factors may be inhibiting the effectiveness of autonomy-supportive interventions or the beneficial effects of perceived autonomy support. One such possibility is that the variability in effects may arise as a result of differences in contact time between providers. For intention, the effect of overall autonomy support was significantly greater when provided by friends than by teachers. Recommendations arising from this finding are therefore confined to application with children and adolescents, and further research is needed to confirm this apparent discrepancy in effectiveness between providers. Nevertheless, findings indicate that training children and adolescents to provide autonomy support within their peer groups may represent a more effective route within health-related autonomy-supportive interventions than teacher-based provision.

Additional support. The presence of additional support within experimental and intervention manipulations did not moderate the effects of manipulated autonomy support on those outcomes for which there were sufficient effect sizes, namely, behavior and physiological indexes of behavioral adherence. The conclusion that the provision of additional support alongside autonomy support is no more effective than autonomy support alone in changing behavior should be interpreted with caution as findings are based on a relatively small number of tests. However, this provides an avenue for further research to test the implication that the provision of support for competence and relatedness, or other forms of support alongside autonomy-supportive manipulations, may be superfluous to efforts to change health-related behavior. This is consistent with Markland and Tobin's (2010) assertion that autonomy occupies a unique position amongst the three needs in being absolutely critical to the facilitation of internalization and associated outcomes.

One further consideration arising from multifaceted experimental and intervention studies is the necessity of identifying the key components or mechanisms that are responsible for behavior change. Many interventions implementing autonomy support alongside other forms of manipulation are complex and intricate, for instance those incorporating structure and involvement, resulting in difficulty when attempting to tease out those components that were critical in facilitating significant behavior change. For instance, Fortier and colleagues (2007) implemented autonomy support within a multi-faceted intervention that also targeted goal setting, strategies to overcome barriers to behavior change, and the mobilization of social support resources. With the recent emphasis on the importance of determining both the effectiveness of interventions and how they are effective (e.g., Michie & Abraham, 2004), study designs and analyses in this field should allow for the evaluation of mechanisms of change. Particular attention should be devoted to evaluating the effects of provision of autonomy support (i.e., choice, meaningful rationale, and acknowledgement of the individual's perspective and feelings) on perceptions of personal ownership of the behavior and autonomous motivation as the key mediators of behavior change.

Degree of autonomy support. For experimental and intervention studies, no significant moderation by completeness of autonomy support was determined for the effect of manipulated autonomy support on behavior. This finding is contrary to tenets of SDT. Deci et al. (1994) asserted that the provision of all facets of autonomy support is more likely to result in integrated internalization, whereas provision of only one component of this contextual support will likely lead to introjected regulation. As integrated internalization is associated with more adaptive psychological and behavioral outcomes than introjection, it was expected that provision of all facets of autonomy support would confer significantly greater adaptive effects on behavior than the provision of one or two facets. However, it should be noted that the number of effect sizes contributing to the average corrected effect for the provision of all three facets of autonomy support was considerably smaller than the number of effects behind the average corrected effect for less than three facets of autonomy support, which means that the corrected effect for complete autonomy support may be relatively unreliable.

For correlational studies, the assessment of three or less than three facets of perceived autonomy support significantly moderated the effect of perceived autonomy support on behavior. The average corrected effect size for assessment of all three facets of perceived autonomy support was substantially and significantly larger than that for less than three facets perceived autonomy support. This finding reinforces the importance of employing measures of perceived autonomy support that tap all core facets of the construct; the provision of choice, acknowledgement of the individual's perspective and feelings, and the delivery of a personally meaningful rationale for the behavior.

Comparison group. Although significant moderation by comparison group was not evident, the average corrected effect size for the effect of manipulated autonomy support on behavior was larger when implemented against an autonomy-thwarting or controlling comparison group relative to a standard control. Consistent with the predictions of SDT, the effects of autonomy support on behavior should be larger when compared to a condition in which autonomy has been actively undermined than a condition in which autonomy has neither been enhanced nor undermined (Deci & Ryan, 2000). The average effect for controlling comparison conditions moderator group comprised far fewer individual effect sizes than that for standard control condition moderator groups. This highlights the need for more studies comparing autonomy-supportive interventions against both forms of comparison condition (e.g., Chatzisarantis et al., 2007). However, it is not ethical to expose individuals to controlling conditions pertaining to health-related behaviours. Research of this nature would therefore need to be conducted in an artificial and controlled laboratory environment and with a novel behaviour. Delayed autonomy-supportive treatment may also be used to ensure that participants are not disadvantaged in any way following exposure to controlling manipulations.

Overall, the moderator analyses did not fully account for the heterogeneity in effect sizes as considerable variability remained unexplained by statistical artifacts following these analyses. Future research should examine the moderation of mediated relationships (see Preacher, Rucker, & Hayes, 2007), such as the mediation of the association between autonomy support and behavior by autonomous motivation, to determine external factors that may affect the effectiveness or magnitude of the effect of autonomy-supportive interventions on health-related behavior. This would provide useful guidance for researchers and practitioners in the development of behavior change interventions.

Process Model of SDT and Health-Related Behavior

Findings of the meta-analytic path analysis provided confirmation of the proposed pattern of relationships stipulated in Williams et al.'s (2006) SDT process model. Significant and positive direct effects of overall autonomy support on autonomy, competence, and relatedness need satisfaction variables were found. Consistent with mediation hypotheses, a significant indirect effect was established for overall autonomy support on behavior, mediated by the need satisfaction variables and autonomous motivation. Notably, overall autonomy support exhibited a significant direct effect on well-being suggesting that the provision of autonomy support enhances well-being independent of its effect on autonomous motivation.

Collectively, these findings provide confirmation of the proposed mechanisms by which manipulated and perceived autonomy support affect actual behaviour and other salient outcomes in the health domain across the current set of studies. Results were also congruent with previous independent empirical tests of the process model (e.g., Fortier et al., 2007; Halvari et al., 2009; Williams et al., 2006). According to Williams et al.'s (2006) model, autonomy support facilitates need satisfaction and the internalization of behavioral regulations and, in doing so, promotes uptake of, and adherence to, health-related behaviors. Current results therefore provide insight into the processes by which manipulated autonomy support affects health-related psychological and behavioral outcomes. It should, however, be acknowledged that the parameters linking autonomous motivation and behavior to well-being in the present model were based on a small number of effect sizes and estimates may therefore be unreliable. Additionally, considerable heterogeneity in the effects underlying the model suggested the presence of moderator variables relating to the nature of the autonomy support provided, which may account for much of the unexplained variance.

Limitations and Directions for Future Research

The present meta-analysis has supported the theorized positive associations between overall autonomy support and key health-related psychological and behavioural outcomes. The majority of reported effect sizes were shown to be robust, although some of the effect sizes were relatively small, and moderator analyses have suggested some useful routes for future research. However, a number of limitations must also be acknowledged.

The interpretation of the moderator analyses is complicated by the finding of significant associations between seven pairs of the moderator variables, which indicates that the effects of each were not independent. The effects of the moderators on the effect sizes in the current analysis could not therefore be unequivocally considered unconfounded. For instance, the significant association between age of sample and provider of autonomy support meant that the unique effects of age and provider as moderators of the relations between autonomy support and key dependent variables could not be determined meta-analytically. This non-independence between clusters of moderators necessitates the need for caution when interpreting some findings of this meta-analysis. Future research should aim to disentangle these complex associations between moderators. In the present analysis, there were insufficient data in some cells to enable the testing of effects of autonomy support in subgroups of studies defined by the pairs of associated moderator variables. It is also important to acknowledge that meta-analysis only allows associations to be established between moderators and outcomes and it does not permit definitive conclusions regarding the direction of causality in effects (Patall et al., 2008).

While the path analysis of the SDT process model was based on averaged zero-order correlations corrected for measurement and sampling error, the majority of the effect sizes were heterogeneous suggesting that considerable variance in effect sizes remained unexplained. The correlations used in the process model were therefore likely affected to some extent by moderator variables. Future studies, if sufficient numbers of effect sizes are available, could be synthesized and analyzed in moderator groups to explore the influences of moderator variables on the mediation relationships within the process model.

A considerable amount of research in this field is cross-sectional or prospective in design, and the SDT literature on autonomy support would be further developed through the designing of more experimental and intervention studies that control for potential moderators of the effects of autonomy support on psychological and behavioral outcomes. Nevertheless, the limited data available indicate a strong positive effect of autonomy support on perceived autonomy support, suggesting that the two are closely linked and that perceived autonomy support does reflect the provision of autonomy support from social agents. There exists, however, the possibility that perceived autonomy support may not accurately reflect absolute provision of autonomy support but rather individuals' tendencies to interpret the environment as autonomy-supportive. According to Deci and Ryan (1985b), people differ in the extent to which they are generally oriented towards self-determination and this may bias the perceptions of events in their environment or social context, such as the 'climate' fostered by social agents, as autonomy-supportive or controlling. Future research should explore this possibility and seek to determine whether perceived autonomy support is independent of generalized self-determined orientations. It may, in fact, be the case that perceived autonomy support, perhaps partly comprised of general causality orientations, is the critical determinant of the effectiveness of autonomy-supportive interventions rather than the absolute level of autonomy support provided. This issue could also be addressed in future research, through determining whether actual autonomy support predicts changes in autonomous motivation and behavior while controlling for perceived autonomy support and general causality orientations. Future research could also explore the role of perceived autonomy support as a mediator of associations between autonomy support, motivation and health-related behavior.

It is important to note that several of the effect sizes in the present study were based on a relatively small number of tests, which may limit their reliability. This is likely to be the case for effects of overall autonomy support on ill-being and controlled motivation, for which non-significant, relatively trivial effect sizes were found. The non-significance of the effect of autonomy support on composite measures of controlled motivation may be partially due to the combination of two distinct forms of controlled regulation (introjected and external) in creating a composite controlled motivation variable in some of the primary studies. This assertion is confirmed when the two component regulation styles are segregated. We found a positive effect for overall autonomy support on introjected regulation and a negative effect on external regulation in the current analysis. It is therefore recommended that future research employs either individual measures for each of the forms of behavioral regulation or a measure of relative autonomous motivation representing the degree to which a behavior has been internalized.

Finally, although all health-related behaviors were included within the meta-analysis, physical activity was disproportionately represented as the health behavior of interest in the primary studies (33 articles reported physical activity or exercise as the only behavioral outcome), as acknowledged previously (Hagger & Chatzisarantis, 2009). Future research should aim to encompass a wider range of health-related behaviors in order to draw more robust conclusions regarding the effects of autonomy support in the health behavior domain.

Conclusions

The meta-analysis contributes to knowledge by providing the first quantitative synthesis of research on manipulated and perceived autonomy support and health-related psychological and behavioral outcomes, elucidating moderators of the relationships between overall autonomy support and these outcomes, and confirming the mediation of these relationships as hypothesized in the SDT process model. Results support key tenets of SDT and the appositeness of the SDT process model to explain health-related outcomes across diverse health contexts. Future research on autonomy support should focus on incorporating measures of integrated regulation, particularly in experimental and intervention studies in which internalization and integration are predicted to occur. This would serve as a mediating variable and provide more information on the mechanisms of the effects of autonomy support on behavior. The present research has also highlighted the need for well-controlled experimental and intervention studies exploring the effects of autonomy support against both standard control and controlling comparison conditions (e.g., Chatzisarantis et al., 2007). The finding that perceived autonomy support from friends was more effective than that from other sources suggests that training individuals to provide autonomy support within their peer groups could provide an effective route for the delivery of autonomy support in future intervention studies. The importance of assessing all three facets of perceived autonomy support within correlational research should also be heeded in future research in addition to increasing the body of evidence implementing all components of autonomy support within experimental and intervention studies. The trend in the current data suggests that manipulation of all core components of autonomy support facilitates greater positive changes in health behavior than manipulation of one or two components, but more data is needed to determine whether this finding is statistically significant. Health practitioners would also be well advised to implement autonomy support at a young age as present results suggest that children appear more receptive than adults. Finally, in accordance with the recommendations of Michie and Abraham (2004), focus should be placed on determining exactly which components of multifaceted interventions that include autonomy support components are effective and identifying mechanisms integral to health behavior-change.

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Chapter 3

Associations between motivational orientations and chronically-accessible outcomes in leisure-time physical activity: Are appearance-related outcomes controlling in nature?

McLachlan, S., & Hagger, M. S. (2010). Associations between motivational orientations and chronically-accessible outcomes in leisure-time physical activity: Are appearance-related outcomes controlling in nature? *Research Quarterly for Exercise and Sport*, 81, 102-107.

Abstract

A cross-sectional survey design was employed to investigate the motivational basis of chronically-accessible outcomes in leisure-time physical activity based on self-determination theory (SDT; Deci & Ryan, 1985, 2000). It was hypothesised that striving for appearance-related physical activity outcomes would be associated with controlling motivational orientations, as such outcomes are unlikely to represent personally-endorsed motives but rather externally-referenced reasons for engaging in physical activity. Participants (N = 276) completed the Behavioural Regulation in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997) and reported up to three outcomes that they hoped to achieve in their leisure-time physical activity using a free-response measure (Levesque & Pelletier, 2003). Results showed that the appearance-related outcome measure was significantly and positively correlated with an external regulatory style (r = .20, p < .01) and significantly and negatively correlated with intrinsic motivation (r = -.13, p < .05). A logistic regression analysis indicated that for a one unit increase in introjected regulation for leisure-time physical activity, the model predicted an increase of 1.87 in the odds of the primary chronically-accessible outcome being appearance-related (odds ratio = 1.87, p < .05). Results supported the hypothesis that chronically-accessible appearance-related outcomes in physical activity tend to be controlling in nature. Findings may partially explain high dropout rates in physical activity programmes and could be employed in the development of interventions to promote physical activity.

Associations between motivational orientations and chronically-accessible outcomes in leisure-time physical activity: Are appearance-related outcomes controlling in nature?

Research suggests that physical inactivity plays a causal role in the rise in chronic health problems such as obesity, diabetes-mellitus, and coronary heart disease (Lee & Skerritt, 2001). Researchers in the physical activity domain have employed a range of motivational theories to increase understanding of this behavior. Self-determination theory (SDT; Deci & Ryan, 1985, 2000) is a social psychological motivational theory that has been extensively applied in this domain to identify motivational correlates of physical activity behavior.

SDT has successfully predicted behavioral persistence and well-being in a variety of contexts (Deci & Ryan, 2000). SDT advocates that qualitatively different forms of motivation can be elicited from interactions between the individual and the environment. Deci and Ryan (1985) argue that motivated behaviors differ in the degree to which they are self-determined or *autonomous* versus non-self-determined or *controlled*. Six qualitatively different forms of motivational or *regulatory* style have been identified within the theory, which vary in their degree of relative autonomy: intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation. These regulatory styles are proposed to lie on a continuum, known as the perceived locus of causality (PLOC), ranging from intrinsic motivation at one extreme to amotivation at the other. Intrinsic motivation is said to represent the prototypic instance of self-determined motivation (Deci & Ryan, 2000) and reflects engaging in behaviors for no external reinforcement, a sense of choice and personal investment. Intrinsic motivation is related to high levels of interest, enjoyment, and persistence with tasks (Deci & Ryan, 2000), and the maintenance of self-regulatory capacity for health-related behavior (Hagger, Wood, Stiff, & Chatzisarantis, 2009). Integrated regulation is the most autonomous form of extrinsic motivation, as this refers to a process in which individuals convert externally-referenced requests or pressures into personally-endorsed reasons that are congruous with their true self. Identified regulation lies adjacent to integrated regulation and represents engagement in a behavior in order to attain valued behavioral outcomes. Introjected regulation is located next to identified regulation and describes behavioral participation to obtain feelings of self-worth or to avoid negative emotions such as guilt and shame. External regulation is the prototypical form of non-self-determined motivation, with behavior perceived as emanating entirely from external contingencies. Amotivation lies at the far end of the continuum and is characterized as participating in a behavior for no discernable reason or intention.

Research has shown that autonomous motivation from the PLOC is related to physical activity engagement and persistence. Ryan, Frederick, Lepes, Rubio, and Sheldon (1997) demonstrated that autonomous motivation facilitates long-term adherence to physical activity, and autonomous motives are strongly associated with intentions and effort regarding physical activity participation (Chatzisarantis, Hagger, Biddle, & Karageorghis, 2002). Further, Ekkekakis and Lind (2006) found that imposing exercise intensity in overweight individuals led to decreased enjoyment of exercise relative to self-selected intensity. Imposed exercise intensity is likely to represent a controlling regulation and may diminish autonomous motivation, which could have significant consequences for behavioral persistence.

A recent development in research on self-determination theory is the distinction between intrinsic and extrinsic motivation and intrinsic and extrinsic goal contents. The content of the goals that people pursue, intrinsic or extrinsic, has been shown to be distinct from motives for performing behaviors (Vansteenkiste, Soenens, & Lens, 2007). Although the pursuit of intrinsic goals frequently results from autonomous motives and the pursuit of extrinsic goals is often based on controlling regulations, goal contents and underlying regulations are distinct (Vansteenkiste et al., 2007). Vansteenkiste, Simons, Lens, and

Sheldon (2004) reported that an experimental manipulation of goals, by framing them as intrinsic or extrinsic, resulted in reliable differences in depth of processing, test performance, and persistence for both the learning of text material and physical exercise. Intrinsic goal framing resulted in positive effects on all learning outcomes. Therefore the content of goals and motivational orientations are separate but related concepts and can be influenced by the social context that may either support or thwart autonomous motivation and goal pursuit.

Deci and Ryan (2000) also asserted that the content, or *'what'* of goal pursuits can influence behavior and well-being. Research has shown that autonomous aspirations exhibit positive relationships with self-actualization and vitality, while controlled aspirations are negatively associated with well-being and social functioning (Kasser & Ryan, 1993). It is therefore important to determine whether the motivation underlying desired behavioral outcomes in a physical activity context is autonomous or controlled, in order to understand behavioral persistence and well-being and to aid the development of interventions to improve health outcomes.

Hagger and colleagues (2009) outlined the problem of identifying the motivational basis of desired outcomes in physical activity, using the example of a weight loss outcome. These authors argued that the weight loss outcome in physical activity, i.e. "I exercise to lose weight," could be interpreted as either autonomous or controlled. For some individuals, such an assertion may represent an autonomous outcome, because they want to be healthy, whereas for others this outcome may be desired in order to look good for others, which indicates a controlling motivational basis. Similarly, Vansteenkiste and colleagues (2007) highlighted that people may focus on one outcome for very different reasons; while some individuals pursue physical attractiveness because they want to conform to society's appearance ideals, others pursue this outcome because they personally value being attractive. It is important to clarify the motivational basis of such behavioral outcomes in physical activity because of the implications of motivational orientations for behavioral persistence and well-being.

In order to identify the motivational basis of desired behavioral outcomes, it is necessary to examine associations between these outcomes and the underlying regulatory styles postulated by SDT. Sheldon and Kasser (1995), for example, showed that extrinsic goal striving was positively correlated with controlled self-regulation. Similarly, Ingledew and Markland (2008) showed that appearance/weight motives in exercise participation were significantly related to introjected and external regulations, and external regulation mediated the negative association between the appearance/weight motives and exercise participation, while health/fitness motives were related to identified regulation, which mediated effects of these motives on exercise participation. These findings highlight the importance of considering both goal contents and motives when attempting to understand motivated behavior, particularly because both are related to behavioral persistence and well-being.

To date, research examining relations among goal pursuit and motivational styles in SDT has focused on self-reported motives from traditional inventories such as the Exercise Motivations Inventory version 2 (EMI-2, Markland & Ingledew, 1997). Studies have neglected to investigate relations between conventional self-reported motivational orientations and motivations that are chronically-accessible. While conventional self-report measures of motivational orientations serve as direct measures of motivation, chronically-accessible motivations can be accessed indirectly, consistent with Fazio and Olsen's (2003) distinction between direct and indirect measures. Research in the construct and attitude accessibility literature has suggested that chronically-accessible constructs and attitudes, i.e. those that are most readily spontaneously generated and therefore have high activation potential, are most likely to guide social judgement and behavior (Higgins, King, & Mavin, 1982; Fazio, Chen, McDonel, & Sherman, 1982). This principle has been applied to research on motivation, in which chronically accessible motivations (i.e. those that are most readily accessible and therefore have greatest activation potential) are argued to represent those forces most likely to motivate behavioral engagement.

Recent research has adopted this approach to study the effects of motives from self-determination theory on intrinsic motivation and behavior. Levesque and Pelletier (2003) employed techniques derived from the attitude accessibility literature to examine the effects of accessible autonomous and heteronomous (controlled) motivations in an academic context, using a free-response measure. This measure required participants to list up to 10 reasons that they had for attending university. Each participant's first two reasons were considered to serve as a proxy measure for their most chronically accessible motivations and were coded as either autonomous or heteronomous, consistent with Higgins and colleagues' (1982) assertion that primacy of output reflects chronic accessibility. This indicator of chronic accessibility has been employed in the attitude accessibility literature, in which the ease and speed with which attitudes are expressed reflects their accessibility (Bizer & Krosnick, 2001). Importantly, this literature has also shown that attitudes that are accessed most readily are those that are most strongly related to behavior (Kokkinaki & Lunt, 1997). Further, Bizer and Krosnick (2001) demonstrated that attitude importance can cause heightened accessibility, supporting the notion that readily-expressed attitudes are the most salient.

Levesque and Pelletier (2003) found that chronically-accessible autonomous motivations predicted long-term behavior beyond traditional scaled measures of motivational orientations. Further, despite some correspondence between the chronically-accessible measure of motivation and scaled self-report measures, some discrepancies existed, suggesting that participants were accessing different information for each measure. Most participants were found to be chronically controlled in their motivation for studying, while the majority of participants expressed an autonomous orientation on the self-report measures.

Chronically accessible motivation has also been shown to moderate the effects of planning on physical activity behavior (McLachlan & Hagger, in press). It is therefore important to determine the motivational basis underlying individuals' reported outcomes in physical activity to gain an understanding of their behavior, as traditional scaled motivational measures alone may not provide a sufficient explanation of motives. Adopting methods from construct and attitude accessibility research and applying them to the present study, we suggest that desired outcomes in physical activity with greatest activation potential will be the most chronically accessible (Higgins, 1996). These outcomes are likely to be those that the individual pursues when engaging in physical activity and should therefore represent their general motivational orientations toward that behavior. The chronically-accessible measure also confers the advantage of serving as an indirect measure of motivational orientations, as participants are not aware of what the measure taps, therefore self-report bias is likely to be reduced.

The present study aimed to explore relations between chronically-accessible outcomes in physical activity and scaled measures of motivational orientations from a self-determination perspective. Methods from construct and attitude accessibility research and Levesque and Pelletier's (2003) study were used to identify participants' chronically-accessible desired outcomes in physical activity. Although a variety of outcomes were expected to be salient, the focus of the present study was to determine the regulatory basis of appearance-related outcomes. It was hypothesised that chronically-accessible appearance-related outcomes in physical activity, such as weight loss and 'toning up', would be related to controlling motivational orientations as indicated by a scaled measure. The chronically accessible outcomes measure was used as a proxy for chronically accessible motivation, as desired outcomes drive behavioral engagement and represent the types of motivation that people experience whilst pursuing behavior. The study will make a unique contribution to the social and health psychology literature by exploring the regulatory basis of the chronically-accessible outcomes that people pursue in their leisure-time physical activity behavior.

Method

Participants

Participants (*N* = 276; *Mean age* = 29.39, *SD* = 12.25) were recruited from universities and employers in South East England and completed a single questionnaire received through postal mail. Of the original 276 participants, 142 provided data on all study variables. The large non-completion rate resulted from including data only from participants who completed a measure of integrated regulation, which was incorporated after the beginning of the study. The exclusion of those participants who did not provide data for the integrated regulation measure allowed examination of associations between chronically-accessible outcomes and the complete range of motivational orientations specified by self-determination theory.

There were 29 males and 113 females in this final sample. Participants who did not provide complete data were significantly older, t (274) = -11.74, $p < .001$, and there were significantly more males in this group, χ^2 (1) = 12.95, p < .001. Of this final sample, 14.1% had not participated in any physical activity over the last six months, while 26.1% had not participated in any physical activity over the past two weeks. The mean rating on the self-report physical activity scale over the previous six months in this final sample was 2.99 (SD = 1.37) and over the past two weeks was 2.85 (SD = 1.58), where ‘1’ represented no participation in physical activity, ‘2’ represented participation once per week, ‘3’ represented participation two days per week, ‘4’ represented participation several days per week, ‘5’ represented participation many days per week, and ‘6’ represented participation most days per week.

Design

Using a cross-sectional design, participants completed the behavioral regulation in exercise questionnaire (BREQ, Mullan, Markland, & Ingledew, 1997), containing measures of motivational regulations. In addition, participants completed an open-ended measure of physical activity outcomes that they aimed to attain. Participants gave their informed consent prior to completing the questionnaires and were informed of their rights to confidentiality and to withdraw from the study at any time. Ethical approval for the study was obtained from the School of Psychology, University of Nottingham. Prior to completing the measures, participants were presented with a definition of leisure-time physical activity. Participants were asked to consider the vigorous and active physical activities that they might do in their leisure-time and were provided with examples such as jogging, swimming, and sports training.

Measures

Chronically-accessible physical activity outcomes measure. Participants were asked to list up to three important outcomes that they aimed to achieve through leisure-time physical activity over the following three weeks. Participants were informed that these outcomes could be anything that they hoped to accomplish through doing leisure-time active sports and/or vigorous physical activities over the next three weeks and were asked to write down the first three that came to mind. The measure was phrased such that participants who did not currently participate in physical activity could respond in a hypothetical manner. The frequency of primary outcomes listed by participants is given in Table 3.1. For the purpose of subsequent analyses, primary outcomes were coded dichotomously; participants reporting a primary outcome that was appearance-related were allocated a code of ‘0’ while those reporting a primary outcome unrelated to appearance were coded ‘1’. The first (primary) outcome listed for each participant was coded, as this is believed to best represent participants' chronically-accessible motivations (Levesque & Pelletier, 2003).

Perceived locus of causality. The BREQ (Mullan et al., 1997) was used to measure perceived locus of causality for leisure-time physical activity. The questionnaire contains 19 items with four items for each the four types of motivational regulation with the exception of the introjection measure which contains 3 items: intrinsic motivation (e.g., "I enjoy exercise"; $\alpha = .81$), identified regulation (e.g., "I participate in exercise because I gain a lot of benefits that are important to me"; $\alpha = .97$), introjected regulation (e.g., "I will feel bad with myself if I do not exercise"; $\alpha = .84$), and external regulation (e.g., "I do it because significant others want me to exercise"; $\alpha = .86$). Responses to each item were made on 4-point scales anchored by "not true at all" (1) and "very true" (4). The BREQ subscales have exhibited satisfactory internal reliabilities and construct and discriminant validity in confirmatory factor analyses (Mullan et al., 1997). A subscale was added to the BREQ to measure integrated regulation. This was based on the integrated regulation subscale (e.g., "I exercise because it is part of my true self"; $\alpha = .85$) developed by Mallett, Kawabata, Newcombe, Otero-Forero, and Jackson (2007).

Results

Main Analyses

Correlation analysis. Point biserial correlations were computed between study variables as the chronically-accessible physical activity outcomes measure was dichotomous. The chronically-accessible outcomes measure was positively and significantly correlated with external regulation ($r = .20$, $p < .01$) from the BREQ, and negatively associated with intrinsic motivation ($r = -.13$, $p < .01$). This suggests that reporting appearance-related outcomes is linked with lower levels of autonomous or self-determined forms of regulation and higher levels of controlled or heteronomous forms of regulation in physical activity. There were no other significant correlations.

Independent-samples t-test. An independent-samples t-test was used to test for a significant difference in relative autonomous motivation for physical activity between individuals reporting appearance-related primary outcomes and those citing primary outcomes that were unrelated to appearance. A relative autonomy index (RAI) was calculated in alignment with Vallerand and Bissonnette (1992) and weighted the regulatory constructs according to their position on the continuum. Intrinsic motivation, as the most autonomous form of motivation, was given the highest weighting (+3), while integrated regulation was assigned a less positive weight (+2) and identified regulation was given the lowest positive weighting (+1) of the autonomous forms of motivation. External regulation, as the more controlled form of motivation, was assigned the stronger negative weight (-2), while introjected regulation was assigned a lower negative weight (-1). These products were then summed to produce the RAI. The independent-samples t-test revealed that those participants who reported a primary outcome unrelated to appearance exhibited significantly higher relative autonomous motivation ($N = 112$, $M = 7.49$, $SD = 3.83$) than those who reported an appearance-related primary outcome ($N = 30$, $M = 5.77$, $SD = 3.59$), t (140) = 2.21, $p < .05$.

Logistic regression analysis. Using logistic regression analysis, the appearance-related outcomes variable was regressed on intrinsic motivation and integrated, identified, introjected, and external regulations. Results of the analysis are provided in Table 3.2[1]. The analysis yielded a significant equation (χ^2 (5, $N = 142$) = 7.48, $p < .05$, Nagelkerke $R^2 = .08$), indicating acceptable fit of the model with the data. Introjected regulation emerged as the only significant independent predictor of primary outcome type (odds ratio = 1.87, $p < .05$; 95% confidence interval [CI95] lower bound of odds ratio = 1.01; CI95 upper bound = 3.43). Results indicated that for a one unit increase in introjected regulation, the model predicted an increase of 1.87 in the odds of the primary chronically-accessible outcome being appearance-related.

Table 3.1

The Frequency of Primary Chronically-Accessible Outcomes Cited by Participants

Outcome	*Frequency*
Get fit/improve fitness[a]	65
Lose weight*	23
Improve skills/performance[b]	13
Release stress	1
Maintain/improve health[c]	23
Shape/tone up*	7
Improve mood	1
Increase self-confidence	2
Enjoyment	6
Socialising	1

Note. Primary chronically-accessible outcomes were collapsed into the above categories. [a]The get fit/improve fitness category included outcomes relating to maintaining or improving fitness levels, building upper body strength, cardiovascular exercise, easier breathing, regaining pre-injury fitness, increasing walking speed, establishing an exercise routine, and increasing stamina. [b]The improve skills/performance category included outcomes relating to improving speed, skill level, technique and learning a routine in sport of physical activity. [c]The maintain/improve category health included outcomes relating to maintaining or improving physical or mental health, increasing energy and enhancing one’s sense of well-being. *Coded as appearance-related outcomes.

Table 3.2.

Results of the Logistic Regression Analysis Predicting Primary Outcome Type from Explicit Regulatory Variables

Regulation	B (SE)	Exp B	CI_{95} Exp B	
			Lower Bound	Upper Bound
Constant	-1.17 (1.26)	.31	-	-
Introjected	.62 (0.31)*	1.87	1.01	3.43
External	.32 (0.34)	1.36	.70	2.63
Integrated	.01 (0.40)	1.01	.46	2.21
Identified	-.28 (0.55)	.76	.26	2.23
Intrinsic	-.45 (0.50)	.64	.24	1.70

Note. Exp B = Expected beta coefficient also known as Odds Ratio; CI_{95} Exp B = 95% Confidence Intervals for Expected beta coefficient.
* $p < .05$

Discussion

The present study explored associations between traditional scaled measures of motivational orientations and chronically-accessible appearance-related outcomes in leisure-time physical activity. It was hypothesized that citing an appearance-related outcome as the most chronically-accessible reason for participating in leisure-time physical activity would be associated with a controlling motivational style on a scaled measure of behavioral regulation. Findings supported this hypothesis. Analyses showed that participants who spontaneously reported an appearance outcome as their most accessible desired outcome in physical activity tended to report higher levels of extrinsic motivation on the BREQ. Correlations also indicated that striving for an appearance-related primary outcome in physical activity was significantly related to lower intrinsic motivation for physical activity, further supporting the hypothesis that appearance outcomes are controlling in nature. In addition, a logistic regression analysis indicated that a one unit increase in introjected regulation predicted an increase of 1.87 in the odds of the primary chronically-accessible outcome being appearance-related. This provides support for the hypothesis that appearance-related primary outcomes in leisure-time physical activity are controlling in nature and suggests that engagement in physical activity for appearance-related reasons is likely to be prompted by the desire to avoid feelings of guilt and shame.

To our knowledge, the present study is the first to examine the associations between chronically-accessible outcomes and a conventional measure of motivation in a health context. A unique contribution of the study is the finding that a chronically accessible appearance-related primary outcome or goal for engaging in leisure-time physical activity is significantly associated with a controlling motivation orientation. While Ingledew and Markland (2008) reported similar findings in their study of the regulatory underpinnings of exercise motives, these researchers employed only a conventional scaled measure of exercise participation motives (i.e., goals). In contrast, the present study employed an open-ended measure derived from the literature on construct- and attitude-accessibility to indirectly tap chronically-accessible motives, in addition to the use of a conventional direct measure of motivation.

Findings have important implications for understanding physical activity behavior. As striving for appearance-related outcomes in physical activity appears to be associated with introjected and external forms of behavioral regulation, participating in physical activity in order to attain an appearance-related outcome may be associated with less behavioral persistence and lower well-being than participating in physical activity for more autonomous reasons. This speculation is based previous research, such as Pelletier, Fortier, Vallerand, and Briere’s (2001) study of the motivation of competitive swimmers, in which introjected regulation predicted only short-term persistence and external regulation was negatively associated with persistence at a 22-month follow-up. Preoccupation with appearance outcomes in physical activity may therefore go some way to explaining the high dropout rates in exercise programmes. It is therefore important to ensure that interventions to increase levels of leisure-time physical activity resist an exclusive focus on appearance-related outcomes by framing outcomes in terms of autonomous motivation. This could be achieved by emphasizing health, enjoyment, and skill-development as potential goals in leisure-time physical activity. However, it is important to avoid denigration of appearance and weight motives in physical activity, as this may also threaten autonomy. Individual motives should be acknowledged and respected (Ingledew & Markland, 2008) to prevent loss of autonomy and dropout from exercise participation, while simultaneously promoting autonomous reasons. Further, appearance-related goals may not be invariably extrinsically motivated, as they may come to be internalized and assimilated with the self, rather than contingent on others' evaluations. In such situations, where appearance-related goals are governed by non-contingent self-worth (Deci & Ryan, 1995), underlying motivational orientations will not necessarily be controlling in nature. Sheldon (2004) supports this notion, arguing that self-esteem goals are often rated as enjoyable. Nevertheless, an independent-samples t-test confirmed that individuals who reported appearance-related primary outcomes in physical activity exhibited significantly lower autonomous motivation than participants who cited primary outcomes that were unrelated to appearance.

Conclusions and Directions for Future Research

Several limitations of the present study necessitate further investigation. First, the study was cross-sectional in design which prohibits the inference of causality (Hagger & Chatzisarantis, 2009). Second, the correlations represent associations between variables, which provide only an indication of the motivational orientations governing chronically-accessible outcomes in physical activity. Future research needs to employ an experimental design in which situational motivational orientations are manipulated and effects on desired physical activity outcomes observed. This may serve to indicate whether priming an autonomous motivation orientation would increase the salience of other physical activity outcomes relative to those relating to appearance. Third, no behavioral measure was employed, which limits the utility of the findings in terms of drawing conclusions about the effect of striving for appearance-related outcomes in physical activity on physical activity behavior. It would be valuable to explore the differential impact of chronically-accessible appearance-related outcomes and traditional self-reported motivation on prospective physical activity behavior. Finally, the sample was not homogeneous in terms of level of physical activity and findings should be replicated in a higher-active sample. Despite methodological limitations, this study has provided preliminary support for the hypothesis that chronically-accessible appearance-related outcomes in physical activity are associated with controlling motivational orientations and suggests routes for further exploration of this issue.

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Footnote Chapter 3

[1]The intrinsic, identified, and extrinsic scales from the modified BREQ exhibited significant skewness and/or kurtosis estimates. In order to check whether these departures from normality affected results, the skewed and/or kurtotic scales were transformed using a natural logarithmic function as recommended by Fidell and Tabachnick (2003). Repeating the analysis with the log-transformed variables revealed virtually identical results. We are therefore confident that the results reported are unaffected by departures from normality.

Chapter 4

The influence of chronically-accessible autonomous and controlling motives on physical activity within an extended theory of planned behaviour

McLachlan, S., & Hagger, M. S. (in press). The influence of chronically-accessible autonomous and controlling motives on physical activity within an extended theory of planned behaviour. *Journal of Applied Social Psychology*.

Abstract

An extended theory of planned behavior (Ajzen, 1991), incorporating the post-decisional phase of behavior and constructs from self-determination theory (Deci & Ryan, 1985), was tested for physical activity using a prospective survey design. Participants (*N* = 172) completed measures of intentions, attitudes, subjective norms, perceived behavioral control (PBC), self-determined motivation, continuation intentions, and chronically-accessible physical activity motives. Participants completed a self-report measure of physical activity three weeks later. Path analysis supported the predictive utility of the proposed model. Importantly, the effect of continuation intentions of success on physical activity behavior was moderated by chronically-accessible physical activity motives. Findings underscore the importance of taking into account continuation intentions, self-determined motivation and individuals' chronically-accessible motives when developing physical activity-promoting interventions.

Introduction

Increasing rates of obesity in America and Europe are incurring severe health-related consequences and necessitate large-scale behavioral dietary and physical activity interventions to decrease the prevalence of obesity and associated chronic diseases. Mokdad et al. (2003) reported that overweight and obesity were significantly associated with a variety of chronic diseases, illustrating the potential impact of escalating obesity rates on health and quality of life. Low participation in physical activity has emerged as a significant independent predictor of obesity within the European Union (Martínez, Kearney, Kafatos, Paquet, & Martínez-Gonzalez, 1999). Research has shown that physical activity is an essential component in reducing and preventing obesity (Ross, Freeman, & Janssen, 2000) and has concluded that interventions aimed at preventing the escalation of obesity prevalence should target physical inactivity as a priority. It is therefore important to examine psychological determinants of leisure-time physical activity, to identify potentially modifiable variables that can be targeted in interventions.

Self-Determination Theory

SDT is an organismic theory of human motivation that has been extensively employed in the health domain and has been successful in explaining behavior in both sport and physical activity contexts (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Hagger & Chatzisarantis, 2007). SDT views behavior as driven by fundamental needs for competence, autonomy, and relatedness. Humans are portrayed as active agents in the pursuit of fulfilment of these needs (Deci & Ryan, 2000). This theory also broadly distinguishes between two types of behavioral regulation; intrinsic motivation refers to participating in a behavior for interest, enjoyment, or satisfaction inherent in that behavior, while extrinsic motivation describes participation in a behavior for reasons separable from the behavior itself, such as to obtain social approval.

Intrinsic motivation represents the prototypic instance of self-determined or autonomous motivation (Ryan & Deci, 2000) and is associated with behavioral quality and persistence, whereas extrinsic forms of regulation are associated with a lack of sustained behavior over time (Ryan & Deci, 2000). SDT also identifies four types of extrinsic motivation, placed at various points along a motivational continuum ranging from intrinsic to extrinsic motivation. The continuum is known as the *perceived locus of causality* (PLOC). These types of extrinsic motivation differ according to the degree to which they are self-determined or autonomous. Integrated regulation falls closest to intrinsic motivation on the continuum and describes the most complete form of the internalisation of extrinsic motivation (Deci & Ryan, 2000), when behavior is consistent with the self and congruent with one's identity and values (Ryan, 1995). Identified regulation lies adjacent to integrated regulation and represents behavioral participation for reasons based on salient goals or values, although driven by factors external to the self. The least internalised form of extrinsic motivation is introjected regulation, which falls adjacent to external regulation and represents engagement in behavior to experience feelings of pride or worth, or to avoid feelings of shame or guilt. As such reasons originate within the self, introjected regulation is considered more autonomous than external regulation. External regulation represents performing a behavior in order to satisfy a demand or to gain an external reward and individuals experiencing external regulation are likely to feel alienated or controlled (Ryan & Deci, 2000).

SDT possesses considerable pragmatic value, as promoting an autonomous motivational orientation has been shown to increase behavioral persistence (e.g., Edmunds, Ntoumanis, & Duda, 2007). However, although SDT predicts that individuals displaying extrinsic or controlling motivational orientations are unlikely to show behavioral persistence, research using an SDT framework in the health behavior domain has not yet identified strategies that can be used to facilitate behavioral persistence in such individuals beyond the development of interventions that aim to promote internalisation, i.e., the process of changing the behavioral regulations toward greater autonomy. Given that the process of internalisation may take a considerable period of time, additional strategies may be required to facilitate behavioral persistence in controlled individuals.

Recent research has suggested that autonomous and controlled motivational orientations or reasons for engaging in behaviors should be distinct from the goals that a person pursues (Vansteenkiste, Soenens, & Lens, 2007). The self-concordance model (Sheldon & Elliot, 1999) predicts that individuals can pursue goals that are self-concordant or autonomous or self-discordant or non-autonomous. The pursuit of self-discordant goals is likely to result in a person exerting less effort in striving to attain those goals than the pursuit of self-concordant or autonomous goals. Sheldon and Elliot (1999) showed that individuals make greater progress towards autonomous or self-concordant behavioral goals because they exert greater effort in their pursuit. Thus, it is imperative that interventions target both reasons and goals that people pursue in order to foster persistence in behaviors such as physical activity and that particular effort is devoted to assisting individuals with self-discordant goals to learn strategies that will aid the enactment of behavior.

Chronically-Accessible Motives in SDT

Virtually all previous research examining links between behavioral regulation and behavioral persistence in health behavior domains has employed traditional direct scaled measures of autonomous motivation (e.g. Mullan, Markland & Ingledew, 1997). Although these are important, Levesque and Pelletier (2003) have suggested that such measures do not capture automatic, non-conscious aspects of motivation and proposed that an indirect measure of chronically accessible motivational orientations, generated through open-ended free-response paradigms derived from the construct and attitude accessibility literature (Higgins, King, & Mavin, 1982; Krosnick, 1989), may be useful. These paradigms indicate that overarching attitudes, motives and goals may be activated outside conscious control or awareness. Accessibility is defined as the activation potential of available knowledge, thus chronically accessible motives are those located at the most readily accessible storage level (Higgins, 1996). Primacy of output has been used as an indicator of chronic accessibility; individuals' first spontaneously generated responses are believed to best represent their chronically accessible constructs, attitudes or motivations (Higgins, 1996). This indirect means of assessing chronic accessibility confers the advantage that participants are unaware of what is being measured, thereby minimising self-report bias. In contrast, scaled instruments tend to be more direct informational measures and participants are likely to be aware of what is being assessed.

Levesque and Pelletier (2003) suggested that measures of chronically-accessible motivation are more likely to tap different motivational forces underlying behavior than conventional scaled measures. These authors showed that a substantial discrepancy exists between regulatory styles elicited by chronic motivational measures and traditional scaled motivational measures and suggested that individuals may access different motivational orientations for each measure. The authors' postulation that measures of chronically-accessible motivation are more likely to represent those regulatory styles determining behavior was supported by their finding that chronic autonomous motivation predicted long-term academic behavior beyond scaled measures. It is interesting to note that while the measure of chronically-accessible motivation was superior at predicting behavior, the scaled measure was more predictive of intention. A possible explanation for this is that the chronically-accessible measure of motivation bypasses the deliberative route of intention formation, as it may reflect automatic and spontaneous motivations. In contrast, the scaled measure may assess deliberative and reflective aspects of motivational orientations and is therefore likely to be more strongly associated with behavioral intentions. This is consistent with Strack and Deutsch's (2004) dual-systems model, which explains social behavior as a function of both reflective (i.e., deliberative) and impulsive (i.e., spontaneous) processes and emphasises the independence of the impulsive system from intentions. The measures also reflect Fazio and Olsen's (2003) distinction between direct and indirect measures in social cognition research. The use of a measure of chronically-accessible motivation may therefore complement direct scaled measures and provide a more complete assessment of motivational forces underlying behavior.

Theory of Planned Behavior

Social cognitive theories, such as the theory of planned behavior (TPB), can serve as frameworks in the development of physical activity behavior change interventions by identifying predictors of physical activity and providing targets for change. Such theories can aid the development of persuasive communications and experimental manipulations to promote physical activity if they are successful in accounting for significant variance in physical activity behavior, as this indicates that important behavioral predictors are captured. The TPB is a parsimonious model of behavior-specific social-cognitive determinants of behavior (Ajzen, 1988, 1991). The theory proposes that behavioral intention is the proximal predictor of behavior, and that intention is predicted by attitudes, subjective norms, and perceived behavioral control (PBC). PBC also directly predicts behavior when perceptions of control are realistic. The TPB has demonstrated efficacy in explaining variance in intentions and behavior in a number of behavioral contexts (Armitage & Conner, 2001), including physical activity (Hagger, Chatzisarantis, & Biddle, 2002b). However, a substantial amount of variance remains unaccounted for by the TPB variables (Hagger et al., 2002b). Furthermore, research has revealed large discrepancies between health-related intentions and behavior, a phenomenon that has become known as the intention-behavior 'gap' (Godin, Conner, & Sheeran, 2005; Sniehotta, Scholz, & Schwarzer, 2005; Orbell & Sheeran, 1998).

Conner and Norman's (2005) meta-analysis reported that intentions and PBC explain just 25.6% of the variance in behavior. It therefore appears necessary to extend the TPB to achieve a more comprehensive account of the determinants of adults' leisure-time physical activity, and to invoke constructs and principles from other theories that may enhance the model's predictive utility.

Limitations of the TPB and the Role of Continuation Intentions

When the TPB is used to predict behavior that does not closely follow the measurement of intentions, its exclusive focus on the pre-decisional or motivational phase of behavior and its neglect of the post-decisional phase (Gollwitzer & Sheeran, 2006; Sniehotta, Scholz, & Schwarzer, 2005; Schwarzer, 2001) poses a substantial limitation. This may underlie the unexplained variance in behavior after consideration of TPB constructs and could be linked to the intention-behavior discrepancy. During the motivational phase of behavior, individuals consider whether a behavior will lead to desired outcomes, while the post-actional phase refers to the subsequent process of assessing whether the behavior has aided the attainment of those outcomes. Ajzen (1991) argued that such post-decisional evaluations can effect changes in intentions, causing a discrepancy between original intentions and subsequent behavior. For example, attainment of desired behavioral outcomes may further motivate some individuals into continuation of a behavior, but could prompt others to terminate the behavior (Gollwitzer & Sheeran, 2006; Sheeran, Webb, & Gollwitzer, 2005; Sniehotta, Scholz, & Schwarzer, 2005).

In response to this limitation, Chatzisarantis et al. (2004) developed the construct of *continuation intentions* to explore the role of post-decisional evaluations in explaining the intention-behavior discrepancy within a TPB framework and in a health domain. This construct is used to measure or induce deliberation of post-decisional considerations in advance, through the use of conditional statements of intentions. This is important because promoting people to form a response in advance of a given contingency or situation arising will facilitative the response being activated when the situation arises. Continuation intentions are usually measured in response to hypothetical scenarios which prompt individuals to consider situations in which health behavior either has or has not been successful in bringing about desired outcomes. Two types of continuation intentions are proposed. *Continuation intentions of success* represent individuals' intentions to continue performance of a health behavior under post-decisional conditions in which the behavior has been perceived to lead to desired behavioral outcomes and *continuation intentions of failure* signify individuals' intentions to maintain performance of the health behavior under post-decisional conditions in which the behavior has been perceived as unsuccessful in bringing desired behavioral outcomes (Chatzisarantis et al., 2004). Chatzisarantis and colleagues argued that continuation intentions are close approximations of actual intentions in the post-decisional phase because statements of continuation intentions lead individuals to use hypothetical reasoning and construct mental models of possible post-decisional situations in order to infer their intentions. Studies have shown that including continuation intentions alongside conventional intentions partially accounts for the discrepancy between intentions and behavior and that continuation intentions have utility in informing interventions to reduce the discrepancy (Chatzisarantis et al., 2004; Chatzisarantis & Hagger, 2008).

Integrating the Theories: TPB and SDT

The TPB identifies the proximal factors that guide behavior but does not address the global motivational forces operating on attitudes, subjective norms, perceived behavioral control, and intentions. Self-determination theory, in contrast, aims to explain such general motives and could potentially contextualise the social cognitive constructs proposed by the TPB (Hagger, Chatzisarantis, & Biddle, 2002a). The integration of social cognitive models, such as the TPB, with SDT may therefore provide a more comprehensive account of the determinants of intentional behavior. In this sense, theoretical integration in the current study refers to amalgamating the two theories in order to achieve complementarity and a more complete account of physical activity behaviour (Hagger, 2009), rather than to reduce redundancy or attain axiomatization. Research integrating these theories has demonstrated that people form behavioral beliefs and perceptions of control that are autonomous in nature, and these perceptions mediate the impact of autonomous motives on intentions and behavior. A recent meta-analysis of studies integrating these theories provided support for the complementary nature of the theories (Hagger & Chatzisarantis, 2009).

However, research to date has integrated concepts from SDT with only the original, pre-decisional-focused form of the TPB and not with an extended TPB framework that addresses the post-decisional phase of behavior. Measures of autonomous and controlled motivation within a TPB framework have also been limited to scaled measures; measures of chronically-accessible motivation have not been included. Given the substantial differences between these two measures, as described by Levesque and Pelletier (2003), it is important to test the value of incorporating measures of chronically-accessible motivational orientations in the TPB, as these may account for spontaneous and non-conscious influences on behavior and produce a more comprehensive model of health behavior.

The Present Study

Based on previous research integrating the TPB and SDT (Hagger & Chatzisarantis, 2009), it was hypothesized that attitudes, PBC, and a scaled measure of self-determined motivation for physical activity would significantly predict behavioral intentions to participate in leisure-time physical activity and that intentions and self-determined motivation would significantly predict leisure-time physical activity behavior. It was also hypothesised that the inclusion of continuation intentions would predict significant proportion of variance in physical activity behavior, after accounting for the effects of the original TPB variables and self-determined motivation (Chatzisarantis & Hagger, 2008). In addition, it was hypothesised that a chronically-accessible measure of autonomous motivation would moderate the relationship between continuation intentions and physical activity behavior (see Figure 4.1 for hypothesised model).

As individuals with a controlled motivational orientation towards physical activity are more likely to experience failure in their goal striving, based on Sheldon and Elliot's (1999) finding that individuals make more progress towards autonomous goals because greater effort is expended, continuation intentions of failure are more likely to be useful for controlled individuals. Planning for a situation in which goals have not been attained may help to facilitate maintenance of physical activity behavior if the situation then arises. In contrast, continuation intentions of success may not be useful for controlled individuals, firstly because such individuals are less likely to experience success in goal striving and secondly because they are more likely to desist upon experiencing success because the external contingencies underlying behavioral engagement will no longer be operant. Continuation intentions of success may be of more use to autonomous individuals, as those with an autonomous motivational style are more likely to encounter success in goal pursuit, meaning that planning for such a situation would help to automate behavioral decisions upon encountering it. Alternatively, continuation intentions of success may be superfluous for autonomous individuals, as their autonomous motivation may perpetuate the behaviour even after experiencing success in goal striving. The key hypothesis for this study is that the chronically-accessible motivation measure will moderate the relationships of continuation intentions of success and failure with physical activity behavior. The relationship between continuation intentions of success and physical activity behavior is predicted to be positive and significant in individuals whose chronically-accessible outcomes reflected autonomously-oriented motivation and non-significant in those whose chronically-accessible outcomes reflected controlled motivation for their physical activity behavior. In contrast, a positive and significant relationship is expected between continuation intentions of failure and physical activity behavior among individuals whose chronically-accessible outcomes reflected controlled-oriented motivation, on account that they are more likely to experience failure in goal striving and are less naturally-inclined to persist. Chronically-accessible primary outcomes in physical activity were used to represent chronic motivational orientation, on the basis of previous research (Levesque & Pelletier, 2003; McLachlan & Hagger, 2010).

Method

Participants and Design

Participants (N = 259) were staff and students recruited through self-selected sampling from one University in the UK [University masked for blind review] and staff from several private companies in South East UK. A prospective correlational design was employed with the first and second waves of data collection separated by a three-week interval. Each participant received two questionnaires; the first contained measures of the psychological constructs and the second contained a self-report measure of physical activity behavior. Questionnaires were distributed by the researcher or through postal mail. Of the total sample, 19.7% had not participated in any active sports/vigorous physical activities of at least 40 minutes duration over the past six months, while 29.3% had not engaged in this level of physical activity during the previous two weeks. The mean level of physical activity of the sample over the past six months was 2.89 (*SD* = 1.45) and 1.56 (*SD* = 1.56) over the previous two weeks, where '1' represented no participation in physical activity of the specified intensity and duration, '2' represented participation once per week, '3' represented a couple of days per week, '4' represented several days per week, '5' represented many days per week, and '6' represented most days of the week.

Measures[1]

Demographic variables. Participants were asked to report their age in years, gender, date of birth and the first three letters of their mother's maiden name in order to match first-wave and follow-up data whilst preserving anonymity.

Past physical activity behavior. A two-item measure of past physical activity behavior was used. Participants were asked to provide the frequency with which they had participated in active sports/vigorous physical activities of at least 40 minutes duration and indicated responses on six-point Likert scales ranging from 1 (*'not at all'*) to 6 (*'most of the days per week'*) (Bagozzi & Kimmel, 1995). This measure has demonstrated acceptable construct and validity statistics in previous research (Hagger & Chatzisarantis, 2005; Hagger, Chatzisarantis, & Harris, 2006).

Attitudes towards physical activity.[2] Three items measured attitudes towards physical activity. The statement "For me, doing active sports and/or vigorous physical activities for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks is…" preceded the items and responses were made on 7-point semantic differential scales with the following bipolar adjectives as end-points: *of no use-useful*, *unsatisfying-satisfying*, and *unimportant-important*.

Subjective norms. Subjective norms were measured using four items (e.g., "Most people who are important to me would *want* me to do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks"). Responses were made on 7-point Likert scales ranging from 1 (*'strongly disagree'*) to 7 (*'strongly agree'*).

Perceived behavioral control. PBC was assessed using three items (e.g., "I am confident I can do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks"), assessing both the self-efficacy and controllability facets of PBC (Ajzen, 2002). Responses were made on 7-point Likert response scales ranging from 1 (*'very unlikely'*) to 7 (*'very likely'*).

Intentions. Intentions were assessed through three items (e.g., **"**I intend to do active sports and/or vigorous physical activities for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks"). Responses were made on 7-point Likert response scales ranging from 1 (*'strongly disagree'*) to 7 (*'strongly agree'*).

Continuation intentions of success. Initially, participants were asked to consider general behavioral goals that they may wish to achieve through leisure-time physical activity, as in Chatzisarantis and colleagues' (2004) study. Participants were then asked to consider a hypothetical scenario in which they had achieved all of their behavioral goals and reported their intentions to continue leisure-time physical activity in this situation. Three items measured continuation intentions of success (e.g., "If I achieve all of my exercise goals, I will still intend to continue doing active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time"). Responses were made on 7-point response scales ranging from 1 (*'strongly agree'*) to 7 (*'strongly disagree'*). Items were based on Chatzisarantis and Hagger (2008).

Continuation intentions of failure. Participants were also asked to report their intentions to continue with leisure-time physical activity in a hypothetical scenario in which they had failed to attain salient goals through physical activity. Three items were used to measure intentions to continue physical activity in this situation, which were virtually identical to those items used to assess continuation intentions of success, except each statement began with "If I fail to achieve my exercise goals..." Response scales were identical to those used to measure continuation intentions of success.

Self-determined motivation. The Behavioral Regulation in Exercise Questionnaire (BREQ, Mullan, Markland, & Ingledew, 1997) measured perceived locus of causality for leisure-time physical activity. The BREQ is based on Ryan and Connell's (1989) measure of PLOC and comprises multiple-item measures of each of regulation type: intrinsic motivation (e.g., "I enjoy exercise"), identified regulation (e.g., "I participate in exercise because I gain a lot of benefits that are important to me"), introjected regulation (e.g., "I will feel bad with myself if I do not exercise"), and external regulation (e.g., "I do it because significant others want me to exercise"). Four items were used for each of intrinsic motivation and identified and external regulations, while introjected regulation was assessed through three items. Responses were made on 4-point scales ranging from 1 (*'not true at all'*) to 4 (*'very true'*). To reduce the number of variables, a Relative Autonomy Index was calculated using a weighted summation of the averaged BREQ scales, recommended by Pelletier and Sarrazin (Pelletier & Sarrazin, 2007). The RAI was calculated according to the following formula: external regulation x (–2) + introjection x (–1) + identification + intrinsic motivation x (2). This provided a single score reflecting relative self-determination (autonomy) for physical activity. Positive scores on this index reflect more self-determined behavioral regulation (Goudas, Biddle, & Fox, 1994; Goudas, Biddle, & Underwood, 1995).

Chronically-accessible autonomous and heteronomous outcomes. Participants were asked to list up to three main outcomes they hoped to attain through leisure-time physical activity. Participants were told that these outcomes could be anything that they hoped to achieve through participation in leisure-time active sports and/or vigorous physical activities over the next three weeks and were asked to write down the first three that came to mind. This free response measure was intended to tap chronically-accessible motivation, based on Levesque and Pelletier's (2003) methodology. Consistent with Higgins and colleagues' (1982), primacy of output was used to indicate chronic accessibility. The technique originates in the attitude accessibility literature, in which attitudes expressed most readily have been those most strongly associated with behavior (Fazio, Chen, McDonel, &

Sherman, 1982; Kokkinaki & Lunt, 1997). Outcomes were coded dichotomously; participants reporting an autonomously-oriented primary outcome (e.g., "to have fun", "to feel healthy") were allocated a code of '1', while those reporting a controlled primary outcome (e.g., "to lose weight", "to tone body") were coded '2'. Coding was based on empirical evidence (McLachlan & Hagger, 2010), showing that appearance-related outcomes were significantly associated with extrinsic motivation and that individuals reporting a controlling regulatory style were almost twice as likely to report striving for an appearance-related outcome in their physical activity. Further evidence to support this coding system comes from Ingledew and Markland (2008), who reported that appearance- and weight-related motives were a significant predictor of external regulation, the prototypical form of extrinsic motivation.

Physical activity behavior. Physical activity behavior was measured using two items (e.g., "In the last 3 weeks, I participated in active sports and/or vigorous physical activities for at least 40 minutes during my leisure time…"). Responses were made on 7-point Likert response scales, ranging from 1 (*'not at all'* or *'never'*) to 7 (*'most days of the week'* or *'very often'*). This measure was based on Godin and Shephard's (1985) single-item self-report behavioral measure, which has demonstrated adequate validity and reliability relative to objective measures of physical activity. A period of 40 minutes was chosen, as this more than satisfies the minimum physical activity recommendations for healthy adults (Haskell, Lee, Pate et al., 2007).

Procedure

Participants were informed that they were participating in a survey on physical activity. The first questionnaire provided a definition of leisure-time active sports and/or vigorous physical activities prior to the psychological measures. Participants were asked to consider the active sports and/or vigorous physical activities of at least 40 minutes duration, four days per week, which they might do over the following three weeks during their leisure-time. They were informed that this definition included anything that is ‘really active’, and were provided with the examples of jogging, swimming, and sports training. Participants were provided with this description at both waves of data collection. The follow-up questionnaire was distributed three weeks after administration of the initial questionnaire and measured prospective physical activity behavior. This interval was intended to reduce common method variance and to allow a reasonable period during which physical activity goals could be realised.

Data Analysis

Missing data were replaced through mean substitution. Research hypotheses were tested by path analyses via simultaneous process using the EQS v.6.1 computer software (Bentler, 2004). A robust maximum likelihood estimation method was employed to protect against violations of the assumption of normality of distribution in the data. Errors were correlated between attitude, subjective norm and perceived behavioral control, and between continuation intentions of success and failure, as these constructs were expected to show intercorrelation. Indices of fit used to assess the adequacy of the models in accounting for the data were the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI), the Standardised Root Mean Squared Residuals (SRMSR) and the Root Mean Square Error of Approximation (RMSEA). Values of .90 or above are deemed acceptable for model fit for the CFI and NNFI, although values of .95 are preferred, and a cut-off value of .08 or less for the SRMSR and RMSEA indicates satisfactory model fit (Hu & Bentler, 1999). The parsimony-adjusted comparative fit index (PCFI; Mulaik et al., 1989) and the parsimony-adjusted non normed fit index (PNNFI; Kline, 2004) were used to assess the goodness-of-fit accounting for the parsimony of the model. A PCFI value of 0.50 alongside CFI values of 0.90 or greater has been considered to indicate acceptable fit of the data, accounting for model parsimony (Mulaik et al., 1989) and higher values of PNNFI indicate superior fit (Kline, 2004). The

Lagrange Multiplier (LM) test indicated fixed parameters within the model that would result in significant improvement in the goodness-of-fit chi-square value if released. Moderation effects were tested using multi-sample path analytic models with invariance tests to evaluate significant differences between the two groups in the hypothesised moderated relationships.

Results

Preliminary analyses

Participants. The attrition rate between the first and second waves of data collection was 33%, resulting in a final sample of 172 adults (Male = 53, female = 119; Mean age = 30.83, *SD* = 13.21). There were no significant differences in age, gender distribution, or distribution of autonomous and heteronomous outcomes by those that that provided follow-up behavioral data and those that did not.

Descriptive statistics, intercorrelations, and reliability statistics. Mean-average composites of each of the psychological and behavioral variables were computed. The only exception was the dichotomous chronically accessible outcome measure. Descriptive statistics, correlations, and reliability statistics for the variables can be found in Table 4.1. Cronbach alpha values and inter-item correlations indicated that measures demonstrated adequate internal reliability, with the exception of the continuation intentions measures.

Path Analysis

The extended TPB model was tested in the entire sample using path analysis using the composite variables. Potential effects of past behavior on all other constructs were controlled through inclusion of this variable as an independent predictor of all other variables in the model. Intentions, PBC, RAI, and the chronically accessible outcomes measure were set to predict physical activity behavior. Attitude, subjective norm, PBC, RAI and the chronically accessible outcomes measure were specified as predictors of intention. RAI was also set to predict intentions indirectly through attitude and PBC. Covariances were specified between

Table 4.1.

Descriptive Statistics, Intercorrelations and Reliability Statistics for Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9
1. PB	2.88	1.48	**.79**								
2. Attitude	5.23	1.48	$.52^{**}$	**.89**							
3. SubN	4.84	1.31	$.19^{**}$	$.53^{**}$	–						
4. PBC	4.92	1.42	$.49^{**}$	$.47^{**}$	$.32^{**}$	**.75**					
5. RAI	3.67	2.33	$.36^{**}$	$.35^{**}$	-.08	$.25^{**}$	–				
6. Intention	3.97	1.99	$.69^{**}$	$.76^{**}$	$.45^{**}$	$.59^{**}$	$.30^{**}$	**.94**			
7. CIS	4.94	1.20	$.33^{**}$	$.45^{**}$	$.28^{**}$	$.23^{**}$	$.23^{**}$	$.42^{**}$	**.57**		
8. CIF	4.36	1.38	$.43^{**}$	$.50^{**}$	$.26^{**}$	$.32^{**}$	$.30^{**}$	$.55^{**}$	$.53^{**}$	**.67**	
9. PA	3.55	1.78	$.74^{**}$	$.51^{**}$	$.17^{*}$	$.42^{**}$	$.40^{**}$	$.67^{**}$	$.35^{**}$	$.54^{**}$	**.94**
10. CAM	1.23	.42	-.09	-.10	$.16^{*}$	-.05	$.25^{**}$	-.09	-.06	$-.13^{*}$	-.14

Note. Cronbach alpha reliability coefficients are shown on the principal diagonal in bold typeface; PB = past behavior; SubN = subjective norm; PBC = perceived behavioral control; RAI = relative autonomy index; CIS = continuation intentions of success; CIF = continuation intentions of failure; PA = physical activity behavior; CAM = chronically-accessible motives; *M* = mean; *SD* = standard deviation. $^{*}\ p < .05$ $^{**}\ p < .01$.

predictors of intention and between continuation intentions of success and failure. Goodness of fit indices showed that the model demonstrated good fit to the data, Satorra-Bentler Scaled (SB) $\chi^2 = 20.97$, $df = 12$, $p = .05$; CFI = .99; NNFI = .95; SRMSR = .08; RMSEA = .07; 90% confidence intervals (CIs) of RMSEA = .00 (lower bound), .11 (upper bound). The parsimony fit indices PCFI (Mulaik et al., 1989) and PNNFI (Kline, 2004) emerged as .26 and .25, respectively, indicating that the model was not parsimonious. The model accounted for considerably more variance in both intention and behavior than previous applications of the TPB. A meta-analysis of studies that applied the TPB to physical activity reported that constructs accounted for 44.5% of variance in intention and 27.41% of variance in behavior (Hagger et al., 2002b). In contrast, the present model accounted for 78.3% of variance in intention and 59.7% of variance in physical activity.

Standardised path coefficients for the free parameters in the path analysis can be found in Figure 4.2. The model was used to test hypothesised relationships among the psychological and behavioral constructs. The hypothesised significant and direct effects of attitude ($\beta = .37$, $p < .05$) and PBC on intentions were supported ($\beta = .25$, $p < .05$). As hypothesised, attitude ($\beta = .09$, $p < .05$) and PBC ($\beta = .07$, $p < .05$) exhibited significant indirect positive effects on physical activity behavior, mediated by intentions. PBC did not exert a significant direct effect on behavior; this hypothesis was therefore rejected. Scaled autonomous motivation exhibited a significant and direct positive relationship with behavior ($\beta = .11$, $p < .05$) but no significant direct effect on intentions. This hypothesis was therefore partially supported. Scaled autonomous motivation showed a significant indirect effect on intentions, mediated by attitudes and PBC ($\beta = -.27$. $p < .05$).[3] As hypothesised, intentions showed a significant and direct positive relationship with behavior ($\beta = .21$, $p < .05$). There was no significant direct effect of chronically-accessible autonomous and heteronomous outcomes on physical activity; this hypothesis was rejected.

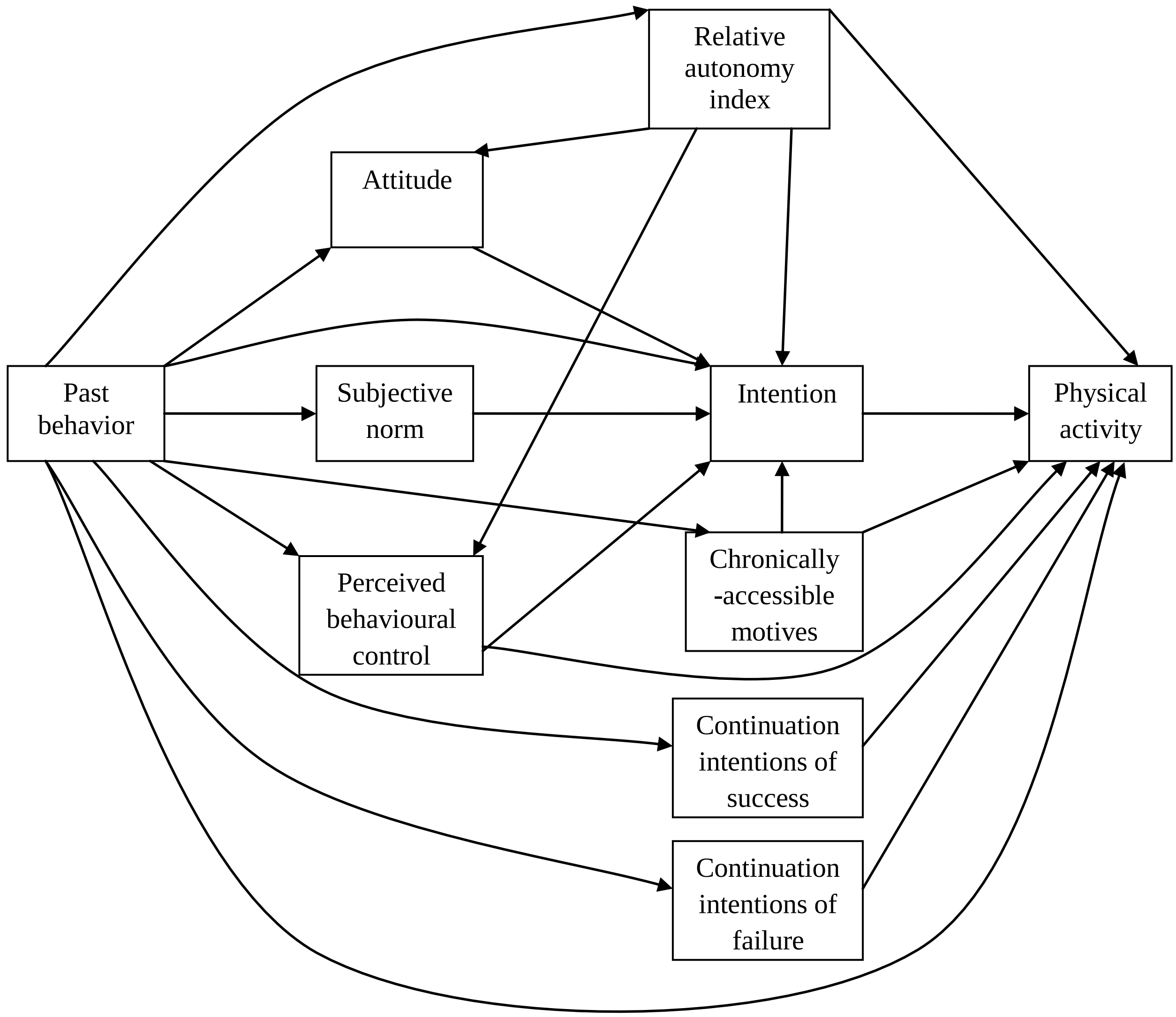

Figure 4.1. Hypothesised relationships between variables in the extended TPB model.

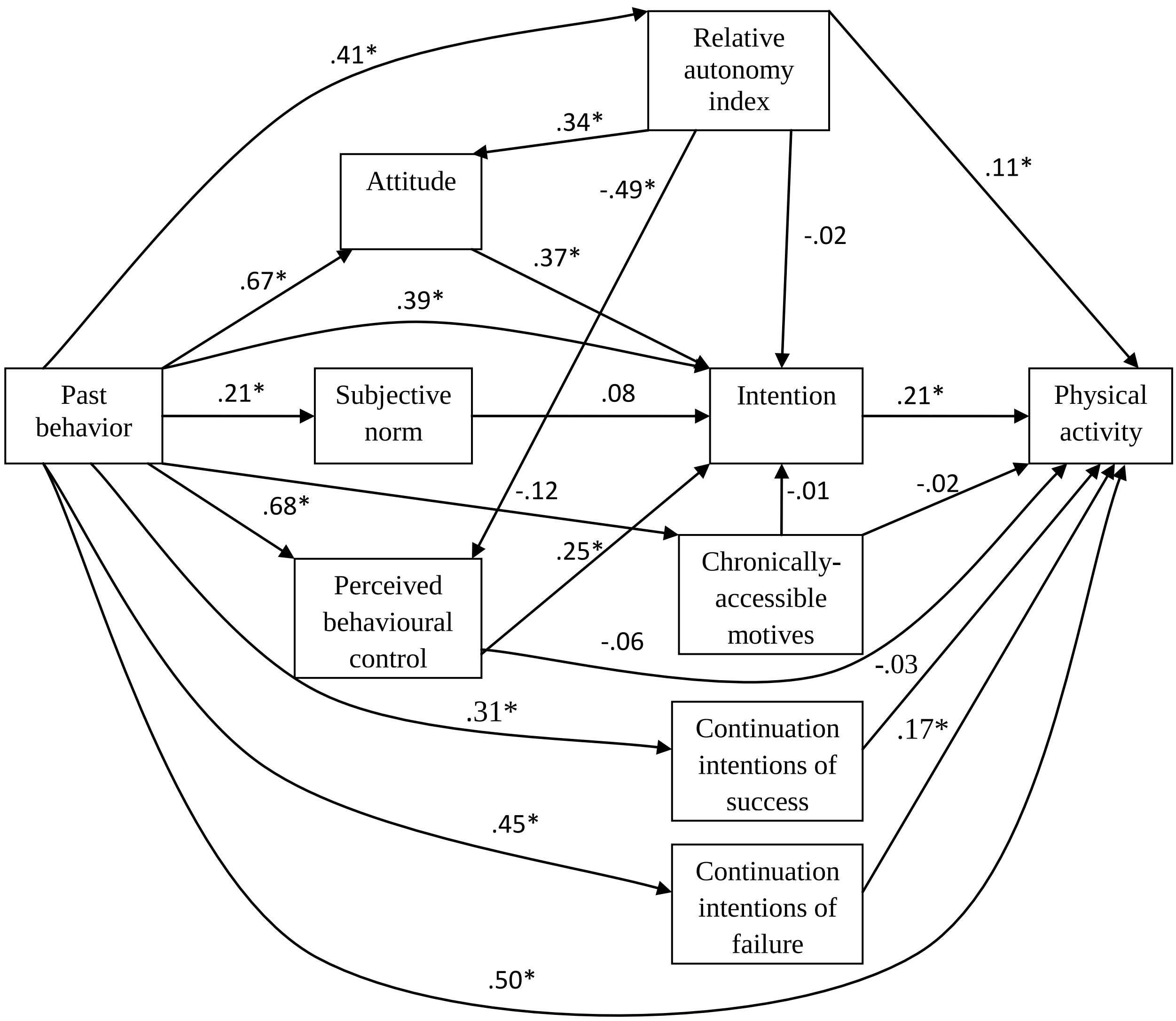

Figure 4.2. The extended TPB model showing the results of the single-sample path analysis. *Note.* Error covariances (ϕ) not included in the path diagram for clarity: Chronically-accessible motives↔relative autonomy index, ϕ = -.21, p < .05; attitude↔relative autonomy index, ϕ = .51, p < .05; subjective norm↔relative autonomy index, ϕ = -.19, p < .05; perceived behavioral control↔relative autonomy index, ϕ = .54, p < .05; attitude↔chronically-accessible motives, ϕ = -.06, p > .05; subjective norm↔chronically-accessible motives, ϕ = .22, p < .05; perceived behavioral control↔chronically-accessible motives, ϕ = -.01, p > .05; subjective norm↔attitude, ϕ = .39, p < .05; perceived behavioral control↔attitude, ϕ = .49, p < .05; perceived behavioral control↔subjective norm, ϕ = .14, p > .05; continuation intentions of failure↔continuation intentions of success, ϕ = .49, p < .05.

Moderation analysis

In order to test the hypothesised moderation of the effects of continuation intentions of success and failure by the chronically-accessible motivational measure, the sample was segregated into two samples. One sample comprised participants that reported a primary autonomous outcome in the chronically-accessible measure (hereafter known as the 'autonomous outcomes group', N = 133) and the other comprised participants that cited a primary controlling outcome (the 'controlled outcomes group', N = 39). The path analysis model was re-estimated in each sample and the invariance of the parameter estimates tested using multi-sample analysis, constraining the parameter estimates to be invariant across the groups. Essentially, this analysis enabled the identification of any differences in associations between constructs across the groups. Initially, a baseline model was determined, based on the criteria of parsimony and substantive meaning. This model exhibited adequate fit with the data, SB χ^2 = 37.30, df = 20, p = .01; CFI = .97; NNFI = .91; SRMSR = .10; RMSEA = .10; 90% CIs = .05 (lower bound), .15 (upper bound). Following the estimation of this model, tests for the equivalence of parameters (path coefficients) across groups were conducted. All parameters within the original model were constrained equal. This tested for the equivalence of the network of associations specified within the model across the two groups. The invariance analysis produced a model that showed adequate fit to the data, SB χ^2 = 56.18, df = 39, p = .04; CFI = .97, NNFI = .95; SRMR = .11; RMSEA = .06; 90% CIs = .02 (lower bound), .11 (upper bound). One of the constrained paths was flagged as non-invariant based on the Lagrange Multiplier (LM) test for releasing constraints, suggesting that the association between the two constructs to which this path pertained was not equivalent across the groups. The LM test indicated that the path between continuation intentions of success and physical activity behavior differed significantly (p < .01) between the two groups, providing partial support for the hypothesis that the relationships between continuation intentions and physical activity behavior would be moderated by the chronically-accessible outcomes measure.[4] A significant negative path was determined between continuation intentions of success and physical activity behavior in the controlled group ($\beta = -.30$, $p < .05$) but there was no significant path between these variables in the autonomous group. Freeing this parameter resulted in improved model fit, SB $\chi^2 = 50.02$, $df = 38$, $p = .09$; CFI = .98; NNFI = .97; SRMSR = .11; RMSEA = .06; 90% CIs = .00 (lower bound), .10 (upper bound), thereby supporting the non-invariance of this association across the two groups. For completion, the model resulting from the release of this constraint was re-examined for further non-invariant parameters across the groups. The LM test for this model indicated that no other parameters were non-invariant across the groups, thus there was no significant moderating effect of chronically-accessible motivation on the relationship between continuation intentions of failure and physical activity behavior.[5]

Discussion

The present research tested an extended TPB model that incorporated a traditional scaled measure of autonomous motivation and a measure of chronically-accessible autonomous and heteronomous outcomes according to self-determination theory. It was hypothesised that the TPB variables of attitudes, subjective norms, and PBC would have direct positive effects on intentions and indirect positive effects on physical activity through the mediation of intentions and that PBC and intentions would exert significant direct effects on physical activity. It was also hypothesised that autonomous motivation, as assessed by the traditional scaled measure, would exert a significant direct effect on behavior and a significant indirect effect on intentions through mediation by attitudes and PBC. Finally, the chronically-accessible outcomes measure was expected to exert a significant direct and negative effect on behavior and to moderate the effects of continuation intentions of success and failure on physical activity behavior. The chronically-accessible outcomes measure was used to divide the sample into two groups; the autonomous group consisted of individuals who freely reported that they primarily participated in leisure-time physical activity for reasons unrelated to weight loss or physical appearance, and the controlled group was composed of individuals who reported engaging in leisure-time physical activity primarily for reasons relating to weight loss and physical appearance.

Results partially supported the hypothesis that the chronically accessible autonomous outcome measure would moderate the effects of continuation intentions on physical activity behavior. Direct paths for continuation intentions of success and failure on physical activity were significant in the controlled group only. In this group, a positive path was found between continuation intentions of failure and physical activity, while a negative path was found between continuation intentions of success and physical activity. The LM test confirmed that the parameter estimates for continuation intentions of success on behavior were not invariant across the two groups.

The discovery that chronically-accessible autonomous and controlled outcomes moderated the effect of continuation intentions of success on physical activity and the trend towards moderation of the effect of continuation intentions of failure on physical activity carry substantial implications for theory on psychological antecedents of physical activity behavior and also for interventions to increase physical activity. The absence of significant paths from continuation intentions of success and failure to physical activity behavior in the autonomous group suggests that planning continuation of behavior for situations of success and failure in goal attainment in advance of such decisions is not of use to such individuals. This could be because autonomous motivation is conducive to behavioral persistence and this motivational orientation alone provides sufficient impetus to maintain behavior upon encountering either success of failure in goal striving, meaning that continuation intentions may be superfluous. In contrast, continuation intentions of failure showed a significant and positive path with behavior in the controlled group, presumably because planning to continue behavioral engagement in situations of failure in goal attainment is useful in assisting these individuals to maintain efforts to achieve their goals after perceived failure. However, continuation intentions of success showed a significant negative association with physical activity behavior in the controlled group, suggesting that planning to continue engagement in physical activity behavior in situations of successful goal attainment was not useful in ensuring maintenance of physical activity. Possible explanations for this negative relationship are that the multicollinearity between continuation intentions of success and failure within controlled individuals has caused a suppressor effect, or current measures of continuation intentions of success do not assess the true nature of the construct. However, the correlation between the continuation intention statistics while significant ($r = .53$, $p < .01$) was not particularly high and tolerance statistics were acceptable. Furthermore, we also performed the correlation analysis for the high and low chronically accessible motives groups and found that the correlations were comparable. This evidence seems to rule out the premise that multicollinearity and suppressor effects were responsible for the negative relation between continuation intentions of success and behaviour. Perhaps a more likely explanation was that high continuation intentions of success, as tapped by the current measure, may reflect a likelihood of terminating physical activity if success is not encountered, thus responding to these items could function counterproductively and represent intention to maintain physical activity only if success is experienced. This may be an issue for future measurement; it would be important to highlight in hypothetical scenarios that it is important to develop personally-relevant criteria for success.

Findings are consistent with key tenets of SDT (Deci & Ryan, 1985, 2000), which suggests that behavioral persistence is greater when individuals are autonomously motivated. This assumption has been supported by research in the physical activity domain (e.g., Wankel, 1993). It could therefore be inferred that for individuals who participate in leisure-time physical activity for interest, enjoyment, satisfaction, and well-being, for instance, the planning of post-decisional intentions in advance achieved through formation of continuation intentions is unnecessary for behavioral maintenance.

In contrast, for individuals citing controlled primary outcomes in physical activity, planning to continue participation in physical activity in situations in which goals have not yet been achieved may be conducive to behavioral persistence, as such individuals may require additional assistance in goal attainment. The formation of continuation intentions of success, however, does not appear to incur beneficial effects for individual citing controlled outcomes as their most accessible, as such individuals are not interested in maintaining physical activity after obtaining desired outcomes and are highly likely to terminate behavior after these outcomes have been obtained, regardless of planning for situations of successful goal attainment. Results are consistent with previous findings suggesting that continuation intentions of failure have greater predictive utility for physical activity behavior than continuation intentions of success (Chatzisarantis & Hagger, 2008). Importantly, the chronically-accessible outcomes measure is independent of the traditional conceptualisation of intentions and represents non-conscious and spontaneous influences on behavior, in contrast to the deliberative nature of intentions.

Unexpectedly, a negative path, albeit virtually nil and non-significant, emerged between the scaled measure of autonomous motivation and intentions. Further analyses revealed that the exclusion of past behavior from the model restored the indirect effect of autonomous motivation on intention, mediated by attitude and PBC. This suggests that despite grounding decisions to exercise in autonomous motivation, the influence of autonomous motivation is not independent of past behavior. Continuation intentions, in contrast, are unlikely to be inextricably tied to past behavior and may exert a greater bearing on future physical activity.

The findings of this study underscore the importance of considering individuals' chronically-accessible motivational orientations when developing techniques to enhance levels of physical activity. This study has used a novel approach to exploring differences in social cognitive determinants of physical activity behavior between individuals with different motivational orientations for physical activity, by using a free-response measure of chronically-accessible outcomes or motives for physical activity to differentiate between individuals who tend to pursue autonomous and controlled accessible outcomes. This measure was an indirect method of accessing motivational orientations and therefore conferred the advantage that participants were unaware of exactly what the measure was tapping, thereby minimising self-report bias. Importantly, the model compensates for a shortcoming of the TPB by incorporating a direct measure of behavioral regulation in the form of the RAI. Further, the extended TPB model encompassed the post-decisional phase of behavior, which is neglected by the original TPB, thereby providing a more complete account of the social cognitive determinants of physical activity. The model accounted for more variance in both intentions and behavior than applications of the original TPB model in the physical activity domain (see Hagger et al., 2002b). A further strength of the study was the use of path analysis, which is a flexible and powerful technique that allowed error in prediction to be explicitly modelled and tested the mediation and moderation effects within the proposed network of relationships.

However, the present study was limited in several ways. First, the interval between the two waves of data collection may have been insufficient for continuation intentions to affect behavior. A period of three weeks may have been too short to reasonably expect participants to have succeeded or failed in their goal pursuit, so the measure of physical activity may not have accurately reflected effects of participants' continuation intentions. A greater time interval that enables realisation of longer-term goals would be desirable in future research. The measure of physical activity was also limited, as the two-item measure employed is unlikely to have reflected the complexity of physical activity behavior and could have suffered from self-report bias. Other limitations are the discrepancy in sample size between the two groups and the unsatisfactory internal reliability of the continuation intentions items. However, previous research (Chatzisarantis et al., 2004; Chatzisarantis & Hagger, 2008) has reported adequate internal reliability for the same continuation intentions items. Future research could usefully determine the reliability of the present findings by recruiting a larger sample of controlled individuals and by assessing whether findings can be replicated for other health behaviors. It may also be valuable to employ an implicit measure of chronically-accessible motivation in future, as this could assess more accurately non-conscious motivational forces acting on physical activity. Items for the measurement of continuation intentions could be revised, in order to avoid any potentially counterproductive effects that may arise with the use of current measures of continuation intentions of success, and an objective measure of physical activity should be used to substantiate self-report measures in future work.

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Footnotes Chapter 4

[1]Further details of questionnaire items are available from the first author on request.

[2]Theory of planned behavior variables were based on guidelines produced by Ajzen (2003).

[3]In all analyses testing for significant indirect effects the following criteria proposed by Baron and Kenny (1986) were met: (1) significant correlations between the dependent variable and the independent (predictor) variable(s); (2) significant correlations between the mediator and the independent variable(s); (3) a significant unique effect of the mediator on the dependent variable when it is included alongside the independent variable(s) in a multivariate test of these relationships; and (4) the significant effect of independent variable on the dependent is attenuated or extinguished when the mediator is included as an independent predictor of the dependent variable. The significant indirect effect test is equivalent to a Sobel (1982) test.

[4]We also conducted our analysis of interactions using moderated hierarchical regression analysis to ensure that the main and interaction effects in the path analyses were robust. In accordance with the recommendation of Aiken and West (1991), all independent variables were standardised, in order to avoid the problem of multicollinearity linked with the use of interaction terms. In the first step of the regression analysis, attitude, subjective norm, perceived behavioral control, intention, chronically-accessible motivation and continuation intentions of success and failure were entered as predictors of physical activity. In the second step, two interaction terms were entered, representing multiplicative composites of continuation intentions of success and chronically-accessible motivation and continuation intentions of failure and chronically-accessible motivation. In the final step, past behavior was entered as a predictor, in order to statistically control for its effects. Results showed that intention ($\beta = .62$, $p < .01$), subjective norm ($\beta = .23$, $p < .01$) and continuation intentions of

failure (β = .26, p < .01) were significant independent predictors of physical activity behavior in the first step of the analysis, accounting for 50.0% (47.8% adjusted) of the variance in physical activity. In the second step of the analysis, intention (β = .64, p < .01), subjective norm (β = .21, p < .01) and continuation intentions of success (β = .48, p < .05) were significant independent predictors of physical activity behavior. The interaction between continuation intentions of success and chronically-accessible motivation was also significant (β = .55, p < .01), with a total of 52.4% (49.7% adjusted) of the variance in physical activity behavior accounted for. This supported the finding of the multi-sample path analysis, that chronically-accessible motivation significantly moderated the association between continuation intentions of success and strengthened the inference that continuation intentions are differentially effective in predicting physical activity behavior, dependent upon chronic motivational orientation. In the final step, past behavior emerged as a significant independent predictor of physical activity (β = .49, p < .01) but did not subsume any of the statistically significant effects that were determined in the second step of the analysis.

[5]Although there was no significant moderating effect of chronically-accessible motivation on the relationship between continuation intentions of failure and physical activity behavior because the path representing this relationship was statistically invariant across the groups, the multi-sample analysis revealed a significant direct effect of continuation intentions of failure on physical activity in controlled individuals (β = .36, p < 0.05) and no such significant effect in autonomous individuals (β = .11, p > .05).

Chapter 5

Do people differentiate between intrinsic and extrinsic goals in physical activity behavior?

Abstract

The distinction between intrinsic and extrinsic goals, and between goal pursuit for intrinsically- and extrinisically-motivated reasons, is a central premise of self-determination theory. Proponents of the theory have proposed that the pursuit of intrinsic goals and intrinsically-motivated goal striving each predict adaptive psychological and behavioral outcomes relative to the pursuit of extrinsic goals and extrinsically-motivated goal striving. Despite evidence to support these predictions, research has not explored whether individuals naturally differentiate between intrinsic and extrinsic goals. Two studies tested whether people make this differentiation when recalling goals for leisure-time physical activity. Using memory-recall methods, participants in Study 1 were asked to freely-generate physical activity goals. A subsample (*N* = 43) was asked to code their freely-generated goals as intrinsic or extrinsic. In Study 2, participants were asked to recall intrinsic and extrinsic goals after making a decision regarding their future physical activity. Results of these studies revealed that individuals' goal generation and recall exhibited significant clustering by goal type. Participants encountered some difficulties when explicitly coding goals. Findings support self-determination theory and indicate that individuals discriminate between intrinsic and extrinsic goals.

Keywords: Motivation, self-determination theory, goals.

Do People Differentiate Between Intrinsic and Extrinsic Goals in Physical Activity Behavior?

Physical activity has been implicated as a significant factor in health promotion and disease prevention (e.g., Astrup, 2007; Bassuk & Manson, 2005; Schmitz et al., 2005). Warburton, Nicol, and Bredin (2006) presented robust evidence for the efficacy of regular physical activity in both the primary and secondary prevention of major chronic diseases, including cardiovascular disease, diabetes, cancer, obesity, depression, hypertension and osteoporosis. In addition there is also evidence that regular participation in physical activity confers substantial mental and physical health benefits (Penedo & Dahn, 2005). Studies have also documented the value of moderate and high levels of physical activity in substantially extending life expectancy (Franco et al., 2005; Warburton et al., 2006).

However, despite the clear benefits of regular physical activity for a range of health and disease outcomes, physical inactivity remains a pervasive problem. For example, research examining levels of physical activity and inactivity in adults and children in the United States revealed that only 27.7% of adults met recommended levels of either moderate or vigorous physical activity, with almost 30% reporting no regular physical activity outside a work context (Pratt, Macera, & Blanton, 1999). Similarly, Livingstone, Robson, Wallace, and McKinley (2003) reviewed recent evidence regarding levels of physical activity in adults and reported that up to 40% of US adults are sedentary in their leisure time. Adults in England exhibit comparable levels of inactivity; a study of 15,423 adults showed that less than one-third participated in adequate amounts of physical activity to accrue health benefits, and these findings held when analyses were restricted to currently 'healthy' adults (Harrison, McElduff, & Edwards, 2006). Physical inactivity appears to be equally ubiquitous in children. A study of 5595 children in Southwest England reported that only 2.5% of children met currently internationally endorsed recommended levels of physical activity (Riddoch et al., 2007).

Social psychological theories are often employed in order to understand and predict physical activity behavior (e.g., Chatzisarantis, Hagger, Smith & Pheonix, 2004; Orbell, Hagger, Brown & Tidy, 2006; Schwarzer, 2008). Self-determination theory (SDT, Deci & Ryan, 1985, 2000), in particular, has been frequently applied to develop an understanding of physical inactivity and to provide methods to enhance physical activity levels through intervention. SDT is an organismic dialectic theory of human motivation that has been successfully employed to understand behavior engagement and persistence in varied applied domains such as health, education, and occupational and organisational settings. In SDT, behavior is viewed as driven by three fundamental psychological needs: the needs for competence, autonomy, and relatedness. The need for competence describes individuals' drive to function effectively in their environment, the need for autonomy relates to the desire to experience oneself as the initiator and regulator of one's actions, and the need for relatedness refers to individuals' propensity to form close and fulfilling interpersonal relationships. Humans are portrayed in SDT as active agents in the pursuit of fulfilment of these needs (Deci & Ryan, 2000).

With regard to the needs to experience autonomy and competence, the theory broadly distinguishes between two types of behavioral regulation: intrinsic and extrinsic motivation. Intrinsic motivation refers to participating in a behavior for the enjoyment, satisfaction, and interest inherent in the behavior, whereas extrinsic motivation describes participation in a behavior for reasons that are separable from the behavior itself such as gaining approval from others. Deci and Ryan (1985) argued that intrinsically-motivated behaviors are driven by a desire to fulfil psychological needs for autonomy and competence. Intrinsic motivation represents the prototypical form of self-determined motivation (Ryan & Deci, 2000) and is associated with adaptive psychological and behavioral outcomes such as higher behavioral quality, greater persistence, more effective learning, better health, and superior well-being, concentration, positive affect, and adaptive behavioral, cognitive, and physical self-evaluative patterns (e.g., Black & Deci, 2000; Fortier, Sweet, O'Sullivan, & Williams, 2007; Kasser & Ryan, 1996; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004; Pelletier, Fortier, Vallerand, & Briere, 2001; Ryan & Deci, 2000; Standage, Duda & Ntoumanis, 2005; Thogersen-Ntoumani & Ntoumanis, 2006). Extrinsic motivation is associated with behavioral persistence only so long as the external contingency such as rewards or reinforcements are present and is related to less adaptive outcomes such as boredom, superficial learning and lower quality of behavior (e.g., Deci & Ryan, 1985; Ntoumanis, 2001; Wang & Guthrie, 2004). This is because an individual views the behavior as emanating from outside the self and therefore feels pressured and coerced into doing the behavior by external forces.

Meta-analyses have also supported the importance of intrinsic motivation. Patall, Cooper, and Robinson (2008) analysed 41 studies examining the effect of an environmental support for intrinsic motivation, choice, on intrinsic motivation and associated outcomes. The provision of choice enhanced intrinsic motivation, effort, perceived competence, and task performance. Similarly, a meta-analysis identified intrinsic motivation as a significant predictor of physical activity behavior (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003). The importance of employing a self-determination theory perspective to predict physical activity behavior is becoming increasingly endorsed (Edmunds, Ntoumanis, & Duda, 2006; Landry & Solomon, 2004) and the theory has been used in the development of many behavior-change interventions, including those directed at physical activity (e.g., Chatzisarantis & Hagger, 2009; Edmunds, Ntoumanis, & Duda, 2008).

Self-Determined Motivation and Goals

Within SDT, a conceptual distinction is made between motivation and goal content. Whereas motivation focuses on the "why" or reasons underlying behavioural engagement, goal content refers to the "what" or objective of goal striving. Research has examined the *types* of goal that people pursue within the context of SDT. Kasser and Ryan (1996) distinguished between intrinsic and extrinsic goals. Intrinsic goals have been defined as those that are inherently rewarding and fulfilling to pursue, through the satisfaction of the three psychological needs. Such goals contribute to the development of personal interests and aspirations, and include goals for promoting social relationships, community contribution, and personal growth. In contrast, extrinsic goals have an outward focus and goal striving is directed towards outcomes such as fame, wealth, and a desirable image. Goals have been differentially associated with types of motivation from SDT. For example, in the domain of physical activity, Ingledew and Markland (2008) showed that appearance and weight goals increased external and introjected regulations and decreased exercise participation, while health and fitness motives enhanced an intrinsic form of motivation and increased physical activity participation. These authors additionally reported that social engagement goals increased intrinsic motivation. Similarly, Gillison, Standage, and Skevington (2006) found that intrinsic goals positively predicted self-determined motivation, which led to adaptive quality of life and behavioral outcomes. McLachlan and Hagger (2010, see also Chapter 3) have also shown that chronically-accessible appearance and weight loss-related goals in physical activity are associated with controlled, less-self-determined forms of motivation. Goals are therefore of crucial importance in determining the type of motivation underlying behavior (Gillison, et al., 2006). However, there is also evidence to suggest that goals and motivation are distinct constructs in SDT and predict unique variance in psychological and behavioral outcomes. For instance, Sheldon, Ryan, Deci, and Kasser (2004) showed that relative extrinsic goal content predicted variance in well-being that was not reducible to the motivation underlying these goals. Goal content has received increased attention in physical activity research over recent years. For example, Sebire, Standage, and Vansteenkiste (2009) reported that relative intrinsic goal content positively predicted a number of adaptive psychological outcomes independent of the effects of participants' self-determined motivation.

A number of studies both within and outside the physical activity context have demonstrated the differential effects of intrinsic and extrinsic goals on behavioral outcomes with intrinsic goals conferring advantages such as persistence, learning, achievement, reduced anxiety, and well-being (e.g., Sebire et al., 2009; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004a; Vansteenkiste, Simons, Soenens, & Lens, 2004b). For example, Vansteenkiste and colleagues (2004a) showed that framing tasks in terms of intrinsic goals, such as personal growth and health, resulted in deeper processing of learning material, higher test performance, and greater behavioral persistence than was observed with extrinsic goal framing. Such research has therefore led to recommendations that behavior change interventions should target goal content in addition to focusing on motivation. In the physical activity context, researchers have suggested that exercisers and exercise practitioners focus on the explicit content of exercise goals and promote intrinsic relative to extrinsic goal pursuit (e.g., Gillison et al., 2006; Sebire et al., 2009). Notwithstanding this research, no investigation to date has validated the distinction between intrinsic and extrinsic goals by exploring whether individuals *can* and *do* actively differentiate between these goal types. Although Vansteenkiste and colleagues' findings implied that people can distinguish between these goal types, their investigation did not provide evidence that individuals exhibit a tendency or propensity to make this distinction. The current investigation therefore assessed whether individuals naturally discriminate between intrinsic and extrinsic goals in the physical activity, in order determine whether individuals make this distinction at some level of representation. Methods to address this issue were adopted from research in the fields of attitudes and memory.

Clustering Methods

The present studies are based closely on the methodology of Trafimow and Sheeran (1998) and are informed by previous studies examining distinctions between various theoretical constructs in social psychology, including behavioral and normative beliefs, and attitudes and perceived control (e.g., Trafimow & Duran, 1998; Trafimow & Fishbein, 1995). The clustering procedure used to analyse the data was based on previous free recall research (e.g., Roenker, Thompson, & Brown, 1971). Both studies also utilise the spontaneous generation paradigm used by Higgins and colleagues in their research on construct accessibility (Higgins & Brendl, 1995; Higgins, King, & Mavin, 1982).

As an example of this approach, Trafimow and Sheeran (1998) carried out a series of experiments to determine whether people actively distinguish between the cognitive and affective belief components of attitudes. The rationale underlying the experiments was that if a person has to make a decision regarding an attitude object, the decision is likely to be easier if their beliefs regarding the attitude object relate to the same attitudinal dimension (i.e., affective beliefs with other affective beliefs and cognitive beliefs with other cognitive beliefs) than if they relate to different dimensions. Thus people should be more inclined to consider affective beliefs in relation to other affective beliefs and cognitive beliefs in relation to other cognitive beliefs than to make comparisons between affective and cognitive beliefs in relation to a behavioral decision. It therefore follows that more, and stronger, associations should be formed within belief type than between affective and cognitive beliefs. This notion was termed ‘the associative hypothesis’ (Trafimow & Sheeran, 1998), as associations were predicted between beliefs that relate to each other in the process of making a behavioral decision. Trafimow and Sheeran argued that such processing would be cognitively efficient, as considering each set of beliefs together should lead to a general concept regarding affective aspects of an object or behavior and a general concept regarding cognitive aspects of an object or behavior. Such concepts can then be stored for future use in decision-making rather than processing a large set of beliefs for each dimension on every occasion necessitating a decision. Trafimow and Sheeran (1998) therefore argued that the clustering of self-generated and recalled beliefs regarding cognitive and affective dimensions of an object or behavior would support the associative hypothesis and the general distinction between cognitive and affective components of attitude.

The aforementioned experiments showed that people do form more associations between beliefs on the same attitude dimension than between beliefs on different dimensions. In one experiment, behavioral beliefs presented by the experimenter were recalled in clusters of cognitive and affective beliefs when participants were required to process the beliefs and make a behavioral decision. Clustering was computed through the use of the adjusted ratio of clustering (ARC) index developed by Roenker and colleagues (1971). A score of unity (1.00) on the ARC index is indicative of perfect clustering, while a score of zero indicates chance clustering and a minus score reflects below chance clustering. A further experiment showed that affective beliefs and cognitive beliefs for smoking behavior clustered together when participants were asked to list their own beliefs about this familiar behavior, regardless of a priming manipulation intended to encourage negative clustering of responses. The experiment also showed that participants' beliefs had not clustered by valence as ARC scores computed on the basis of valence did not differ significantly from zero in either the prime or no prime condition.

An additional study by Trafimow and Sheeran (1998) provided further evidence for the associative hypothesis and its generality across behaviors by asking participants to list their own beliefs about having unprotected sex the following weekend. In support of the associative hypothesis, the mean ARC score based on participants' own coding of their beliefs was significantly greater than zero, showing that cognitive and affective beliefs were clustered separately. Again, findings were not attributable to difference in belief valence.

Trafimow and Sheeran concluded that people can and do differentiate between cognitive and affective beliefs and that the process of making a behavioral decision prompts clustered associations between beliefs to develop. Finally, Trafimow and Duran (1998) employed similar methods to demonstrate the distinction between the attitude and perceived control constructs from the theory of planned behavior (TPB; Ajzen, 1991), and evidence of cognitive belief clustering has also been used to support the distinction between attitudes and subjective norms postulated by the TPB (Trafimow & Fishbein, 1995). In summary, findings from these studies lend robust converging evidence in support of the associative hypothesis, as significant clustering emerged when people listed and coded self-generated beliefs, even for a familiar behavior and with a priming manipulation intended to deter the hypothesised pattern of clustering.

The Present Investigation

The clustering method developed by Roenker and coworkers, recommended by Srull (1984) for use in person memory and social cognition and employed by Trafimow and colleagues (Trafimow & Duran, 1998; Trafimow & Fishbein, 1995; Trafimow & Sheeran, 1998), was adopted in the present research to explore whether people can and do differentiate between intrinsic and extrinsic goals in a health-related physical activity context. This research will further understanding of the motivational factors underpinning health-related physical activity and advance knowledge of self-determination theory by testing whether people tend to make the distinction between their goals consistent with the intrinsic-extrinsic motivational forms proposed in the theory. In the first study, participants were asked to freely list goals that they or others might strive for in physical activity, and a subsample was also asked to return to their lists to mark each goal with either an ‘I’, if they believed the goal to be driven by ‘intrinsic motivation’, or an ‘E’ if they believed the goal to be driven by ‘extrinsic motivation’. Participants were provided with definitions of intrinsic and extrinsic motivation to aid their understanding of the terminology. The second study employed a recall task to ascertain whether a list of physical activity goals presented to participants was recalled in clusters of intrinsic and extrinsic goals. It was hypothesized that self-generated and recalled goals for physical activity would be clustered according to goal type, i.e. intrinsic or extrinsic, and that participants would reliably code their own beliefs as intrinsic or extrinsic.

Study 1

Method

Participants. Participants were undergraduate University students studying psychology (N = 98, 35 males, 63 females, *M* age 19.81, *SD* = 2.38).

Procedure. Data collection took place under quiet classroom conditions. Participants were provided with written instructions asking them to list all the goals that either they or others might strive to attain when participating in leisure-time physical activities and were provided with the examples of running, swimming, and playing active sports. At this stage, no participants were made aware of the distinction between intrinsic and extrinsic motivation. A randomly-selected subsample of participants (*N* = 43) was then asked to return to their lists to mark each goal with either an ‘I’, if they believed the goal to be intrinsically motivated, or an ‘E’, if they believed the goal to be extrinsically motivated. Definitions of intrinsic and extrinsic motivation were provided. Intrinsic motivation was defined as “participating in the behavior for reasons of interest, enjoyment or satisfaction” and extrinsic motivation was defined as “participating in a behavior for external rewards or outcomes, such as gaining approval from others.”

Two independent raters, both experts in SDT, then categorized each goal as either intrinsic or extrinsic. Consistent with SDT (Deci & Ryan, 1985, 2000) and previous research exploring intrinsic and extrinsic goals in physical activity (e.g., Gillison et al., 2006; Sebire, Standage, & Vansteenkiste, 2008), goals relating to fun, enjoyment, socialising, valued health-related outcomes, and achieving a healthy lifestyle were classed as intrinsic, while goals relating to weight loss, appearance, and externally-based rewards such as social recognition were categorized as extrinsic. An inter-rater agreement level of 100% was observed.

Data Analysis. The adjusted ratio of clustering (ARC) index proposed by Roenker and colleagues (1971) was employed to determine whether goals were clustered by goal type. Goals were coded by two independent raters. An ARC score represents the proportion of actual category repetitions above chance to the total possible category repetitions above chance. The ARC was selected over other indices of clustering for several reasons. First, the ARC identifies maximum clustering when the maximum amount of organisation within the set of words has occurred. Second, the ARC has been shown to produce a consistent value of zero with random clustering across different total recall (Schmidt, 1997). Finally, the methods employed in the current paper were based closely on those of Trafimow and Sheeran (1998) and it was therefore deemed appropriate to employ the same clustering index as these authors. A score of one on the ARC index represents perfect clustering and a score of zero indicates chance clustering, i.e. random listing or recall of beliefs. Negative scores represent less than chance clustering (Roenker et al., 1971). The following formula was used to compute ARC scores: $ARC = [R – E(R)]/ [max R – E(R)]$, where R represents total number of observed category repetitions, max R represents maximum possible number of category repetitions, and E(R) represents expected (chance) number of category repetitions. E(R) is calculated by summing the squares of the number of items from each category, dividing this by the total number of items and subtracting 1. An example of the ARC calculation is provided in Appendix 2.

Results

A list of the modal goals generated by participants is presented in Table 5.1. Examining the clustering of goals listed, 22 of the 98 participants showed perfect clustering by goal type (ARC = 1.00). A prototypical list of self-generated goals was “lose weight, tone up, look attractive, be healthy, feel good”. A one-sample *t*-test indicated that the mean cluster score (M = .14, SD = .61) differed significantly from chance clustering, t (97) = 2.19, p < .05. Common errors in participants’ labelling of goals included categorizing goals relating to winning competitions (n = 7) and relieving boredom or preventing other distractions (n = 8) as intrinsic, and categorizing outcomes related to health and fitness (n = 8) and social interaction (n = 11) as extrinsic.

Discussion

Results indicate that there was significant clustering of freely-generated physical activity goals by goal type in these participants. The mean cluster score was positive and differed significantly from chance, suggesting that intrinsic and extrinsic goals were clustered together in participants’ freely-generated goal lists. These findings support individuals’ capacity to make the broad distinction between intrinsic and extrinsic goals in a physical activity context and indicate stronger connections in memory between goals of the same type than goals of different types.

However, when participants were asked to return to their goal lists to explicitly code goals as either intrinsic or extrinsic, they encountered difficulties in reliably distinguishing between the goals. Errors in categorizing goals included labelling goals relating to winning competitions and relieving boredom or preventing other distractions as intrinsic. Although it is possible that the motivational regulations underlying these goals may differ between individuals, there is general consensus in the literature that these represent extrinsic goals in physical activity. Other errors included the erroneous categorization of outcomes related to health, fitness, and social interaction as extrinsic. Again, although it is acknowledged that there may be individual differences in the exact motivations underlying these goals, previous research has indicated that both health and fitness-related and social interaction goals are

Table 5.1

The List of Physical Activity Goals Presented to Participants in Study 2, with Categorization by Goal Orientation

Goal content	Goal orientation
Physical fitness	Intrinsic
Weight loss	Extrinsic
Good health	Intrinsic
Physical attractiveness	Extrinsic
Enjoyment	Intrinsic
Toned body	Extrinsic
Social interaction	Intrinsic
Impress others	Extrinsic
Enhance self-esteem	Intrinsic
Win awards	Extrinsic
Develop friendships	Intrinsic
Satisfy competitive desires	Extrinsic
Reduce stress	Intrinsic
Relieve boredom	Extrinsic
Improve skills	Intrinsic
Build muscle	Extrinsic

intrinsic in nature (e.g., Sebire et al., 2009).

These findings suggest that although individuals may possess the capacity to distinguish between intrinsic and extrinsic goals in physical activity at some level, explicitly distinguishing between these goal types resulted in some degree of uncertainty. To extend these findings, we conducted a further study to determine whether significant clustering by goal type would occur for the free recall of modal physical activity goals from Study 1. For the second study goal coding was carried out by SDT experts, as findings from Study 1 provided evidence that participants may encounter difficulty when explicitly categorizing goals into the proposed intrinsic and extrinsic categories.

Study 2

Method

Participants. Participants (N = 104, 33 males, 67 females, information on gender missing for four participants, *M* age 23.53, *SD* = 8.15) were undergraduate and postgraduate University students of economics, engineering, education, computer science, and politics.

Procedure. This study employed a free-recall paradigm to explore whether participants' recall of a list of health behavior goals would be clustered by goal type from SDT, i.e. intrinsic and extrinsic goals. The list of goals was developed from the modal responses from Study 1, and intrinsic and extrinsic goals were alternated such that two goals of the same type did not appear consecutively. This was intended to prevent clustering from occurring as an artefact of order of presentation of the goals. The experiment was created as an online survey and consisted of a series of stages. A website link was emailed to prospective participants, which directed them to the online survey. Participants were informed that the investigators were interested in determining why people engage in leisure-time physical activity and that they would be asked to complete four short tasks to help the investigators address that question.

In the first task, participants were presented with the list of leisure-time physical activity goals and were asked to read the list and consider how the goals may apply to their own engagement in leisure-time physical activity. Participants were then asked to make a behavioral decision regarding their leisure-time physical activity, as Trafimow and Sheeran (1998) showed that the clustering of instrumental and affective attitudes in a similar recall paradigm occurred only when participants were asked to make a behavioral decision regarding the attitude object. A seven-point Likert scale was provided for participants to indicate how frequently they would engage in the physical activity behavior in their leisure-time during the following month ranging from one to seven days per week. Participants were then prompted to move to the next page of the survey, where they were presented with a distraction task. This task was unrelated to the purpose of the experiment and required participants to write a passage of prose about their most recent holiday. This was intended to prevent participants from simply recalling the list of goals verbatim.

Following completion of the distraction task, participants were prompted to move to the next page of the survey, which contained the recall task. Instructions stated that participants should try to remember the goals that they read a few minutes previously and list them in the text box provided. Participants were encouraged to try to recall as many goals as possible. Finally, participants were prompted to move to the final page of the survey, which informed them that the survey was complete and thanked them for their participation. Importantly, participants were not able to move backwards to a previous page at any point in the survey, which ensured that they were unable to return to the original goals list when asked to recall the goals.

Data analysis. The ARC index was used to assess the clustering of intrinsic and extrinsic goals, following the same method as employed in study 1. The ARC index computes the chance-expectancy value on the basis of participants' recalled items rather than using the original list of stimuli and was therefore appropriate for this analysis. Again, independent raters categorized the goals, with a 100 percent agreement level. As in Trafimow and Sheeran's (1998) study, recall protocols were scored using a 'general meaning' criterion before cluster scores were computed, i.e., if participants recalled the essence of the goal but not using the exact wording from the original goal list, this was considered a correct recall.

Results

Results indicated that 31 of the 104 participants exhibited perfect clustering by goal type in their recall. A one-sample t-test indicated that the mean clustering score (M = .17. SD = .71) differed significantly from chance clustering, t (103) = 2.49, $p < .05$.

Discussion

Results were consistent with those of Study 1 providing further evidence for individuals' ability to differentiate between intrinsic and extrinsic goals in a physical activity context. The positive nature of the mean clustering score suggested that participants in this sample exhibited significant clustering by goal type when recalling a list of goals relating to leisure-time physical activity, despite presentation of the goals in such a way as to deter recall by goal type.

General Discussion

The present studies aimed to determine whether individuals can and do actively differentiate between intrinsic and extrinsic goals for a health-related behavior, namely, leisure-time physical activity. Although the SDT literature has reported differential effects of intrinsic and extrinsic goals on a variety of outcome variables, such as need satisfaction, persistence, learning, and achievement (e.g., Sebire et al., 2009; Vansteenkiste et al., 2004a), research has not previously addressed whether individuals naturally distinguish between these two goal types. Grounded in methods used to provide empirical support for the construct validity of the instrumental and affective components of attitude, the results of Studies 1 and

2 indicate that individuals differentiate between intrinsic and extrinsic goals without awareness, as both freely-generated and recalled goals exhibited clustering by goal type that was significantly above chance levels. Goals did not appear to cluster semantically, but rather according to their motivational basis. This suggests that individuals have formed strong associations between different types of intrinsic goals and different types of extrinsic goals, and that when asked to generate or recall a goal list, activation spreads from one goal to others of the same type. Thus, it appears that intrinsic and extrinsic goals are represented together in memory in terms of their recall, in accordance with the key tenet of SDT. These associations remained despite priming participants not to recall the physical activity goals in clusters through ordering a list of goals such that a goal was never preceded by a goal of the same type. These findings support the investment of resources into interventions primarily aimed at encouraging a focus on intrinsic relative to extrinsic goals in physical activity through validating this conceptual distinction between goal types.

However, when participants were asked to code their own freely-generated physical activity goals as intrinsic or extrinsic, errors in categorizing goals were found. This suggests that individuals may differentiate between intrinsic and extrinsic goals at an implicit or non-conscious level and that they have difficulty discriminating between these goal types explicitly.

Findings largely mirror those of Trafimow and Sheeran (1998) for cognitive and affective attitudes, although these researchers did determine significant clustering when participants coded their beliefs as cognitive or affective. This difference could be due to methodological variations and the complexity of the distinction. In the present study, participants were asked to list and code goals that they or anyone else may wish to achieve through leisure-time physical activity behavior, whereas Trafimow and Sheeran asked participants to list and code only their own personal beliefs about a behavior. The focus on individuals' own beliefs in Trafimow and Sheeran's study may have resulted in greater ease in categorizing them as cognitive or affective, whereas the broader nature of the generation of goals in Study 1 could have resulted in participants experiencing more difficulty in differentiating between goals that were intrinsic or extrinsic. In addition, the various types of regulatory style underlying physical activity goals are likely more complex in nature than the distinction between cognitive and affective components of attitude, thus making the task of discerning intrinsic and extrinsic goals more difficult. This is because extrinsic motivation can be conceptualized as being more or less self-determined, according to SDT, and there may be more subtle distinctions made within the extrinsic goal category (Ryan & Connell, 1989). For example, the extrinsic goal of losing weight could potentially be driven by self-determined motivation if it is personally valued and endorsed by the individual. The distinction between intrinsic and extrinsic goal content may not therefore be reflective of the complexity of the goal striving process and an appreciation of the motivational orientation underlying the goal may be necessary to predict well-being and behavioral outcomes in leisure-time physical activity. This assertion is supported by Sebire and colleagues' (2009) finding that intrinsic goal content did not predict exercise behavior beyond individuals' self-determined motivation for exercise. The understanding of individuals' ability to differentiate between intrinsic and extrinsic goals could therefore be improved by exploring whether people can differentiate further between the goals related to the various types of behavioral regulation on the motivational continuum proposed by SDT, rather than limiting the test of their discriminatory ability to the broad intrinsic-extrinsic distinction.

The present studies used recall methods to determine whether individuals make the distinction between intrinsic and extrinsic goals. Implicit methods may also be valuable by providing insight into individuals' capacity to differentiate between intrinsic and extrinsic goals. For instance, the Go/No-Go Association Task (Nosek & Banaji, 2001) could be utilised to determine whether intrinsic and extrinsic goals can be discriminated at an implicit level and test individuals' general orientation to pursue a particular goal type. As results of the present studies indicate that individuals hold associations between intrinsic goals and between extrinsic goals in memory but encounter difficulties when asked to code their goals as intrinsic or extrinsic, future research should explore whether individuals' apparent ability to differentiate intrinsic and extrinsic goals without awareness is replicated using implicit methods. Further research could also directly address the question of whether the differential effects of intrinsic and extrinsic goals are dependent upon individuals' awareness of this broad distinction. Nevertheless, the present findings provide important preliminary evidence supporting the intrinsic-extrinsic distinction proposed by SDT, showing that individuals can and do discriminate between intrinsic and extrinsic goals in leisure-time physical activity, albeit seemingly outside their conscious awareness. It is recommended that the methodology employed in the current study is applied in other behavioral domains to provide greater support for the distinction between intrinsic and extrinsic goals.

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Chapter 6

The development of a scale measuring integrated regulation in physical activity

Abstract

Objectives. This research aimed to develop and validate a measure of integrated motivational regulation based on self-determination theory in a physical activity context. *Design*. Cross-sectional and prospective surveys were employed. *Methods.* The measure was developed from first principles from an initial item pool and items were selected using expert evaluators. The validity of the final item pool was tested across high- and lower-active samples (N = 488) using single- and multi-sample confirmatory factor analyses. *Results.* Analyses supported the factorial, nomological, discriminant, and predictive validity of the scale. *Conclusions.* The validity of the integrated regulation measure was supported. Present analyses provide evidence that the scale is a valid and reliable tool that may be used to evaluate the effectiveness of autonomy-supportive interventions in health-related behavioural contexts.

The Development of a Scale Measuring Integrated Regulation in Physical Activity

Epidemiological evidence has shown that low levels of physical activity are associated with a range of chronic health conditions such as coronary heart disease, diabetes, obesity, and cancer (e.g., Hu et al., 2005; Mokdad et al., 2003). However, despite evidence of the health benefits of regular physical activity, a large percentage of populations in Western European countries do not take sufficient exercise for their health (Department of Health, 2004; James, Rigby, & Leach, 2004). Motivation has been highlighted as an important factor in understanding the uptake of and adherence to exercise behaviour (e.g.; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Thøgersen-Ntoumani & Ntoumanis, 2006). It is therefore valuable to identify the motivational factors underlying this behaviour and to map the processes by which these factors influence behavioural engagement and associated outcomes. Valid and reliable measures of social psychological constructs are necessary here, in order to both evaluate the psychological predictors of health behaviour and determine the mediating variables through which health-promoting interventions incur effects.

Self-Determination Theory

Self-determination theory (SDT; Deci & Ryan, 2000) provides a dialectic, organismic account of human motivation that has been adopted to explain influences on health-related behaviour in a number of domains (e.g., Williams et al., 2006) including physical activity (e.g., Hagger, Chatzisarantis, & Biddle, 2002). The theory makes a broad distinction between intrinsic and extrinsic motivation. Intrinsic motivation describes participation in behaviour for reasons of interest, enjoyment or satisfaction inherent in that behaviour. Extrinsic motivation makes reference to participation in a behaviour for reasons or rewards separable from the behaviour itself, such as obtaining approval from others. The theory also specifies a state of amotivation, which refers to “a state of lacking any intention to engage in behaviour” (Markland & Tobin, 2004, p.191).

In SDT, intrinsically-motivated behaviour is viewed as being driven by the organism's desire to satisfy three fundamental psychological needs: competence, autonomy, and relatedness. Humans are viewed as active agents in the pursuit of fulfilment of these needs (Deci & Ryan, 2000). SDT comprises several sub-theories that specify key corollaries of the overall theory. Organismic integration theory (OIT, Deci & Ryan, 1991) specifies a regulatory continuum that not only differentiates intrinsic from extrinsic motivation but also subdivides extrinsic motivation into four types of *behavioural regulation* distinguished by their level of self-determination or autonomy. Intrinsic motivation falls at one end of the continuum and external regulation lies at the other. Intrinsic motivation represents the prototypic instance of self-determined motivation, while external regulation reflects the prototypic form of extrinsic motivation and is characterised by behavioural engagement for reasons entirely external to the self, for instance to attain tangible rewards or meet externally-imposed deadlines (Ryan & Deci, 2000).Three further types of extrinsic motivation lie along the continuum according to the degree to which they have been internalised in striving to service psychological needs: introjected, identified, and integrated regulations.

Introjected regulation is the least autonomous form of extrinsic motivation. This refers to behavioural performance in order to avoid negative affective states, such as guilt and shame, or to enhance feelings of self-worth. Behaviour that is governed by introjected regulation is not accepted as one's own, although the regulation is partially internalised. Identified regulation lies adjacent to introjected regulation and refers to pursuit of behaviour to attain personally-valued outcomes rather than for enjoyment or interest in the activity. Finally, integrated regulation falls adjacent to intrinsic motivation on the continuum and represents the most complete internalisation of a behaviour, such that the behaviour is entirely assimilated as part of the genuine self. This is the most autonomous form of extrinsic motivation.

Pelletier, Dion, D'Angelo, and Reid (2004) suggested that behavioural persistence in striving for desired outcomes is dependent not only on the strength of the motives driving behaviour but also on accepting the regulation for behavioural change as self-determined rather than perceiving it as arising from internal or external pressure. Empirical evidence in the domain of physical activity supports this argument, as autonomous forms of behavioural regulation have been associated with the maintenance of physical activity behaviour over time (e.g., Pelletier, Fortier, Vallerand, & Briere, 2001; Thøgersen-Ntoumani & Ntoumanis, 2006).

Previous Development of Measures of Integrated Regulation

Previous SDT-based research in the health-related behaviour domain has often omitted the full spectrum of constructs from the regulatory continuum. The Sport Motivation Scale (SMS, Pelletier et al., 1995), Behavioural Regulation in Exercise Questionnaire (BREQ, Mullan, Markland & Ingledew, 1997), and the revised BREQ (BREQ-2; Markland & Tobin, 2004) omitted subscales for integrated regulation and do not therefore offer a complete operationalisation of motivational constructs specified by OIT. Studies adopting such measures have therefore excluded integrated regulation as a predictor of physical activity uptake and adherence (e.g., Edmunds, Ntoumanis, & Duda, 2006; Ingledew, Markland & Sheppard, 2004; Wilson & Rodgers, 2004). Integrated regulation has also been omitted from research adopting the regulatory continuum in other domains such as education (Fairchild, Horst, Finney & Barron, 2005).

Decisions to omit integrated regulation from SDT-based instruments in the exercise domain have been based on previous research suggesting that it is not a salient construct in decisions to participate in physical activity (e.g., Pelletier et al., 1995). The omission of integrated regulation from empirical research also seems to stem from difficulties in establishing discriminant validity between intrinsic motivation and autonomous forms of extrinsic motivation on the regulatory continuum (integrated and identified regulations). Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson (2007) experienced such problems in their revision of the SMS (SMS-6), in which three intrinsic motivation factors (intrinsic motivation to know, to experience stimulation, and to accomplish) were collapsed to form a single factor and an integrated regulation factor was added. Nevertheless, despite some cross-loadings, this revised SMS elicited a more parsimonious and better-fitting factor structure consistent with SDT than the original scale.

Modifications of existing measures in physical activity to include integrated regulation have not resulted in definitive measures of the construct, for example Li's (1999) Exercise Motivation Scale (EMS). Wilson, Rodgers, Loitz, and Scime (2006) highlighted that the EMS development precluded definitive conclusions on psychometric validity and reliability of the integrated regulation items and expressed concern at the failure of the EMS to conform to the expected simplex-type pattern[1] of associations among constructs. Wilson and colleagues developed their own four-item measure of integration for use in physical activity contexts. Confirmatory factor analyses provided support for the inclusion of an integrated regulation measure and demonstrated that perceived psychological need satisfaction was positively associated with a composite measure of autonomous motivation incorporating the integration items. Wilson and colleagues also claimed criterion validity for their integrated regulation scale as it contributed uniquely to the prediction of exercise behaviour.

However, Wilson and colleagues' modifications also had some limitations. First, the integrated regulation scale was not developed from first principles, that is, from a definitive pool of items that captured the essence of the integrated regulation concept. Consequently, these items did not reflect how closely bound integrated regulation is to the self and were therefore unrepresentative of the true nature of the construct. Second, the description of both the selection of the four integration items from theoretical specifications and the process of scale development were relatively vague; the authors stated that the items were based on theoretical considerations and adaptation of items from other instruments (Wilson et al., 2006). Third, evaluation of the instrument relied heavily on homogeneous undergraduate psychology student samples, limiting the generalizability of findings (see Hagger, Biddle, Chow, Stambulova, & Kavussanu, 2003). Fourth, little support was provided for the construct validity of the integrated regulation items, as Wilson and co-workers focused largely on the relationships of the integrated item scores with the need satisfaction portion of SDT's nomological network. Further support for the construct validity of the integration items would demand the assessment of relationships with a wider range of theoretically related constructs. Finally, Wilson and colleagues tested the convergent-divergent validity of the measure against Li's (1999) EMS, which they had criticised heavily as lacking construct validity.

Information regarding the addition of an integrated regulation subscale to the Physical Activity Regulation Scale (D'Angelo, Reid, & Pelletier, 2007) was also sparse, with no details of item development or validation processes. However, Lonsdale, Hodge, and Rose (2008) developed a measure of integrated regulation within their Behavioral Regulation in Sport Questionnaire (BRSQ), which demonstrated internal consistency, test-retest reliability, and factorial and nomological validity. The evaluation of this scale was, however, confined to a relatively homogenous sample of competitive sport participants.

Need for a Valid and Reliable Measure of Integrated Regulation

The formulation of a more complete and theoretically-derived instrument measuring motivation for exercise would be an important contribution to this literature for three reasons. First, despite some indications that integrated regulation is not a pertinent motivational factor underlying behaviour in certain populations (Pelletier et al., 1995), research has supported the role of integrated regulation in predicting intended and actual behavioural effort (Deci & Ryan, 1991) and its importance as a key source of motivation in elite athletes (Mallett & Hanrahan, 2004). Second, a measurement instrument incorporating all behavioural regulation types from OIT, including an integrated regulation scale, would enable researchers to gain a more complete explanation of motivational factors underlying leisure-time physical activity. The predictive validity of this instrument should also be superior to previous measures of motivation in exercise, as significantly more variance in behaviour should be explained with the addition of a measure of integrated regulation.

Third, valid and reliable measures of integrated regulation are necessary to evaluate the effects of interventions aiming to facilitate integration. Self-determined forms of motivation have been shown to be reliably associated with positive health outcomes (e.g. Pelletier et al., 2004), thus motivational manipulations to facilitate a shift in locus of causality from external to internal, a process known as integration, would be better served by a more sensitive, fine-grained instrument that includes integrated regulation. Researchers and practitioners interested in promoting health-related behaviour have adopted intervention strategies based on SDT to encourage the internalisation of externally regulated behaviours like physical activity (e.g., Chatzisarantis & Hagger, 2009). The internalisation of such behaviours is important because it is likely to lead to enhanced autonomous motivation and increased self-regulation of health behaviour. Individuals who are autonomously motivated are more likely to persist with behaviour in the absence of external contingencies and overcome temptations to engage in tempting behavioural alternatives such as sedentary activities (Hagger, Wood, Stiff, & Chatzisarantis, 2009, 2010a, 2010b). A valid and reliable measure of internalisation would help ascertain the degree to which externally-regulated behaviours had become integrated through the intervention or assist in identifying the psychological mediators of such interventions on exercise behaviour. The latter is important in the evaluation of interventions because it will help identify and map the components of the intervention that are effective in changing behaviour on to theoretical constructs (Abraham & Michie, 2008).

The Present Study

The present investigation details the development of an integrated regulation scale to use in conjunction with existing measures of intrinsic, identified, introjected, and external regulations and amotivation in an exercise context. The scale can be differentiated from the BRSQ (Lonsdale et al., 2008), as it aims to assess motivation for leisure-time physical activity, rather than motivation for competitive sport in a specialist population. The scale was developed from first principles using an initial item pool and a rigorous a priori, hypothesis-testing approach. An exhaustive literature search was undertaken to identify previous measures of integrated regulation in the domains of physical activity, sport, and dieting. The emergent pool of items was refined through expert ratings in order to provide a representative measure of integrated regulation. We employed multiple expert judges to ascertain the content validity of items, with a formal scaling procedure to rate the representativeness of the items in accordance with Haynes, Richard, and Kubany's (1995) recommendations that scale items should capture all facets of the construct of interest, in this case, integration.

Construct validity was assessed further through examination of relationships between the integrated regulation subscale and constructs shown to be theoretically-related such as life satisfaction, subjective well-being and flow (Csikszentmihalyi, 1975) (e.g., Mallett et al., 2007; Pelletier & Sarrazin, 2007). Attention was also paid to issues of nomological and discriminant validity through examination of the relationships between integrated regulation, the remaining regulatory variables, and six theoretically-related constructs. Finally, a more diverse sample was employed than in previous studies to lend further support for scale validity using a known group differences approach. This was achieved by comparing scores on high- and lower-active samples, in order to determine the factorial invariance of the scale across two groups of individuals who were likely to differ in the level of integrated regulation for physical activity.

The research hypotheses were as follows:

(1) The integrated regulation scale is expected to show discriminant validity with all factors on the continuum, including the most proximal constructs of intrinsic motivation and identified regulation. Integrated regulation scale items are hypothesized to load solely on the expected latent factor in confirmatory factor analyses with no cross-loadings on factors representing intrinsic motivation and identified regulation.

(2) A simplex-like pattern of relationships will emerge among the regulatory constructs, such that constructs situated in closer proximity on the continuum will exhibit stronger associations than constructs situated further away. This will provide evidence of the nomological validity of the integrated regulation scale and situate it appropriately relative to the other constructs.

(3) Nomological validity for integrated regulation will also be evaluated through significant and positive associations of integrated regulation with vitality, life-satisfaction, and pertinent facets of flow. Integrated regulation will additionally exhibit discriminant validity with these constructs. It is expected that the integrated regulation scale will exhibit strong associations with these factors, following previous research in a sports context that has shown strong positive associations between autonomous forms of behavioural regulation and vitality (Pelletier & Sarrazin, 2007), life satisfaction (Pelletier et al., 2004), and flow (Mallett et al., 2007).

(4) Integrated regulation will account for a significant proportion of variance in prospectively-measured physical activity, beyond that accounted for by the other regulatory constructs while statistically controlling for age.

(5) The structure of the model specifying integrated regulation and the remaining regulatory constructs will be invariant across a high-active sample and a lower-active sample, as evidenced through the minimum criteria of invariance of factor structure and factor loadings.

(6) There will be significant differences between the high-active sample and lower-active sample in terms of latent factor means. Specifically, it is hypothesised that the high-active sample will report significantly higher integrated regulation than the lower-active sample.

Method

Participants

The composition of the sample was as follows: 60 participants were undergraduates in engineering (12%), 176 were healthy adult members of the general population (36%), 184 were undergraduates in sports science (38%), and 68 were A-level students (14%), sampled from two Universities, one sixth-form college, community groups, and businesses in the UK (total N = 488, Males = 191, Females = 279, M age = 21.03, SD = 7.53). Thirteen participants did not report their gender and data on age were missing for three participants. The sports science students constituted the high active sample. An independent-samples t-test confirmed that the mean level of past physical activity (M = 4.32, SD = 1.65) was significantly greater in this group than in the remaining participants (M = 3.33, SD = 1.62), t (481) = -6.45, p < .001. The sports science students were selected not only because they were expected to report significantly higher levels of vigorous physical activity than the remaining participants but also because exercise is likely to constitute a more significant part of their lives relative to the other participants and therefore to be more closely tied to their non-contingent self-concept (Sheldon, 2004). The student samples were convenience samples and members of the general population were recruited through self-selected sampling upon receiving information about the study. Participants were recruited through course convenors, group leaders, and business managers, using mail, email and telephone correspondence. All participants provided data on the regulatory constructs and past physical activity, while a sub-sample (N = 310) provided data on measures of life satisfaction, subjective vitality, and facets of flow. A sub-sample of the lower-active sample (N = 153, Males = 38, Females = 115, M age = 23.60, SD = 10.21) provided follow-up behavioural data for exercise at the second wave of data collection. The behavioural data were collected within a parallel study exploring the predictive validity of integrated regulation and were provided by 87% of the 176 individuals who received the second questionnaire. Data from five participants were excluded because of a missing data rate in excess of 5%, resulting in a final sample of 483 participants.

Design

Cross-sectional surveys were employed for the confirmatory factor analyses and the expert rater survey. For the assessment of the predictive validity of integrated regulation, a prospective survey design was used.

Measures[2]

Demographic variables. All participants were asked to self-report age, gender, and date of birth.

Behavioural regulations in exercise. Constructs from the regulatory continuum, with the exception of integrated regulation, were assessed through the revised Behavioural Regulation in Exercise Questionnaire (BREQ-2, Markland & Tobin, 2004). Participants were required to endorse items on a 4-point Likert-type scale to represent their feelings about participating in leisure-time physical activity, defined as including all sports and physical activities that were really active, such as swimming, jogging, and sports training. The response scale was anchored by *not true at all* (1) and *very true* (4). Intrinsic motivation items included “I enjoy exercise” (α = .87), identified regulation items included “I participate in exercise because I gain a lot of benefits that are important to me" (α = .84), introjected regulation items included "I will feel bad with myself if I do not exercise (α = .83), external regulation items included "I do it because significant others want me to exercise" (α = .80), and amotivation items included "I think exercising is a waste of time" (α = .86). The BREQ-2 subscales have also shown satisfactory internal reliabilities in past research, and confirmatory factor analyses of BREQ-2 data obtained from 194 former GP exercise referral scheme participants indicated that the model had an excellent fit to the data (Markland & Tobin, 2004).

Initial integrated regulation item pool. A pool of 19 items was developed to capture the essence of integrated regulation through an extensive literature search of previous studies that measured integrated regulation (e.g., Pelletier et al., 2004; Mallett et al., 2007) and from a content analysis of definitions in the located literature. These items are shown in Table 6.1. Great attention was paid to content validity, with careful selection of items to ensure representation of essential facets of integration and through the use of multiple expert judges in assessing the representativeness of the items in measuring the construct. Eight experts with high familiarity with SDT and psychometrics were asked to rate the representativeness of each item and items adapted from the BREQ-2 measuring the six motivational orientations specified in the regulatory continuum[3]. For the expert rater study, all items made reference to "a health behaviour" to ensure that ratings of representativeness were not specific to any one behaviour and that the scale could be adapted for use with other health-related behaviours. Ratings were made on a 5-point Likert type scale, anchored by *not at all representative* (1) and *very representative* (5). Means and standard deviations for representativeness ratings were computed to identify those items rated as most representative of the integration construct. The items in the main study referred specifically to leisure-time physical activity behaviour and included “I fully accept exercise as an activity which is truly my own”, and “Doing exercise is a fundamental part of who I am”...

Past physical activity behaviour. A two-item measure of past physical activity behaviour over the previous six months and the past two weeks was used. This enabled a representative estimate of physical activity based on both longer-term and very recent levels of physical activity. The measure was based on the methods of Bagozzi and Kimmel (1995) and Chatzisarantis, Hagger, Smith, and Phoenix (2004). The first item referred to leisure-time physical activity over the previous six months and the second to physical activity over the previous two weeks. Participants were asked to provide the frequency with which they had participated in active sports/vigorous physical activities during their leisure-time and indicated their responses on six-point Likert scales, anchored by *not at all (1)* and *most of the days per week (6)*. The construct, concurrent, and predictive validity of such self-report measures has been established in previous research (e.g., Cale, 1994; Chatzisarantis et al., 2002; Hagger & Chatzisarantis, 2005).

Subjective vitality. Participants responded to Ryan and Frederick’s (1997) subjective vitality scale. This scale consists of seven items, including “I feel alive and vital” and “I have energy and spirit”. Participants rated the vitality items on 7-point scales, anchored by *not at all true* (1) and *very true* (7), in terms of how they applied to the participant and the participant’s life at the present time. The construct and nomological validity of this scale was established by Ryan and Fredrick, and the measure was reported to correlate significantly with an index of self-determination.

Life satisfaction. Diener, Emmons, Larson and Griffin’s (1985) Satisfaction with Life Scale (SWLS) was employed. The measure contains five items, including “In most ways my life is close to my ideal” and “I am satisfied with my life”. Participants were asked to indicate their agreement with each item by circling the appropriate number on the 7-point

Likert response scales provided. The response scale was anchored by *strongly disagree* (1) and *strongly agree* (7). The SWLS has demonstrated high internal consistency, temporal reliability and concurrent validity with other measures of subjective well-being (Diener et al., 1985).

Flow state scale. Participants completed items measuring the challenge-skill balance, paradox of control, action-awareness merging, and autotelic experience subscales from Jackson and Marsh's (1996) Flow State Scale (FSS) for physical activity and sports contexts in relation to their leisure-time active sports and/or vigorous physical activities. These subscales were considered most closely conceptually related to integration. Example items from the FSS are "I was challenged, but I believed my skills would allow me to meet the challenge" (challenge-skill balance), "I felt in total control of what I was doing" (paradox of control), "I performed automatically" (action-awareness merging), and "I loved the feeling of that performance and want to capture it again" (autotelic experience).Participants were asked to respond to each item on a five-point Likert scale, anchored by *strongly disagree* (1) and *strongly agree* (5). Internal consistency estimates for the FSS were adequate when the scale was administered to a sample of 394 athletes and confirmatory factor analyses supported the hypothesised structure of the scale (Jackson & Marsh, 1996).

Prospective exercise behaviour. A two-item retrospective measure of exercise behaviour was used at the second wave of data collection. This measure referred to the four week period intervening between the completion of the initial questionnaire and the administration of the follow-up behavioural measure. Participants were informed that the two questions related to their leisure-time physical activity over the last four weeks, and this was defined as including all sports and physical activities that were really active, such as swimming, jogging, and sports training. The items were "In the course of the past four weeks, how often have you participated in leisure-time physical activity for 20 minutes at a time?", rated on a 6-point Likert-type scale with endpoints *never* (1) and *everyday* (6), and "I engaged in leisure-time physical activity for 20 minutes at a time the past four weeks with the following regularity", rated on a 6-point Likert-type scale with endpoints *everyday* (1) and *almost never* (6). The latter item was reverse coded. Factor analytic studies have supported the construct validity of such measures in indicating latent behavioural variables (Hagger & Chatzisarantis, 2005) and the concurrent and criterion validity has been confirmed against more objective measures, for instance heart rate monitoring (Cale, 1994).

Procedure

Participants were asked to complete the questionnaires in a quiet environment. The questionnaire was presented as a survey on leisure-time physical activity. In accordance with the British Psychological Society guidelines and those of the institution in which the research was based, participants provided informed consent, were informed of their right to withdraw from the study at any time and all data were collected anonymously to preserve confidentiality. Participants were asked to consider the active sports and/or vigorous physical activities that they might do during their leisure-time and to respond to the questions using this conceptualisation. A definition of active sports and/or vigorous physical activities was provided. The behavioural follow-up measure was administered four weeks following the initial questionnaire. Data from the two waves were matched using anonymous identifiers.

Data Analysis

To test the adequacy of the hypothesised models in accounting for the observed variance and covariance matrices and the construct and discriminant validity of the integrated regulation construct, confirmatory factor analyses (CFAs) were conducted using the EQS v.6.1 computer software (Bentler, 2004). Multi-sample invariance analyses were employed to test the invariance of the factor structure, factor loadings, factor variances, and factor covariances of the regulatory constructs across the high-active and lower-active samples.

Latent means analyses were also conducted to test the invariance of factor intercepts and latent factor means across the samples. In order to protect model estimation from violations of the assumption of normality, a robust maximum likelihood method was employed (Satorra & Bentler, 1988). Model fit was assessed using multiple indices of good fit: comparative fit index (CFI; Bentler, 1990), the non-normed fit index (NNFI; Marsh, Balla, & McDonald, 1988), the standardised root-mean square of the residuals (SRMR; Hu & Bentler, 1995), and the root-mean square error of approximation (RMSEA; Hu & Bentler, 1999) with its 90% confidence intervals (90% CI). For the latent means analysis, the McDonald fit index (MFI; McDonald, 1989) and Akaike's information criterion (AIC; Akaike, 1987) were used. The value of .90 has been suggested as the minimal indication of good fit for the CFI and NNFI indexes (Bentler, 1990), although Hu and Bentler (1999) proposed that values in excess of .95 are representative of a well-fitting model. For the SRMR and RMSEA, values below .08 and 0.5 respectively denote acceptable model fit (Hu & Bentler, 1999). For the MFI, Hu and Bentler (1999) suggested a cut-off score of .89 in representing a well-fitting model, while smaller values for the AIC represent a better fit (Hu & Bentler, 1995). In terms of the multi-sample analyses, Cheung and Rensvold (2002) suggested that a change of -0.01 or less in incremental fit indices between baseline and subsequent constrained models supports equivalence across groups. The Lagrange Multiplier (LM) test was used to indicate fixed parameters within the model that would result in a significant change in the goodness-of-fit chi square if released.

Finally, multiple regression analysis was conducted to assess the predictive validity of the integrated regulation measure. The predictive validity of the measure is of particular importance, given its intended use in illuminating the mediating mechanisms of behaviour change interventions.

Table 6.1

Original Item Pool Measuring Integrated Regulation Pertaining to Physical Activity, with Means and Standard Deviations of Expert Ratings of Representativeness (N = 6)

Item number	Item content	Mean	SD
1†	It is an important part of who I am	5.00	.00
2†*	It is essential to my identity and sense of self	4.83	.41
3†	It is part of my 'true self'	4.83	.41
4	Doing exercise is consistent with my deepest principles	4.67	.52
5†	It is an extension of me	4.83	.41
6†	Participating in exercise is an integral part of my life	4.83	.41
7†*	It is genuinely part of me	4.83	.41
8	It is an expression of my essential self	4.50	.84
9	It contributes to my sense of personal well-being	3.00	1.26
10	I fully accept exercise as an activity which is truly my own	4.50	.84
11	Doing physical activity is consistent with the other things I feel are important in my life	4.67	.52
12	I do it freely and entirely out of my own volition and choice	3.83	1.47
13†*	It is consistent with my values, goals and aims in life	5.00	.00
14	I feel truly myself and authentic in my actions when I exercise	4.50	.84
15†	Doing exercise is a fundamental part of who I am	4.83	.41
16	Doing exercise is part of the way I have chosen to live my life	4.67	.52
17†*	Doing exercise and being myself are inseparable	4.83	.41
18	Participating in exercise is congruent with other important aspects of my life	4.67	.52

19	Doing exercise is a means to satisfy my need to choose the activities I do for myself	3.17	.75

Note. †Item retained after expert ratings of representativeness; *Item retained for final four-item integration scale.

Results

Preliminary Analyses

Missing data. Missing data points were resolved through multiple imputation from existing values for closely-related variables using methods advocated by Schafer and Graham (2002) for cases with less than 5% missing data. Six cases with a missing data rate in excess of 5% were excluded from the analysis.

Internal reliability of the integrated regulation construct. Cronbach's alpha (α) was 0.92 for integrated regulation, indicating excellent internal reliability.

Single Sample CFAs

Development of integrated regulation scale items. A set of four core items measuring integrated regulation was developed on the basis of the nine items to which at least 80% of the expert judges assigned the highest rating of representativeness of the construct and using the physical activity data from the lower-active sample. The data from the high-active sample were then used for cross-validation purposes. The initial pool of 19 items, along with means and standard deviations for representativeness can be found in Table 6.1. The nine items rated most representative were set to load on a single latent factor for integrated regulation in physical activity. The loading of each indicant item on the latent factor, the item variance, and error terms associated with each item were freely estimated, except for one loading that was set to unity, as is convention (Jöreskog, 1993). The overall model exhibited good fit with the data, S-B χ^2 = 78.96, df = 27, p < .001; CFI = .98; NNFI = .97; SRMR = .02; RMSEA = .08, 90% CI, lower bound (LB) = .06, upper bound (UB) .10.

Table 6.2

Factor Loadings and Variance Extracted for the Nine Items Rated as Most Representative of the Integrated Regulation Construct by the Expert Raters

Item number	Item content	Factor loading	Variance extracted (%)
1	It is an important part of who I am	.88	77.4
2	It is essential to my identity and sense of self	.92	85.0
3	It is part of my true self	.93	86.1
5	It is an extension of me	.88	77.0
6	Participating in exercise is an integral part of my life	.87	75.6
7	It is genuinely part of me	.91	83.2
13	It is consistent with my values, goals, and aims in life	.73	53.8
15	Doing exercise is a fundamental part of who I am	.91	82.6
17	Doing exercise and being myself are inseparable	.86	72.5

No substantial misspecification was present in the model, as no standardized residuals exceeded 2.00. All nine items demonstrated satisfactory standardized factor loadings (median λ = .88, range .73 to .93, median R^2 = .77), exceeding the recommended minimum of 0.400 (Ford, MacCallum, & Tait, 1986) and the integrated regulation factor accounted for in excess of 50% of the variance in each of the items. Factor loadings and variance extracted by the integrated regulation factor for the nine items are given in Table 6.2. Four items were selected for the final scale in order to provide a measure compatible with the BREQ-2. Items 2 (“It is essential to my identity and sense of self”), 7 (“It is genuinely part of me”), 13 (“It is consistent with my values, goals and aims in life"), and 17 ("Doing exercise and being myself are inseparable") were selected as the core set of items to assess integrated regulation. These four items exhibited substantial factor loadings and >50% average variance extracted by the integrated regulation factor and, most importantly, their content was deemed to capture the fundamental characteristics of integrated regulation, as described by Deci & Ryan (2000) and Deci, Eghrari, Patrick, and Leone (1994). Only two of the four items with the greatest variance extracted and highest factor loadings were selected because of considerable overlap between three of these items in terms of the facets of integrated regulation represented. A further CFA for these four integrated regulation items was conducted, in which the four items were set to load onto a single factor. This model exhibited good fit to the data, S-B $\chi^2 = 3.15$, df = 2, $p = .21$; CFI = .998; NNFI = .995; SRMR = .01; RMSEA = .04, 90% CI = .00 (LB), .13 (UB).[4] These four items were therefore retained for the final integrated regulation scale.

Nomological and discriminant validity. A CFA model was specified with six factors representing the four-item integration scale and the subscales from the BREQ-2 for the lower-active sample. Correlations between the factors were free parameters in the model, as is convention in CFA models. Overall, the model showed adequate fit to the data, S-B $\chi^2 =$ 377.33, df = 174, $p < .001$; CFI = .93, NNFI = .91; SRMR = .06; RMSEA = .06, 90% CI = .05 (LB), .07 (UB). However, the Lagrange Multiplier (LM) test suggested a problem with the discriminant validity of integration item 13 (see Table 6.1 for description) with intrinsic motivation, as a cross-loading was apparent. Covariances among independent variables were examined to determine the existence of the simplex-like pattern among the six regulatory constructs and to ensure that integrated regulation was appropriately situated on the continuum. Factor covariances can be found in Table 6.3. The simplex-like pattern of the continuum of behavioural regulation was largely supported by the lower-active student data, as constructs situated in close proximity exhibited stronger and more positive correlations, while constructs situated at extreme ends of the continuum showed negative correlations. All regulatory constructs showed discriminant validity, as none of the 95% confidence intervals for the interfactor covariances encompassed unity (Anderson & Gerbing, 1988).[5] Integrated regulation was therefore distinct from its neighbouring constructs, namely intrinsic motivation and identified regulation. However, some correlations between proximal factors, for instance intrinsic motivation and identified regulation, were considerably lower than those reported in previous studies (e.g., Mallett et al., 2007; Markland & Tobin, 2004).

Nomological and discriminant validity with theoretically-related constructs. The nomological and discriminant validity of the integration scale was assessed by examining covariances between the subscale and theoretically-related constructs in the lower-active sample. A model was specified with seven latent factors; integrated regulation, subjective vitality, the four facets of flow, and life satisfaction. Again, correlations between the factors were free parameters in the model. The model showed good fit to the data, S-B $\chi^2 = 515.01$, df = 443, $p = .01$; CFI = .96; NNFI = .96; SRMR = .06; RMSEA = .04, 90% CI = .02 (LB), .05 (UB). Standardized factor loadings for the integrated regulation scale were satisfactory, and the variance accounted for by the latent factor exceeded the 50% minimum criterion for adequacy for all but one item (integration item 13). Factor covariances are shown in Table 6.4. Integrated regulation was significantly and positively associated with all constructs except life satisfaction. Discriminant validity for integrated regulation was also evident as none of the 95% confidence intervals for the interfactor covariances encompassed unity.

Cross-validation in the high-active sample. The CFA model testing the nomological and discriminant validity of the integration construct with the remaining regulatory constructs was cross-validated using the data of the high-active sample. As in the previous analyses, six factors were specified using the integration factor and items from the BREQ-2, and correlations between factors were freely estimated. This model showed adequate fit with the

Table 6.3

Covariances Among Factors Representing the Six Regulatory Constructs

Regulation	1	2	3	4	5	6
1. Intrinsic motivation	-	.12**	.04**	.06**	-.01	-.01**
2. Integrated regulation	.47**	-	.06**	.18**	.01	-.01
3. Identified regulation	.33**	.30**	-	.05**	.01	-.01
4. Introjected regulation	.28**	.31**	.29**	-	.10**	-.01
5. Extrinsic regulation	.02	.09**	.02	.15**	-	.01
6. Amotivation	-.15**	-.06**	-.17**	-.12**	.09**	-

Note. Coefficients below principal diagonal are for the sample comprising lower-active students and members of the general public (N = 299) and above the principal diagonal for the high-active student sample (N = 184). * $p < .05$, ** $p < .01$

data, S-B $\chi^2 = 251.12$, df = 174, $p < .001$; CFI = .92; NNFI = .90; SRMR = .07; RMSEA = .05; 90% CI = .04 (LB), .06 (UB). Factor covariances supported the simplex-like pattern of relationships for the regulatory constructs (Table 6.3). Discriminant validity was evident for all constructs, as none of the 95% confidence intervals for interfactor covariances encompassed unity. However, several correlations between proximal constructs were weak and the fit of the model, although acceptable, was worse than observed with the data of the lower-active sample.

Table 6.4

Covariances Among Factors Representing Integrated Regulation for Physical Activity, Life Satisfaction, Vitality, and the Four Facets of Flow

Construct	1	2	3	4	5	6	7
1. Integrated regulation	-	.02	.19**	.05	.05	.03	.07*
2. Life satisfaction	.15	-	.36**	.15**	.10*	.15**	.13**
3. Subjective vitality	.39**	.53**	-	.11**	.08*	.13**	.13**
4. Challenge-skill balance	.23*	.09	.25*	-	.15**	.18**	.18**
5. Action-awareness merging	.23**	.02	.28**	.34*	-	.21**	.11**
6. Paradox of control	.26**	.19*	.38**	.44*	.38**	-	.20**
7. Autotelic experience	.29**	.20*	.31**	.38*	.32**	.43**	-

Note. Coefficients below principal diagonal are for the lower-active sample (N = 299) and above the principal diagonal for the high-active sample (N = 184). * $p < .05$, ** $p < .01$

Cross-validation with theoretically-related constructs. The model testing the nomological and discriminant validity of the integrated regulation scale with life satisfaction, subjective vitality, and the four facets of flow was cross-validated in the high-active sample. The fit of the model was satisfactory, S-B χ^2 = 577.05, df = 443, p < .0001; CFI = .94; NNFI = .93; SRMR = .06; RMSEA = .04, 90% CI = .03 (LB), .05 (UB). Factor covariances are given in Table 6.4. Integrated regulation was significantly and positively associated with subjective vitality and autotelic experience, but not with the remaining constructs. Despite positive associations with subjective vitality and autotelic experience, integrated regulation still exhibited discriminant validity, as, again, none of the 95% confidence intervals for the inter-factor covariances included unity.

Regression Analysis

The predictive validity of the integrated regulation measure was tested through multiple regression analysis for those lower-active participants who provided follow-up physical activity data. Multiple regression using manifest variables, rather than structural equation analyses using latent variables, was used due to restrictions in sample size. This has the limitation of introducing a modicum of measurement error. However, as factors were very well specified with high factor loadings and average variance extracted in the CFAs, it is unlikely that the findings in analyses using manifest variables were substantially affected by this.

In the regression model, physical activity was regressed on the six regulatory constructs and age. The overall regression model was significant, F (7,144) = 8.84, $p < .001$, $R^2 = .30$. A total of 30.1% of variance in physical activity behaviour was accounted for. The only significant independent predictor of physical activity behaviour was integrated regulation, $\beta = .26$, $p < .05$. Collinearity diagnostics did not indicate any problems with multicollinearity, as the variance inflation factor was substantially lower than the criterion of 10 proposed by Bowerman and O'Connell's (1990). The predictive validity of the integrated regulation measure was therefore supported for physical activity.

Multi-Sample CFAs

Invariance analysis. Multi-sample CFA analyses were conducted to test the invariance of the PLOC continuum for physical activity across the high-active and the lower-active samples. For invariance to be established, Byrne, Shavelson, and Muthén (1989) stated that invariance of factor loadings was the minimum acceptable criterion. In the first instance, a baseline model was estimated in the high-active and lower-active samples to determine whether the factor pattern for the regulatory constructs was invariant across samples. The same model was specified as in previous analyses, with six latent factors representing the six regulatory constructs and the same indicant items. This baseline model exhibited satisfactory fit to the data, supporting the feasibility of the factor pattern across samples, S-B χ^2 = 609.66, df = 346, $p < .001$; CFI = .93; NNFI = .92; SRMR = .07; RMSEA = .06, 90% CI = .05 (LB), .06 (UB). The second step constrained factor loadings to be equal across samples. This analysis yielded a good fit, S-B χ^2 = 642.34, df = 361, $p < .001$; CFI = .93; NNFI = .92; SRMR = .08, RMSEA = .06, 90% CI = .05 (LB). According to Cheung and Rensvold's (2002) invariance criterion, it was concluded that the factor loadings were invariant across the samples.

In the third step, factor variances were also constrained to be equal across groups. This model yielded suboptimal goodness-of-fit statistics, S-B χ^2 = 802.63, df = 367, $p < .001$; CFI = .89; NNFI = .87; SRMR = .51; RMSEA = .08, 90% CI = .08 (LB), .09 (UB). As incremental fit indices showed a decrease well in excess of Cheung and Rensvold's .01 criterion, some degree of noninvariance was apparent. Examination of the LM-test for releasing constraints indicated that the factor variances for intrinsic motivation, integrated regulation, identified regulation, introjected regulation, and amotivation factors were noninvariant.

In the final stage, factor covariances were constrained to be equal across the groups. This resulted in a model that exhibited inadequate fit with the data, S-B χ^2 = 875.43, df = 382, $p < .001$; CFI = .87; NNFI = .86; SRMR = .35; RMSEA = .07, 90% CI = .07 (LB), .08 (UB). The LM-test for releasing constraints indicated that the covariance between intrinsic motivation and introjected regulation and the covariance between integrated regulation and amotivation were non-invariant.

Latent means analysis. To further explore potential differences across the high-active and lower-active samples in mean levels of the six regulatory constructs a latent means analysis was performed. This analysis tests for differences in the latent means of factors across groups by evaluating the invariance of the reproduced indicator item means (intercepts) and latent variable means. Model comparisons were evaluated using the AIC, ECVI, and RMSEA. A baseline model was specified such that items loaded onto their respective factors in the same way as the previous CFA models for the regulatory continuum, but with a constant specified within each equation. Variances were freely estimated for disturbance and error terms and constraints were specified to restrict factor loadings as invariant across the groups, as parameters determined as invariant in the multi-sample analysis should be retained in latent means analyses. This initial model exhibited satisfactory fit with the data, S-B χ^2 = 540.62, df = 349, $p < .001$; AIC = -157.38; MFI = .82; SRMR = .08; RMSEA = .05, 90% CI = .04 (LB), .06 (UB), indicating that the pattern of structured means was supported across the groups.

In the next step of the latent means analysis, item means (intercepts) were constrained to zero. Consistent with the baseline model, factor loadings were constrained as invariant across the groups. The resultant model exhibited adequate fit with the data, S-B χ^2 = 582.52, df = 355, $p < .001$; AIC = -127.48; MFI = .79; SRMR = .08; RMSEA = .05, 90% CI = .04 (LB), .06 (UB) and suggested that there were few substantive differences in the intercept means across samples. The lower-active sample was designated as the reference group for comparisons (Byrne, 1994). Comparisons revealed that the high-active students rated the intrinsic motivation (latent mean difference (LMD) = 24.31, SE = .07, $p < .01$), integrated (LMD = 35.09, SE = .04, $p < .01$), identified (LMD = 26.41, SE = .07, $p < .01$), introjected (LMD = 40.87, SE = .04, $p < .01$), and extrinsic regulation (LMD = 16.18, SE = .05, $p < .01$), and amotivation (LMD = 4.98, SE = .10, $p < .01$) scales higher than the lower-active sample.

In the final latent means analysis model, both item means (intercepts) and latent means were constrained as invariant across the groups. This model exhibited satisfactory fit with the data, S-B χ^2 = 819.35, df = 370, p < .001; AIC = 79.35, MFI = .63, SRMR = .18; RMSEA = .07, 90% CI = .06 (LB), .08 (UB). However, a decrement in fit was evident in comparison to the original baseline model as the AIC was substantially larger in this constrained model. The LM-test for releasing constraints revealed that releasing the six parameters constraining the latent means of the six factors as invariant across the groups would result in a substantial increase in goodness-of-fit of the model. This corroborated the mean comparisons made in step 2, supporting the significantly higher mean levels for the behavioural regulation factors in each sample.

Discussion

The present study adopted a rigorous, a priori, hypothesis-testing confirmatory factor analytic approach to the development of an integrated regulation scale for use in physical activity. The integrated regulation scale was developed from first principles as a mark of rigor to ensure that the various facets of integrated regulation, as defined by Deci and Ryan (2000) and Deci and colleagues (1994), were captured. The initial item pool was developed from an exhaustive literature search to identify previous measures and definitions of integrated regulation in the physical activity and sport domains. Six experts in SDT rated the nineteen items for their representativeness of integrated regulation and four of the most highly rated items were selected for the final scale, on the basis of their capturing the essence of integrated regulation. This focus on the face validity of items in representing the underlying construct follows Wilson and co-workers' (2006) recommendation that further research on the development of measures of behavioural regulation for physical activity should closely examine item-content relevance and the representation of constructs.

The newly-developed four-item integrated regulation scale exhibited factorial validity through a series of confirmatory factor analyses. Although there was some cross-loading of one item (item 13) with intrinsic motivation, this item was retained because it represents a fundamental aspect of integration and reflects Deci and Ryan's (2000) definition of the assimilation process as bringing identified regulations into congruence with other values and needs. Nomological validity was also demonstrated for the scale. A simplex-like structure was evident for the regulatory constructs, with integrated regulation emerging as appropriately situated on the continuum, i.e., factor covariances were positive and strongest with its neighbouring constructs, while negative associations were apparent with constructs located at the distal end of the continuum. However, the simplex-like structure was more apparent in the data of the lower-active sample and only partially supported by the high-active sample data. Nomological validity for the integrated regulation scale was also supported through confirmatory factor analyses specifying latent factors representing six constructs theoretically-related to integrated regulation alongside the latent integrated regulation factor.

The integrated regulation factor also exhibited positive and significant covariances with five of these constructs in the lower-active sample and with two of these constructs in the high-active sample. The finding of less significant covariances between integrated regulation and the six theoretically-related constructs in the high-active sample than in the lower-active sample could reflect that integrated regulation is more fully developed in the former population and therefore more distinct from other related constructs.

Importantly, the integrated regulation factor covaried positively and significantly with facets of flow, which has been viewed as an important motivational consequence by researchers adopting a SDT perspective (e.g., Kowal & Fortier, 1999). Despite significant factor covariances, none of the covariance confidence intervals encompassed unity, thus discriminant validity was also established for the integrated regulation scale. Crucially, discriminant validity was demonstrated between integrated regulation and the two other most autonomous forms of regulation from SDT, namely, intrinsic motivation and identified regulation, which have frequently been found not to be statistically discriminable in previous research in sport and exercise (e.g., Lonsdale et al., 2008; Mallett et al. 2007).

Multi-sample invariance analyses supported the invariance of the factor pattern and factor loadings for the regulatory constructs for across the high-active and lower-active samples, thereby confirming the factorial validity of the integrated regulation scale. However, factor variances and covariances did not demonstrate invariance across the samples. The differing patterns of covariance between regulatory constructs in the two samples may reflect that the intrinsic, integrated, and identified constructs are more differentiated in high active individuals. Further support for the validity of the scale was provided through latent means analysis, as latent mean estimates indicated that the high-active sample reported significantly greater levels of integrated regulation than the lower-active sample, which is consistent with physical activity becoming assimilated with the self and constituting an integral part of the lifestyle of the former group. The latent mean estimates also revealed that the high-active group reported significantly higher levels in the other regulatory constructs, including the controlling forms of motivation. These findings are counterintuitive, as high-active individuals would be theorised to report significantly lower levels of controlling motivation than individuals for whom physical activity may be less fundamentally important and self-defining. However, it is feasible that the high-active individuals may be more motivated to avoid the shame and guilt associated with inactivity, to obtain self-worth from engaging in physical activity and to attain tangible rewards associated with physical activity and sport, which could underlie these elevated levels of introjected and external regulations. The finding that the high-active sample also reported significantly greater amotivation is more problematic. A speculative explanation for this relates to the nature of the amotivation items. The amotivation scale from the BREQ-2 reflects non-intentionality with respect to behaviour and is supposed to represent a lack of motivation. However, one possibility is that people who are intrinsically motivated may endorse these items because they reflect the spontaneous attraction that behaviours that are intrinsically appealing have for such individuals. For example, these individuals may be intrinsically attracted physical activity rather than consciously intending to participate. It is possible therefore that some amotivation items may tap less conscious, implicit motivational factors that lead to behavioural engagement.

In terms of the predictive validity of the scale, integrated regulation emerged as the only significant independent predictor of physical activity behaviour in a sub-sample of the lower-active individuals. Results therefore not only suggest that integrated regulation is a valid construct in this domain, in contrast to the assumptions of much previous research (e.g., Pelletier et al., 1995) but also that it is predictive of physical activity behaviour, consistent with the findings of Wilson and colleagues (2006). However, the measure of integrated regulation in the present study confers advantages over that developed by Wilson and colleagues as it was developed from first principles to ensure representation of the essence of the construct and validated in a more diverse sample. Further, the present study provided greater evidence for the nomological validity of the scale.

The measure of integrated regulation developed in the present paper has great potential as a means to assess the extent to which controlling forms of regulation are internalised and become integrated into a person’s repertoire of behaviours to satisfy fundamental psychological needs. Given the importance of autonomous forms of motivation, such as integrated regulation, in predicting behavioural persistence and quality and psychological well-being in physical activity (e.g., Standage, Duda & Ntoumanis, 2005; Thøgersen-Ntoumani & Ntoumanis, 2006), the development of a valid measure of this construct is essential in evaluating interventions targeted at changing motivation for physical activity. Incorporating the present measure of integrated regulation within SDT-based questionnaires for physical activity will also increase the fidelity of measurement instruments in SDT. Although Lonsdale and colleagues (2008) incorporated a measure of integrated regulation in their behavioural regulation in sport (BRSQ) instrument, they advised against the use of this measure in a physical activity context, as it was specifically developed for use with competitive sports participants, and recommended context-specific instruments. The present study meets that need by providing a valid measure of integrated regulation and situating it amongst established measures of the other regulatory constructs from OIT to facilitate the comprehensive measurement of behavioural regulation in physical activity.

Limitations, Conclusions, and Recommendations for Further Research

The development of the integrated regulation measure focused on establishing initial validity of the instrument and did not assess forms of reliability beyond the internal consistency. Future research should assess the test-retest reliability of the scale. Further, results on the prediction of prospective physical activity should be interpreted with a degree of caution until findings are replicated using more objective measures of behaviour, as common method variance may have artificially inflated the relationships (Pedhazur & Schemlkin, 1991). The present study was also limited by the adoption of correlational cross-sectional and prospective methods. It would be valuable to employ cross-lagged panel designs in future studies utilising the integrated regulation subscale to assess the dynamics of integrated regulation over time. It would also be important to employ the scale alongside interventional methods manipulating autonomy in physical activity to examine the sensitivity of the scale to measuring the internalisation process and the role of integrated regulation as a mediator of behaviour change. Nevertheless, the present study has provided evidence to support the validity of the integrated regulation scale for physical activity, demonstrated its structural invariance across two diverse samples, its ability to distinguish between high-active and lower-active samples, and has provided some support for its predictive utility.

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Footnotes: Chapter 6

[1]The simplex-like structure of the continuum refers to the expectation that constructs located adjacent to each other will exhibit strong positive relationships, while constructs situated further apart will show weaker positive associations and constructs at opposite poles will be unrelated or negatively related.

[2]The full questionnaires are provided in Appendix 4.

[3]For the expert rater survey, eight experts in SDT, working at several universities in the United Kingdom, were contacted via email and informed about the purpose of the study and the expert survey that they were invited to complete; 75% agreed to assist with rating the content validity of items measuring the SDT motivational constructs. These experts were asked to rate each item for the degree to which it was representative of each of the six regulatory constructs from the PLOC. Ratings were obtained using a 5-point Likert scale anchored by *very unrepresentative (1)* and *very representative (5).* Mean representativeness ratings are provided in Table 6.1. Items pertaining to integrated regulation that received a rating of very representative of this construct from at least 80% of the experts were retained for further analysis. This resulted in items 1, 2, 3, 5, 6, 7, 13, 15, and 17 being retained. Two of these items (items 1 and 13) received the highest possible representativeness rating from all six SDT experts. For all further analyses, only these nine items rated as most representative of integrated regulation were included.

[4]The factorial validity of the final set of four integrated regulation items was also replicated for dieting behaviour (see Appendix 3).

[5]The nomological and discriminant validity of the integrated regulation measure with the other constructs from the regulatory continuum was replicated for dieting behaviour (see Appendix 3).

Chapter 7

Effects of an autonomy-supportive intervention on tutor behaviors in a higher education context

McLachlan, S., & Hagger, M. S. (2010). Effects of an autonomy-supportive intervention on tutor behaviours in a higher education context. *Teaching and Teacher Education, 26*, 1204-1210.

Abstract

Empirical evidence has attested to the benefits of autonomy support in a classroom context, in facilitating students' autonomous motivation, well-being, creativity, engagement, and persistence. However, most interventional research aiming to increase teachers' autonomy-supportive behaviors has been conducted in school and college contexts, with few studies aimed at university tutors. The current study implemented a brief theory-driven autonomy-supportive intervention in university seminars and developed an observational checklist instrument to assess behavior change. Tutors who received brief training in autonomy-supportive teaching techniques showed significant increases from baseline in two important autonomy-supportive behaviors in their classes. However, students of the tutors assigned to the intervention condition did not report significantly greater perceived autonomy support or autonomous motivation relative to a control group, nor did these students achieve significantly higher coursework grades. Potential implications and suggestions for further development of the intervention are discussed.

Keywords: motivation; autonomy support; intervention; behavior change

Introduction

Research in the educational domain has shown that the nature of students' motivation, in addition to its intensity, is fundamentally important in determining well-being, persistence, and achievement-related outcomes (e.g., high grades and attainment) (e.g., Black & Deci, 2000). Empirical studies have documented a range of benefits of motivational interventions for school and college students, including engagement with learning material (Reeve, Jang, Carrell et al., 2004), depth of processing, test performance, and persistence in educational tasks and work (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). However, there is a dearth of literature exploring the effects of such interventions within higher-education and university contexts. It is important that motivational interventions are developed for university students, particularly as university provides a very different learning context to the environment in educational institutions with which students were previously familiar. Self-regulated learning is greater within the university than the school or college contexts and autonomous motivation may therefore become particularly important in sustaining independent learning.

Self-Determination Theory and Motivational Interventions in Education

Many motivational interventions implemented within educational contexts have been grounded in a macro theory of human motivation, known as self-determination theory (SDT; Deci & Ryan, 1985; 2000). Self-determination describes a state in which one's behavior is endorsed by the self at the highest level of reflection and a sense of freedom to engage in activities that are interesting, personally-valued, and vitalising is experienced (Deci & Ryan, 1985). One of the key postulates of SDT is that humans are innately predisposed towards the mastery of challenges and psychological growth, but that these processes require the satisfaction of three fundamental psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2000). SDT also proposes a broad distinction between intrinsic and extrinsic motivation, which is particularly pertinent to the need for autonomy, or the desire to experience behavior as self-initiated and self-regulated (Deci & Ryan, 1985, 2000). Intrinsic motivation supports autonomy and is characterised by engaging in behavior for the sake of the behavior itself and for the outcomes of enjoyment, satisfaction, and fulfilment. Extrinsic motivation is evident when behavioral engagement is driven by factors external to the self, such as gaining social approval and avoiding punishment. Deci and Ryan also differentiate between four types of extrinsic motivation: integrated, identified, introjected, and external regulation. These forms of behavioral regulation are situated on a continuum that extends from intrinsic motivation to external regulation. Movement along the continuum of behavioral regulation from extrinsic to intrinsic motivation is enabled through the process of internalisation, in which an activity or behavior is gradually assimilated to the self, to become consistent with existing values and goals. Integrated regulation represents the most internalised form of extrinsic motivation, whereby behavior becomes compatible with one's values, goals, and aspirations.

Determining the quality of motivation underlying behavior is critically important, as the various types of behavioral regulation described by Deci and Ryan (1985, 2000) incur different consequences on behavioral quality, persistence, and well-being. Intrinsic motivation is consistently associated with more effective learning, stronger engagement in behaviors and tasks, higher quality performance, greater behavioral persistence, and superior psychological health, relative to extrinsic motivation. The systematic differences between outcomes of intrinsic and extrinsic motivation have emerged across a variety of domains, including education, work, and health (Assor, Kaplan, Kanat-Maymon, & Roth, 2005; Edmunds, Ntoumanis, & Duda, 2008). It is therefore highly desirable to foster intrinsic motivation in students, in order to maximise their productivity and achievement potential and to ensure their well-being.

Ryan and Deci (2000) emphasise the importance of social context in facilitating the satisfaction of the aforementioned fundamental needs and distinguish between two types of environment that are likely to influence need satisfaction. First, autonomy-supportive environments acknowledge the perspective of the individual and empower them with a sense of choice over their behavior. This type of environment is likely to promote self-determined or autonomous motivational states and psychological need satisfaction. Second, controlling environments indicate to the individual that the control over their behavior is likely to emanate from outside the self and as such is not congruent with the need to be the origin of one's actions. Such environments lead individuals to experience conflict and pressure, likely reduce self-determined or autonomous motivational states, and thwart the satisfaction of psychological needs.

As studying behavior is unlikely to be intrinsically motivated, it is important to implement support for students' autonomy in their educational environment, in order to facilitate a process of internalisation. Deci, Eghrari, Patrick, and Leone (1994) found that three contextual factors are necessary for developing an autonomous motivational style and promoting internalisation, namely provision of a meaningful rationale, acknowledging the actor's feelings, and conveying a sense of choice. Deci and colleagues argued that the absence of two of these factors from the environment is likely to reduce autonomous motivation and can lead to maladaptive behavioral and psychological outcomes. These factors have been utilised in the development of autonomy-supportive techniques, which aim to nurture individuals' inner endorsement of their activities. The provision of autonomy support has been associated with well-being, behavioral quality, and persistence across a range of domains. Empirical evidence has shown that students with autonomy-supportive teachers experience greater autonomy and more positive functioning in terms of classroom engagement, emotionality, creativity, intrinsic motivation, psychological well-being, conceptual understanding, academic achievement, and persistence in school relative to students with controlling teachers (e.g., Hardre & Reeve, 2003). Interventions to increase teachers' autonomy support in the classroom have also yielded encouraging results in terms of improving the learning, persistence, and achievement outcomes of students (e.g., Vansteenkiste et al., 2004). Similar findings have been obtained for health-related behavior in improving adherence and promoting more effective self-regulation (Hagger, Wood, Stiff, & Chatzisarantis, 2009). Chatzisarantis and Hagger (2009), for example, showed that the implementation of an autonomy-supportive style within physical education increased both students' intentions to engage in leisure-time physical activity and their actual physical activity participation. The beneficial effects of autonomy support have also been established as stable across different cultures (e.g., Chirkov & Ryan, 2001).

Modification of Teachers' Behaviors to Support Students' Autonomy

Autonomy-supportive interventions have illustrated that it is possible to modify instructors' autonomy-supportive behaviors through training. For instance, Reeve (1998) successfully increased the autonomy-supportive behaviors of a sample of preservice teachers through an intervention based on a training workbook, but found that teachers who were autonomy-oriented assimilated the information more easily than those who were control-oriented. Reeve and colleagues (2004) also showed that teachers who received training in autonomy-supportive methods increased their autonomy-supportive behaviors from baseline measures, as assessed by rater observation. Interventions have also demonstrated the feasibility of manipulating instructors' behaviors in physical activity and physical education contexts to become more autonomy-supportive through SDT-based training (e.g., Edmunds et al., 2008; Tessier, Sarrazin, & Ntoumanis, 2008). However, the interventions in the academic domain have exhibited some methodological limitations. Reeve's (1998) findings were based on teachers' self-reports of their autonomy-supportive behavior which could have introduced the problem of social desirability bias, while Reeve and colleagues' (2004) intervention adopted four broad bipolar category descriptors with a seven-point rating scale for behavioral assessment that did not fully encompass all potential autonomy-supportive behaviors. Further, Reeve (1998) did not provide full details of the autonomy-supportive instructional strategies that participants were exposed to.

As the majority of this research has employed teachers of school and college students, the present intervention aimed to assess whether a brief SDT-based autonomy-supportive intervention was effective in changing tutors' behaviors to become more autonomy-supportive within a university teaching context. The intervention also aimed to extend previous research in the area by targeting a comprehensive set of autonomy-supportive behaviors identified empirically by Reeve and Jang (2006) as supporting students' autonomy, and incorporating both verbal and non-verbal autonomy-supportive and controlling behaviors, in contrast to the training provided in previous interventions (e.g., Tessier et al., 2008). The training provided within the intervention was also of a briefer nature than that adopted in previous studies (e.g., Reeve at al., 2004), to determine the efficacy of a short and less intrusive training programme to change tutors' behavior. Further, this research endeavoured to develop a more accurate and reliable system of evaluating the fidelity of our intervention to change tutors' autonomy-supportive behavior than those employed previously, through obtaining precise individual ratings for specific behaviors. Through behavioral observation and systematic recording we expected to avoid the potential for social desirability problems associated with the use of self-report measures. This intervention therefore aimed to both extend the application of self-determination theory to a university teaching intervention context and to provide a model for behavior change that could be applied to facilitate autonomy-supportive teaching across a range of settings. For example, teachers could implement these techniques within their everyday lessons, and educators of teachers could also use the model to inform teachers of how to become more autonomy-supportive.

Furthermore, while the beneficial effects of autonomy-supportive teaching on students' motivation creativity, engagement, learning, persistence, and achievement are well documented in the literature (e.g., Black & Deci, 2000; Reeve et al., 2004; Vallerand, Fortier, & Guay, 1997), there is a relative dearth of research exploring the impact of autonomy support on motivational and educational outcomes in a higher education context. The present study therefore also assessed the effects of the autonomy-supportive intervention on the motivation and achievement of the tutors' students.

It was hypothesised that tutors who received the SDT-based autonomy support training would significantly increase the level of autonomy support delivered to students from baseline, across a series of three seminars. Specifically, it was predicted that these tutors would demonstrate a significant increase in the autonomy-supportive behaviors targeted for change, such as the use of encouragement, and a significant reduction in the controlling behaviors that they were asked to reduce, for instance by avoiding the use of directives and commands. These changes were assessed through the use of the systematic observational checklist system. No changes in autonomy-supportive or controlling behaviors were expected in the control tutors. It was also hypothesised that the tutors who received training would self-report significantly increased perceived autonomy support (PAS) for their students over time. No such differences in PAS were expected in the control tutors.

In terms of the predicted effects of the intervention on student outcomes, students in the experimental (autonomy support) condition were expected to internalise their extrinsic motivational orientations for studying and progress to a more internalised state (i.e., their reasons for studying would shift along the self-determination continuum to a more autonomous form of behavioural regulation), whereas students in the control condition were not expected to show any significant increase in autonomous motivation. It was hypothesised that students in the experimental condition would also report a significantly greater increase in perceived autonomy support from pre- to post-intervention than students in the control group. Finally, it was hypothesised that the students' grades would be predicted by experimental condition, such that students allocated to the experimental group would attain higher grades than those in the control group, while controlling for age and past achievement.

Method

Participants

Nine postgraduate tutors were recruited into the study from one UK University, through volunteer sampling. The sample consisted of two males and seven females, with a mean (SD) age of 26.44 (3.75) years. The tutors had a mean (SD) level of teaching experience of 13.94 (16.93) months. Seven of the tutors led seminars in Psychology, one tutor led seminars in Statistics, and one tutor delivered seminars in Film Studies. Student participants were recruited through their class tutor. The students (N = 103; males n = 40, females n = 63; M age = 19.27 years, SD = 2.11) were largely undergraduate subsidiary students studying psychology or film studies as an additional option alongside their main degree (N = 99) and the remaining participants were psychology undergraduates enrolled on a research methods course (N = 4). The experimental group consisted of 64 participants (males n = 27, females n = 37; M age = 19.25 years, SD = 1.54) and the control group comprised 39 participants (males n = 13, females n = 26; M age = 19.31 years, SD = 2.82).

Design

The study employed a prospective experimental intervention design, with three waves of data collection. Baseline behavioral data were collected at time 1, followed by post-interventional data at times 2 and 3. Each wave of data collection was separated by a two-week interval.

Measures

Tutor Measures

Behavioral assessment. A list of target behaviors to be modified in the experimental tutors was developed on the basis of the autonomy-supportive behaviors documented by Reeve and Jang (2006). Those behaviors that Reeve and Jang reported to account for significant unique variance in students' perceived autonomy were categorised as "primary autonomy-supportive behaviors", as these were viewed as those behaviors most important in delivering autonomy-supportive teaching. Those that had only been established as significantly associated with students' perceived autonomy, rather than accounting for unique variance in this outcome in multivariate analyses were classed as "secondary autonomy-supportive behaviors". The primary behaviors included provision of a meaningful rationale, defined as providing students with a personally meaningful explanation for what they are doing, the amount of time students spent talking in class, and the frequency of encouragements offered to boost or sustain students' engagement. Examples of the secondary behaviors include avoidance of directives and commands in engaging students in a task, acknowledgement of the students' perspective through empathic statements, and the offering of hints on how to make progress when students encountered difficulties. A full list of these behaviors, with details of their operationalisation, can be found in Table 7.1. This list was used in the training of the tutors and also served as an observational checklist for assessing the fidelity of the experimental tutors to the intervention during the seminars.

Perceived autonomy support. A self-report measure of PAS was also developed for the tutors, using the fourteen primary and secondary behaviors from the checklist as items. This measure was intended to reflect the degree to which tutors felt that they were implementing autonomy support within their classes. Tutors were asked to express the extent to which they exhibited each of the autonomy-supportive and controlling behaviors, using a four point Likert scale with the anchors *not true at all (1)* and *very true (4)*. Items included "I offer my students encouragement while they are working on tasks", "I make statements that show empathy with my students and demonstrate that I can see things from their point of view", and "I frequently tell my students that they *should, must* or have *got to* do something". Items reflecting controlling behaviors, such as the latter item, were reverse-scored such that higher scores reflected greater autonomy support. Demographic data on gender, age and number of months of teaching experience were also requested from the tutors.

Student Measures

Academic motivation. The Academic Motivation Scale (AMS-C 28, Vallerand et al., 1993) was used to assess the three types of intrinsic motivation (to know, to accomplish, and to experience stimulation), identified, introjected, and external regulations, and amotivation for studying. The stem required students to consider why they attend university, but students were asked to think specifically about the current module when completing this measure. Four items measured each of intrinsic motivation to know (e.g., "Because I experience pleasure and satisfaction while learning new things"), to accomplish (e.g., "For the pleasure I experience while surpassing myself in my studies"), and to experience stimulation (e.g., "For the intense feelings I experience when I am communicating my own ideas to others"). Four items were also employed to tap each of identified (e.g., "Because eventually it will enable me to enter the job market in a field that I like"), introjected (e.g., "Because I want to show myself that I can succeed in my studies"), and external (e.g., "In order to have a better salary later on") regulations, and amotivation (e.g., "I can't see why I go to university and frankly, I couldn't care less"). The AMS-C 28 was supplemented with the integrated regulation subscale developed in Chapter 6, adapted for a higher education setting (e.g., "Because it is essential to my identity and sense of self"). Items were rated on seven-point Likert scales anchored with *does not correspond at all* (1) and *corresponds exactly* (7). Cronbach's alpha reliability coefficients indicated acceptable internal reliability of all subscales at the three waves of data collection, (α range = .71 to .96). The only exception to this was the intrinsic motivation to experience stimulation subscale at the first wave (α =.63). To reduce the number of variables included within the multivariate analysis, a weighted self-determination index was calculated to represent relative autonomous motivation using the formula reported in Vallerand (1997).

Perceived autonomy support. A measure of perceived autonomy support was also administered, developed from the observational checklist to tap the students' perceptions of the micro-level autonomy-supportive behaviours derived from Reeve and Jang (2006) that the experimental tutors were asked to implement. This scale mirrored the provision of autonomy support scale completed by the tutors. Items included "My tutor shows that he/she can understand things from my point of view" and "My tutor frequently states that I *should, must* or have *got to* do something" (reverse scored), and were rated on four-point Likert scales with end-points *not true at all* (1) and *very true* (4) Cronbach's alpha indicated acceptable internal reliability at the three waves of data collection (all α values > .70).

Perceived competence. The Perceived Competence for Learning Scale (Williams & Deci, 1996) was used to quantify students' feelings of competence towards the module. Items included "I feel confident in my ability to learn this material" and "I am able to achieve my goals in this course" and were rated on seven-point Likert scales anchored by *not true at all* (1) and *very true* (7). Cronbach's alphas for the scale exceeded .90 at all three waves of data collection indicating satisfactory internal reliability.

Tutor relatedness. A four-item measure of tutor relatedness (Furrer & Skinner, 2003) was used to assess the degree to which the tutor supported the students' need for acceptance and belonging within the class. Students were presented with the stem "When I am with my tutor…" and items included "I feel accepted" and "I feel valued". Items were rated on four-point Likert scales, with endpoints *not at all* (1) and *very much*. Cronbach's alphas indicated that the scale showed good internal reliability at all waves of data collection (all α values > .70).

Achievement. Each student's module-specific coursework mark was used as an objective indicator of achievement. This ensured direct correspondence between the autonomy support provided by the tutor within classes and the main outcome variable of academic achievement. All coursework was marked by the tutors using the standardised university marking scheme on a continuous scale between 0 and 100. Tutors were not aware of the research hypotheses and all coursework was moderated by an independent member of the academic faculty.

Past achievement. Students' Advanced-level (A-level) examination grades were obtained to control for previous academic achievement. Points were assigned to each A-level grade in order to calculate a standardised and weighted score for past achievement. For the few students who had completed an alternative course of education (e.g., the International Baccalaureate), an equivalent index of past achievement was calculated, based on the students' levels of attainment. For instance, a grading of "excellent" on the International Baccalaureate was equated with an A grade at A-level.

Procedure

The intervention protocol was approved by the ethics committee of a large University within the UK. Tutors were allocated to either the experimental or control condition through a random number generator (http://www.randomizer.org). This resulted in five tutors being allocated to the experimental condition and four tutors being allocated to the control condition. Each tutor conducted three seminars, the first of which served as a pre-interventional baseline measure. Two observers unobtrusively recorded behaviors using the

Table 7.1.

The Behaviours from the Observational Checklist and Their Operationalisation.

Behaviour	Operationalisation
Primary behaviours	
Offering encouragements	Frequency of statements to boost or sustain the students' engagement, such as "Almost" and "You're close".
Time allowing the student to work in their own way	Cumulative number of seconds the tutor invited or allowed the students to work independently and engage in the task in their own way.
Time the students spend talking	Total length of utterances from students, measured in seconds.
Avoid asking controlling questions	Frequency of directives posed as a question and voiced with the intonation of a question, such as "Why don't you go ahead and tell me?"
Avoid making "should"/ "got to" statements	Frequency of statements that the students should, must, have to, have got to, or ought to do something.
Providing a meaningful rationale	Providing students with a personally meaningful explanation for what they are doing.
Secondary behaviours	
Time spent listening	Frequency with which the tutor carefully and fully attended the students' speech, as evidenced by the number of verbal and nonverbal signals of active, contingent and responsive information processing.

Praise as informational feedback	Frequency of statements to communicate positive effectance feedback about the students' improvement or mastery, such as "Good job" and "That's great".
Offering hints	Frequency of suggestions about how to make progress when the student seems stuck.
Being responsive to student generated questions	Frequency of contingent replies to a student-generated question or comment, such as "Yes, you're right" and "Yes, you have a good point".
Making perspective-acknowledging statements	Frequency of empathic statements to acknowledge the student's perspective or experience, such as "Yes, this is difficult".
Minimise time spent holding/monopolising learning materials	Cumulative number of seconds that the tutor physically holds or possesses learning materials.
Avoid uttering solutions/answers	Number of solutions or answers the tutor provides before the student has the opportunity to discover the answer for himself or herself.
Avoid uttering directives/commands	Frequency of directing (in a controlling manner) or commanding students to engage in a task.

observational checklist (please see Appendix 5) in each tutor's first seminar (time 1) and distributed a questionnaire at the end of the session, which contained the demographics questions and the PAS measure. Following baseline measures, experimental tutors attended two standardized twenty-minute training sessions, with a one-week interval between them. These were group training sessions, so all five tutors attended collectively. The initial session was broken down into four components. Initially, approximately five minutes was spent on presenting the key concepts of self-determination theory. Particular focus was given to the distinction between intrinsic and extrinsic motivation and the role of autonomy support in enabling individuals to become more intrinsically motivated. Autonomy support was described as contextual support that aided students' perception of themselves as the originator and regulator of their behavior. Tutors were informed that autonomy support within the classroom referred to teaching in ways that foster self-determined motivation and help students to endorse their own classroom activities. Next, approximately five minutes was devoted to presenting the benefits of providing autonomy support to students. Examples of empirical evidence were presented, including laboratory and intervention studies that have shown that students with autonomy-supportive teachers experience greater autonomy and more positive functioning in terms of classroom engagement, emotionality, creativity, intrinsic motivation, psychological well-being, conceptual understanding, academic achievement and persistence in school relative to students with controlling teachers (e.g., Black & Deci, 2000; Grolnick & Ryan, 1987; Hardre & Reeve, 2003). Following this, five minutes were spent outlining the behaviors that tutors were asked to modify to become more autonomy-supportive. Tutors were informed that the primary behaviors were of paramount importance, but it would also be useful if they tried to implement as many of the secondary behaviors as possible. As tutors were provided with written materials reinforcing all information introduced within the training session, including details of the target behaviors, the behaviors were presented and described briefly. The behaviors were also to be the focus of the second training session. The remaining quarter of the session was used to answer tutors' questions about the intervention and to reinforce the information presented. Following each component of the session, researchers ensured that the tutors expressed comprehension of the information. At the end of the session, tutors were asked to read the materials that they had been given before the second training session, in order to consolidate their learning. In the second session, a brief summary of the previous session was delivered, followed by an outline of the target behaviors. Tutors were then asked to demonstrate how to put each of the behaviors into practice within a classroom setting, to ensure that they were able to implement the required changes to their teaching practice. Feedback was provided to tutors in an autonomy-supportive manner and additional suggestions for implementing the target behaviors were offered. Finally, the remaining few minutes of the session were used to remind tutors to try their best to maintain these behavioral changes within their teaching sessions and for any contact without students outside the seminar context, for example via electronic mail correspondence. The control tutors received equal contact time with the researchers in their attendance at two group discussion sessions, each of twenty minutes' duration. In these sessions, tutors were asked about their opinions on effective teaching methods, techniques that students could use to maximise their learning, and the best ways of conveying information to students. A full list of the discussion questions used with the control tutors is presented in Table 7.2. Tight controls were put in place to ensure that the motivational content did not transfer from the intervention training sessions to the discussion sessions with the control group. Control tutors were not informed that they were participating in an intervention study and no references were made to self-determination theory, autonomy support or motivation. The researchers emphasised their interest in students' behaviors within the classroom setting, in order to avoid the problem of demand effects from these tutors. Several of the questions also focused solely on student behavior, to prevent over-implicating the tutors in the students' motivation and learning.

Observers attended the second (time 2) and third (time 3) seminars of each tutor to record autonomy-supportive behaviors, assess the fidelity of tutors to the intervention manipulations, and administer questionnaires containing the PAS scale. With the tutors' and students' consent, five of the seminars were videotaped to gain data for inter-rater reliability analyses. Two independent observers recorded the autonomy-supportive behaviors from the videotaped seminars and this data was subjected to inter-rater reliability analysis with the data recorded by the main observers. Tutors were fully debriefed regarding the purposes and hypotheses of the study, after delivering their third seminar. At debriefing, the control and experimental tutors were asked about their familiarity with self-determination theory prior to the intervention and indicated that they had not been familiar with the concepts and ideas introduced.

Students were assigned to either the experimental or control group through a randomised cluster experimental design, as assignment was dependent on the allocation of their tutor. Students completed a baseline questionnaire containing measures of their academic motivation, perceived competence, tutor relatedness, and PAS at the end of the class at the first wave of data collection before the autonomy-supportive intervention was implemented (time 1). At the end of the subsequent class, following the implementation of the intervention, students completed the questionnaire again (time 2). After the third class students completed the questionnaire for the final time (time 3). Prior to data collection, participants provided informed consent to participate in a study on academic motivation and studying behaviour and were informed of their right to withdraw at any time. Participants also provided consent to access their coursework grades for the module. The students did not receive any tangible incentives for participation and questionnaires were completed in the absence of the tutors. Anonymity was preserved as questionnaires were matched using a unique code provided by each student. This code was also used to match coursework grades to students' questionnaire data and this process was completed by an independent researcher.

Table 7.2.

Discussion Questions Used With the Control Tutors

Session 1: Teaching experiences and methods
1. What kind of teaching methods do you employ in your classes? Can you give examples?
2. How do you try to engage your students?
3. How do you think you can help students to learn effectively?
4. What do you feel are the biggest challenges you face in your teaching?
5. What do you think is the best way of conveying information to your students, e.g., visual, verbal?
6. How do you take account of the possibility that your students may have differing levels of knowledge and may learn at different rates?
Session 2: Student behaviour and learning
1. What do you think students feel are good qualities for a tutor to have?
2. How do you think students can maximise their learning?
3. How do you think you can facilitate your students to work effectively outside the classroom environment?
4. What student behaviours do you think obstruct their learning experience in class?

Data Analysis

All observational data was averaged between raters for each class, to obtain mean values for the tutor behaviors. Tests of homogeneity of variance and normality of distribution were conducted for the behavioral data and the PAS for each wave of data collection.

Levene's test supported the homogeneity of variance between groups for all but one case, while the Kolmogorov-Smirnov test indicated that data were normally distributed in all cases except four. In cases in which small deviations from normality were observed, ANOVAs were still conducted as this analysis is robust to deviations from normality (Field, 2005). Change in PAS was calculated between each wave of data collection and one-way ANOVAs were used to determine whether the two groups exhibited significantly different patterns of change in this variable across the intervention. Mixed model ANOVAs were employed to assess whether interactions between experimental condition and wave of data collection were present for the objectively-measured autonomy-supportive behaviors. Independent- and related-samples *t*-tests were used to probe significant interaction effects and main effects of time. For the dichotomous provision of rationale variable, chi-square analyses were employed to test for significant differences between the two groups of tutors.

With regard to the analysis of the student data, two 2 x 3 mixed-model ANOVAs tested for significant differences in change in perceived autonomy support and relative autonomous motivation from pre- to post-intervention between the two groups. The within-participants variable in the ANOVAs was the wave of the intervention and the between-participants variable was intervention condition (experimental or control). Hierarchical multiple regression analyses were employed to examine the prediction of module-specific coursework marks from experimental condition, the forms of behavioural regulation from the AMS, and integrated regulation while controlling for age and past achievement.

Results

Preliminary Analyses: Tutor Data

Internal reliability of PAS. The PAS scale demonstrated good internal reliability, $\alpha = .89$.

Teaching experience. An independent samples *t*-test indicated that there was no significant difference in teaching experience between the experimental and control tutors.

Inter-rater reliability. Inter-rater reliability analyses were conducted, in order to assess the reliability of the observational checklist system for recording behavior. The behavioral data were divided into three classes for these analyses: dichotomous variable, time data, and frequency data. For the dichotomous variable, there was 100% agreement between the four raters across the seminars. Intraclass correlations of .99 and .97 were obtained for the time and frequency data, respectively, indicating high inter-rater reliability.

Preliminary Analyses: Student Data

Student attrition. Of the 103 participants who completed the questionnaire at time 1, 72 participants remained in the study at time 2 and 57 participants remained at time 3. This represented attrition rates of 30.09% by the second wave of data collection and of 44.66% by the third wave. Chi-square analyses indicated the proportion of students who dropped out of the study did not differ in their membership of the experimental and control conditions at both the second and third waves of data collection. Chi-square analyses also showed that there were no significant differences in the proportion of males and females who dropped out of the study at times 2 and 3. Further, independent-samples t-tests revealed that there were no significant differences in age between those students who were retained in the study and those who dropped out at both the second and third follow-ups.

Main Analyses: Tutor Data

Self-report PAS data. A borderline significant difference emerged between groups for the change in PAS between waves 2 and 3 of the intervention, F (1, 7) = 5.15, p = .057. Descriptive statistics revealed that the experimental tutors exhibited an increase in PAS between waves 2 and 3, mean (standard deviation) change score = .10 (.08), while the control tutors reduced their PAS over this time, mean (standard deviation) change score = -.13 (.21).

Main effects for behavioral data. Significant main effects emerged for two of the autonomy-supportive behaviors. Means and standard deviations for these behaviors are presented in Table 7.3. There was a significant main effect of time for frequency of perspective-acknowledging, F (2, 14) = 12.69, $p < .01$, partial $\eta^2 = .65$. Post hoc related-samples t-tests indicated that there were significant increases in the mean frequency of perspective-acknowledging statements between waves 1 and 2, t (8) = -3.34, $p = .01$, and between waves 1 and 3, t (8) = –3.62, $p < .01$. A main effect of condition was determined for the frequency with which tutors showed signals of carefully and fully attending to the students' speech, F (1,7) = 9.11, $p < .05$, partial $\eta^2 = .57$. Control tutors displayed significantly more signs of carefully and fully attending to the students' speech than experimental tutors.

Interaction effects for behavioral data. Significant interaction effects between wave of the intervention and experimental condition were determined for two of the autonomy-supportive behaviors. Means and standard deviations for these behaviors can be found in Table 7.3 and the interaction effects are shown in Figures 7.1 and 7.2. The first interaction effect was for the primary autonomy-supportive behavior of amount of time that students spent talking in class, F (2,14) = 5.35, $p < .05$, partial $\eta^2 = .73$. Post hoc tests revealed that the significant difference in the amount of time that students spent talking in class between the control and experimental tutors at the pre-interventional wave of data collection, t (7) = 4.07, $p < .01$, was eliminated by the second and third waves. Although non-significant, there was a trend towards an increase in this variable between waves 1 and 3 of data collection for the experimental tutors, t (4) = -2.59, $p = .06$. At the pre-intervention stage, students of the control tutors spent significantly more time speaking in class than those of the experimental tutors at this stage. In contrast, by the second follow-up phase, the students of experimental tutors spent more time speaking in class than the control tutors' students.

Table 7.3

Means (Standard Deviations) for the Autonomy-Supportive Behaviours for Which Significant Main and Interaction Effects Were Determined

	Experimental condition					
	Experimental			Control		
Behaviour	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
S1[a]	5.35	10.51	18.25	18.44	21.38	15.13
	(7.86)	(7.91)	(8.60)	(5.91)	(7.52)	(11.07)
S5[b]	0.40	1.00	1.15	.31	1.00	2.06
	(0.55)	(0.61)	(.34)	(.47)	(.91)	(1.05)
P3[c]	47.50	155.13	179.50	265.91	197.78	99.22
	(55.57)	(115.18)	(86.29)	(104.05)	(104.85)	(39.49)
S8[d]	2.35	0.75	.20	.88	.75	2.31
	(1.24)	(1.27)	(.27)	(1.18)	(.87)	(1.43)

Note. [a]S1 = frequency of signals that tutor was carefully and fully attending to students' speech; [b]S5 = frequency of perspective-acknowledging statements from tutors; [c]P3 = time students spent talking in class (seconds); [d]S8 = frequency of directives and commands uttered by tutors.

The second interaction effect to emerge was for the secondary behavior of directives and commands given by the tutor, F (2, 14) = 9.53, p < .01, partial η^2 = .58. This represented a controlling behavior and was therefore one of the behaviors that experimental tutors were asked to avoid. Independent-samples *t*-tests indicated that there were no significant differences in frequency of directives and commands uttered by the tutors at the first or second phase of data collection. However, at the third wave, experimental tutors were using significantly fewer directives and commands than control tutors, t (7) = 3.28, p < .05. Further, related-samples *t*-tests showed that there were significant decreases in the frequency

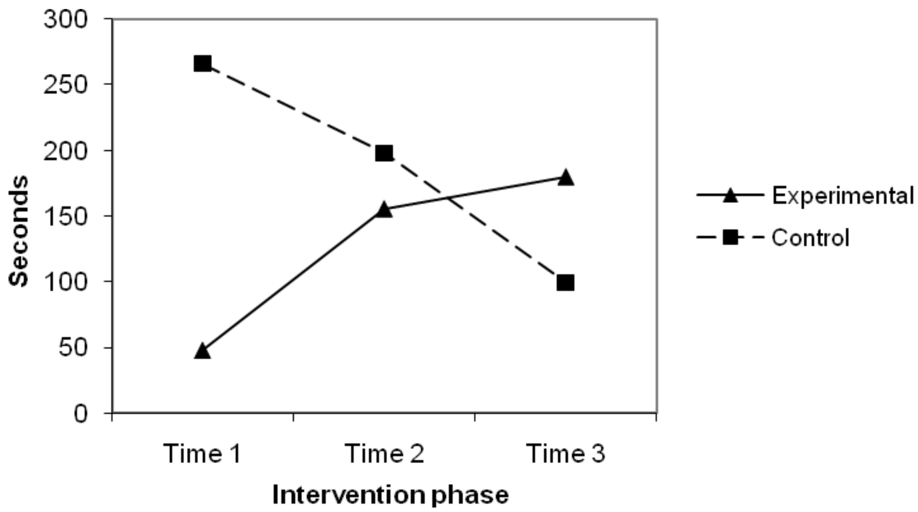

Figure 7.1. The interaction between phase of the intervention and experimental condition for time students spent talking in class.

of directives and commands used by the experimental tutors between the first and second waves of the intervention, t (4) = 3.35, $p < .05$, and between the first and third waves, t (4) = 4.32, $p < .05$. Mean scores showed that the experimental tutors demonstrated a significant reduction in the number of directives and commands used in seminars over the course of the intervention, while control tutors displayed an increase in this behavior. This change in the behavior of the control tutors may have resulted from their role in preparing students for the submission of the module coursework, as the deadline for this work fell shortly after the final observation session.

Main Analyses: Student Data

Perceived autonomy support. A 2 x 3 mixed model ANOVA revealed no significant main effects of time or experimental group on perceived autonomy support. The interaction between time and experimental condition was also non-significant indicating that there was no difference between the experimental and control groups in terms of change in autonomy support over time. Means and standard deviations for perceived autonomy support scores by group at each wave of data collection are provided in Table 7.4.

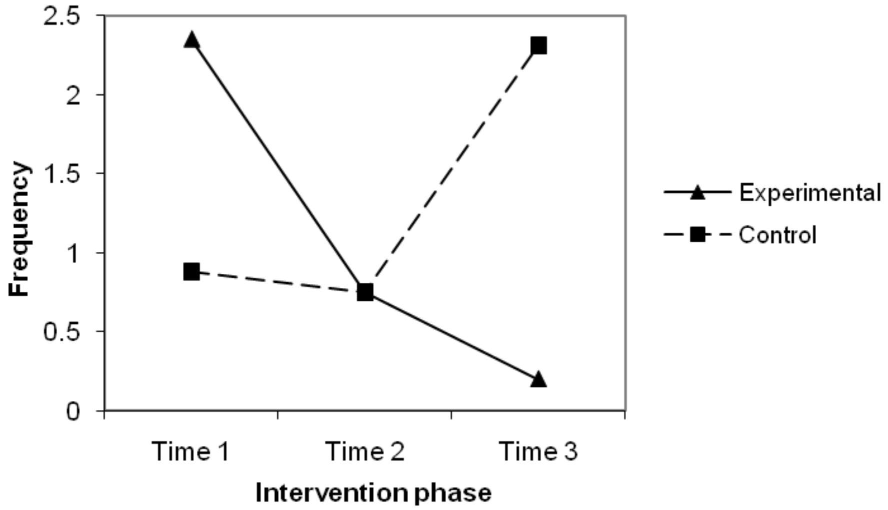

Figure 7.2. The interaction between phase of the intervention and experimental condition for the frequency of directives and commands issued by tutors.

Self-determination index. Despite an increase in self-determined motivation in the experimental group between times 1 and 2, a 2 x 3 mixed model ANOVA showed that there was no significant main effect of either time or experimental group on self-determined motivation. There was, however, a trend towards an interaction between time and experimental condition for level of self-determination towards studying. Students in the experimental group reported an increase in self-determination between time 1 and time 2, and between time 1 and time 3, whereas students within the control condition reported a decrease in self-determination between time 1 and time 2 and between time 1 and time 3, although this finding was non-significant, $F(2, 80) = 3.00$, $p = .06$. Mean and standard deviation self-determined motivation scores for the two groups at each wave of data collection are given in Table 7.4.

Achievement. The hierarchical regression analyses revealed that none of the independent variables were significant independent predictors of module-specific coursework mark, while controlling for age and previous academic achievement.

Table 7.4.

Means (Standard Deviations) for Perceived Autonomy Support and Autonomous Motivation for the Two Groups at Each Wave of Data Collection

Group	Experimental			Control		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
Perceived autonomy support	3.19 (0.31)	3.24 (0.35)	3.12 (0.42)	3.00 (0.39)	3.11 (0.42)	3.07 (0.39)
Autonomous motivation	7.43 (5.32)	9.00 (7.01)	8.15 (7.23)	10.62 (5.09)	8.16 (4.50)	9.24 (4.74)

Discussion

The present study aimed to assess the efficacy of a comprehensive yet brief intervention based on self-determination theory in modifying the autonomy-supportive behavior of postgraduate tutors in a university context. Experimental tutors received two short standardized training sessions in SDT, autonomy support and methods of changing their teaching delivery to become more supportive of the autonomy of their students. Control tutors attended two discussion sessions, in order to receive equal contact time with the instructors as the experimental tutors, but no training was provided for this group. Results indicated that the intervention was moderately successful in changing behavior, with significant changes and large effect sizes in the desired direction emerging for the experimental tutors in two of the behaviors. Experimental tutors increased their facilitation of students speaking in class between the first and third phases of the intervention and exhibited significant decrements in their use of controlling directives and commands between phases 1 and 2, and phases 1 and 3. Importantly, results have indicated that it is possible to increase autonomy-supportive behaviors and decrease controlling behaviors in tutors using a brief intervention. Although many autonomy-supportive behaviors from Reeve and Jang's taxonomy were not significantly changed in the experimental tutors, two important behaviors were modified through a brief forty-minute training intervention across two sessions. These results are promising, particularly in view of the brief nature of the intervention. It is possible that the behaviors that did not change were more difficult for the tutors to monitor and modify, so further training and greater opportunity to put the behavior change into practice could have resulted in changes in these other behaviors. The present study also provides a useful system for autonomy-supportive behavioral modification that could be utilised in other domains. Inter-rater reliability analyses supported the observational checklist as a reliable instrument for recording autonomy-supportive and controlling behaviors and aided the assessment of intervention fidelity. In doing so, the present intervention has met the need for clear and standardized intervention protocol, emphasised by Abraham and Michie (2008), which has not been reported as standard in previous interventions in this field. The intervention protocol and rigorous methods used in the development of the behavioral assessment checklist will ensure that the intervention can be conducted accurately in replications and further applications. This research has also provided an exemplar of the importance of adopting treatment fidelity protocols when evaluating interventions of this type.

In comparison to previous autonomy-supportive interventions, the present study was ambitious in the comprehensive set of behaviors targeted for change. Previous autonomy-supportive interventions have focused largely on the three core components of autonomy support, namely provision of choice and a meaningful rationale from figures of authority, and acknowledgement of the perspective and feelings of others while minimising pressure (Deci et al., 1994). In contrast, the behavioral manipulations implemented in the present intervention focused on a wider range of behaviors, which were based on theory and previous empirical evidence (Reeve & Jang, 2006). Furthermore, while previous interventions have tended to direct efforts towards verbal communications only (e.g., Tessier et al., 2008), the range of behaviors targeted in the present intervention incorporated both verbal and non-verbal autonomy-supportive and controlling tutor behaviors. The analysis of data for each behavior separately also indicated which particular behaviors may be more open to change, rather than grouping behaviors in terms of their underlying nature.

Despite the success of the intervention in modifying tutors' autonomy-supportive behaviors, no significant effects were determined on the perceived autonomy support, self-determined motivation, or achievement behaviour of the students, although the effect on self-determined motivation was borderline significant. These findings are contrary to the experimental hypotheses and are inconsistent with a substantial body of literature attesting to the beneficial effects of autonomy support on academic motivation, well-being, and achievement (e.g., Chirkov & Ryan, 2001; Reeve et al., 2004).

Limitations of the Intervention and Future Research Recommendations

The present intervention was limited by the small sample of tutors employed. Although results appear promising in terms of the success of the intervention in significantly changing two behaviors, the intervention should be implemented on a larger scale, in order to gather stronger evidence for its efficacy. Further, the brief nature of the intervention may have contributed to its failure to change many of the tutors' behaviors. Studies that have reported greater behavior change have tended to use longer training sessions in autonomy-supportive methods (e.g., Chatzisarantis & Hagger, 2009). Increasing the duration of training and staggering the intervention in further applications, with a focus on just a few behaviors in any one training session, may increase its future success in behavioral modification. It is also possible that the brief nature of the intervention may not have provided sufficient opportunity for changes in the motivational orientations and achievement behaviour of students in the experimental condition to be observed. Previous research has employed autonomy-supportive training of a more intensive kind (e.g., Reeve et al., 2004) which may have enabled greater changes in teachers' autonomy-supportive behaviours than were observed in the present intervention study. Indeed, the limited number of tutor autonomy-supportive behaviours for which significant changes were observed in the experimental condition may underlie the absence of significant effects on students' perceived autonomy support, motivation, and achievement.

The limited timeframe in which tutors had the opportunity to actualize the behavioral modifications within the study may also have contributed to lack of significant change in many of the taxonomies. Future studies would benefit not only from extending the tutors' training in autonomy-supportive teaching but also from employing a longer follow-up period in which tutors are able to increasingly implement the autonomy-supportive style. Refresher training sessions to consolidate the tutors' learning of these techniques could aid their behavior change in this respect. The short duration of the follow-up period could also have precluded the emergence of significant effects for the student outcomes. However, previous research has indicated a significant change in school children's engagement over a comparable time period to that employed in the present study suggesting that school children may be more receptive to teacher autonomy support than university students. This is congruent with the finding of greater effects of autonomy support on several psychological and behavioural outcomes in children than in adults within the meta-analysis reported in Chapter 2. This question warrants further exploration and could be addressed by delivering equivalent levels of autonomy support to school children and university students and observing effects on motivation, engagement, and achievement in each sample.

Alternatively, students' minimal exposure to the tutors and the nature of the classes in which the intervention was carried out could have contributed to the lack of efficacy of the intervention in terms of changing their motivation and attainment behaviour. As the experimental students were all subsidiary students, the module for which autonomy support was provided did not represent a substantial component of their overall degree and may therefore have assumed lower importance to the student. This should also be contrasted with school children who have far more prolonged and regular contact with school teachers. Future research would benefit from focusing the provision of autonomy support towards subjects that represent a larger component of students' course or degree.

Further, although the importance of all the behaviors was emphasised to tutors in terms of fostering an autonomy-supportive climate, it is possible that stressing the significance of the primary behaviors could have resulted in tutors devoting less attention to the secondary behaviors. Future applications of the intervention may benefit from eliminating this distinction and determining whether this facilitates greater change in the subset of behaviors currently categorised as secondary. An additional consideration is that the intervention may be assimilated more easily in tutors with greater teaching experience. As the sample employed in the present study were not highly experienced, greater difficulty may have been experienced in trying to cope with the relatively unfamiliar experience of leading seminars, in addition to implementing the behavioral change required by the intervention.

A further limitation of the intervention was the omission of direct manipulations to support students' needs for relatedness and competence. Although several of the behavioral manipulations may serve to support these needs, for example acknowledging the students' perspective and offering hints when a student encountered difficulty, provision of structure and demonstration of interpersonal involvement would have addressed these needs more directly (e.g., Edmunds et al., 2008). Empirical evidence in the exercise domain has demonstrated that teachers are able to modify these socio-contextual factors, in addition to the autonomy-supportive climate, to incur positive effects on motivational, behavioral and affective outcomes (Edmunds et al., 2008). Further research could therefore usefully explore whether university and other tutors are able to adapt their teaching style to support all three fundamental needs. SDT proposes that satisfaction of the needs for autonomy and competence is fundamental to the development of intrinsic motivation (Ryan & Deci, 2000), suggesting that synergistic effects on students' intrinsic motivation may occur with interventions that also support the need for competence. Future research should also explicitly account for tutors' autonomous motivation for teaching, as this has been shown to exert influence over teachers' autonomy-supportive behaviors (Roth, Assor, Kanat-Maymon, & Kaplan, 2007).

Conclusions

The present study demonstrates that a brief intervention targeting autonomy-supportive behaviors in a university context results in significant increases in autonomy-supportive behaviors among postgraduate tutors and provides a detailed protocol for future replications of the intervention, highlighting the importance of rigorous assessment methods to ensure intervention fidelity. However, the intervention did not incur significant effects on the motivation or achievement behavior of the students. Future research should address the methodological limitations of the present intervention and assess its efficacy in changing behavior in other domains.

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Chapter 8

General discussion

General Discussion

Summary and Theoretical Implications of Findings

The aim of the research presented in this thesis was to explore the effects of the internalisation of extrinsically-based goals and motives, both chronic and deliberative, on motivation and health-related and social behaviour. A further objective was to determine the role of autonomy support from social agents in the environment in facilitating internalisation. The studies have addressed gaps in the extant literature on SDT regarding autonomy support and internalisation by analysing the consistency and size of effects of autonomy support on health-related outcomes across the literature, developing measures of chronically-accessible motives and integrated regulation to assess internalisation in a health context, testing people's tendency to distinguish between intrinsic and extrinsic goals, and developing and piloting a brief autonomy-supportive intervention to explore the role of social agents in facilitating internalisation in a novel context.

Findings supported key tenets of the theory and indicated its utility in predicting and changing behaviour. The meta-analysis reported in Chapter 2 underlined the importance of autonomy support in fostering autonomy, competence, and relatedness, facilitating autonomous forms of motivation, and promoting adaptive behavioural and well-being outcomes in the health context across the extant literature. Williams and colleagues' (2006) process model of health-related behaviour was also supported across the studies, using meta-analytically derived corrected correlations in path-analysis to confirm the mediating roles of psychological need satisfaction and autonomous motivation in the association between autonomy support and health-related behaviour.

The study reported in Chapter 3 addressed an important omission in the SDT literature in identifying the regulatory basis of chronically-accessible appearance-related goals in physical activity. Further, this study represents the first use of a measure of chronically-accessible motives for health-related behaviour. The theoretical integration study presented in Chapter 4 supported the theorised influence of internalised or autonomous motivation on behavioural persistence, and showed that continuation intentions of success and failure did not predict behavioural persistence in chronically autonomously-motivated individuals. This suggests an overriding effect of autonomous motivation on behaviour that renders continuation intentions redundant. The significant negative association between continuation intentions of success and behaviour, and the significant positive association between continuation intentions of failure and behaviour observed in the chronically controlled-motivated individuals also supported hypotheses derived from SDT. As such individuals are less likely to experience success in their goal striving due to lack of engagement and persistence, continuation intentions of failure were expected to have greater predictive validity than continuation intentions of success.

The study reported in Chapter 5 provided preliminary support for the core theoretical assumption that individuals can and do differentiate between intrinsic and extrinsic goals. Finally, the scale-development study detailed in Chapter 6 demonstrated the construct, nomological, and predictive validity of the integrated regulation construct as the most fully internalised form of extrinsic motivation, and discriminant validity was established against intrinsic motivation and identified regulation.

Contributions of the Research to Theory and Practice

Synthesis of literature on autonomy support. The meta-analysis of literature reporting the effects of autonomy support on health-related psychological and behavioural outcomes supported the significance and consistency of effects across the literature. Findings also elucidated the roles of a number of significant moderating variables, including age of the recipients of autonomy support, the provider of autonomy support, and the completeness of the assessment of perceived autonomy support. Importantly, findings supported the sequence of relationships proposed in Williams et al.'s (2006) process model for health-related behaviour, such that autonomy support directly predicted need satisfaction and autonomous motivation, and need satisfaction and autonomous motivation predicted behaviour and well-being. A number of research and practical recommendations emerged from the meta-analysis that may guide developments in the field. Suggestions for future research include teasing out effective mechanisms within complex interventions, assessing introjected and external regulations separately rather than combining these in a composite controlled motivation score, and further exploration of the finding that additional support does not appear to augment the effects of autonomy support on behaviour. Future research should also examine the moderation of mediated relationships within the process model, such as the mediation of the association between autonomy support and behaviour by autonomous motivation, to determine the exogenous variables that may influence the effectiveness of autonomy-supportive interventions on health-related behaviour. This would provide useful direction for both researchers and practitioners in the development of targeted behaviour-change interventions.

Implications of the findings for practice encompass providing autonomy support at a young age, when individuals are likely to be more receptive, and utilising friendship and peer groups for the implementation of autonomy support in order to maximise effects. The importance of implementing autonomy support at an early stage of development was also indicated in the intervention study reported in Chapter 7, which revealed no significant effects of the intervention on the adult students' perceived autonomy support, motivation, or behaviour. The issue of ensuring protocol fidelity should be of paramount importance in future autonomy-supportive interventions. Augmentation of these interventions with additional manipulations, such as goal setting and support for self-efficacy, may not be necessary as the meta-analysed average effect of these combined interventions on behaviour was not significantly greater than that for interventions delivering only autonomy support.

The regulatory basis of appearance-related outcomes. The study reported in Chapter 3 addressed a gap in the literature relating to the question of the regulatory basis of appearance-related outcomes in physical activity. Informed by the attitude accessibility literature (e.g., Bizer & Krosnick, 2001) and the methods of Levesque and Pelletier (2003), a measure of chronic physical activity outcomes was used to reflect those goals that were most likely to drive individuals' behavioural engagement. Results indicated that the spontaneous generation of a chronically-accessible appearance-related outcome as the primary goal in physical activity was associated with high external regulation and low intrinsic motivation. Introjected regulation emerged as the only significant independent predictor of outcome type; for a one unit increase in this predictor, the model predicted an increase of 1.87 in the odds of the primary chronically-accessible outcome being appearance-related. Although the denigration of appearance-related goals is not recommended, as this may undermine autonomy (Ingledew & Markland, 2008), findings suggest that health care providers should promote an emphasis on goals such as enjoyment, meeting others, and improving health through physical activity as the pursuit of these outcomes is likely to lead to greater behavioural persistence than those related to appearance. Although the study reported in Chapter 3 did not incorporate a behavioural measure, previous research has indicated that introjected regulation is associated with short-term persistence only and external regulation is negatively associated with long-term behavioural engagement (e.g., Pelletier, Fortier, Vallerand, & Briere, 2001). Health educators and exercise instructors should therefore emphasise health, enjoyment, and social outcomes in physical activity, rather than encouraging individuals to focus on appearance-related goals. Although the denigration of appearance-related goals may not be appropriate, the findings of Chapter 3 suggest that promoting more autonomous outcomes relating to the health, enjoyment, and social benefits of physical activity is likely to lead to greater behavioural persistence and enhanced well-being. This finding may also have implications for wider health-related behaviours, such as dieting.

Measuring chronically-accessible motives in an integrated theoretical framework. Integration of SDT with social cognitive models provides the opportunity to determine more proximal predictors of behaviour that may mediate the effects of overarching motives. The study reported in Chapter 4 represented the first instance of the integration of a measure of chronically-accessible motives, informed partly by the findings of the study reported in Chapter 3, within the TPB framework, which extended previous research by accounting for spontaneous motivational influences on physical activity behaviour. This was an important development as recent research has suggested that the internalisation of behavioural regulation prompts behaviour to proceed in an automatic fashion (Legault, Green-Demers, & Eadie, 2009), which may compromise the suitability of explicit or deliberative assessments of motivational orientation. The model also extended previous research by accounting for the post-decisional phase of behaviour (Gollwitzer, 1996). This phase of behaviour follows the formation of goal intentions and precedes the action phase in which goal-directed behaviours are initiated. The post-decisional phase concerns the formation of plans for the enactment or realisation of behavioural intentions or motives that have already been formed. The finding that chronically-accessible motivation moderated the effects of post-decisional continuation intentions of success on behaviour and the trend towards moderation for the effect of continuation intentions of failure indicate that this planning-based strategy for the continuation of physical activity upon encountering either success or failure in goal striving appears to be differentially effective for chronically autonomous and controlled individuals. Post-decisional planning-based interventions (e.g., Sniehotta et al., 2005) for physical activity may therefore need to be tailored to individuals' chronically-accessible motivation and the degree of internalisation of behavioural regulation. This would help to ensure optimal outcomes and suitable investment of resources in applied settings, as such strategies are likely to be most useful to individuals demonstrating chronic controlled motivation.

Distinction between intrinsic and extrinsic goals. The study reported in Chapter 5 addressed an important theoretical issue in SDT by verifying the assumption that individuals tend to distinguish between intrinsic and extrinsic goals. Although much research has differentiated intrinsic and extrinsic goals and reported unique effects of each on individuals' behaviour and well-being (Schmuck et al., 2000; Sebire, Standage, & Vansteenkiste, 2009; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), individuals' capacity to actively differentiate between these goal types had not previously been determined. The significant clustering of goals by motivational basis reported in Chapter 5 suggests that people can and actively do make this distinction. Considerable inter-individual variability was evident, however, with some participants exhibiting perfect clustering and others showing chance or below chance levels. Furthermore, participants experienced difficulty in explicitly coding their self-generated goals as intrinsic or extrinsic leading to speculation that the differentiation does not occur at an explicit or conscious level. Results therefore substantiated a fundamental tenet of SDT but suggested that discrimination between goal types may not occur consciously. This may relate to the automatisation of self-regulation through the process of internalisation (Legault et al., 2009), such that behavioural regulation becomes automatic for individuals high in self-determination. These findings lend further support to the importance of the development of measures of chronically-accessible motives, as deliberative measures of behavioural regulation may not tap these motivational processes that are likely to occur outside of awareness.

Development of a measure of integrated regulation. The research reported in this thesis has also contributed to the SDT literature by developing a measure of integrated regulation for the physical activity context to be used alongside the BREQ-2 (Markland & Tobin, 2004), thereby enabling full operationalisation of the regulatory constructs specified in organismic integration theory. The construct, discriminant, nomological, and predictive validity of the measure for physical activity was supported in two samples, distinguished by their differing levels of physical activity. Factor structure and loadings were invariant across the samples, but variances and covariances were not invariant and suggested that intrinsic motivation, identified regulation, and integrated regulations were more differentiated in the high-active sample. Past research on the prediction or modification of physical activity behaviour had largely neglected to assess the full spectrum of behavioural regulation constructs postulated in organismic integration theory (e.g., Edmunds, Ntoumanis, & Duda, 2006). One reason for this limitation could be the relative dearth of valid and reliable measures of integrated regulation and previous difficulties encountered in determining discriminant validity of integrated regulation with its neighbouring constructs of identified regulation and intrinsic motivation.

The study presented in Chapter 6 has provided a valid and internally reliable measure of integrated regulation for application in physical activity. Importantly, the measure was able to be statistically discriminated from intrinsic motivation and identified regulation and, challenging the assertions of previous research (e.g., Pelletier et al., 1995), integrated regulation emerged as the only significant independent predictor of physical activity. The validity and internal reliability of a version of the measure adapted for dieting behaviour was also established (please see Appendix 3), and the intervention study reported in Chapter 7 incorporated a further modification of the measure to assess the effects of facilitating internalisation through autonomy support from a key social agent, tutors, on students' perceived autonomy support, integrated regulation, and achievement behaviour relating to a particular course of study. It is intended that the measure will be used in autonomy-supportive behaviour-change interventions in health and other contexts in order to assess the integration of behavioural regulation that is theorised to occur following the provision of autonomy support. In this respect, the measure will allow researchers to assess of the role of integrated regulation as a key mediator in the relationship between autonomy support and behaviour and to determine the complete internalisation of extrinsic goals, such that the behaviour becomes valued and integrated with the self. This will provide important information on the causal mechanisms by which support for autonomy, and therefore internalisation, will lead to increased behavioural engagement in health-behavioural contexts.

Development of an autonomy-supportive intervention. A limitation of the literature on autonomy support evident in the meta-analysis reported in Chapter 2 was the preponderance of cross-sectional and prospective research designs and the relative lack of experimental and intervention studies. Furthermore, within extant interventions, few provided information on the assessment of fidelity to intervention protocol in delivery of the manipulations, which is imperative in inferring the role of intervention manipulations in any significant changes in need satisfaction, motivational, behavioural, and well-being outcomes (Bellg et al., 2004; Hardeman et al., 2007; Michie et al., 2008). The development of such a system is also important in assessing the existing levels of autonomy support delivered in the control group. The study described in Chapter 7 therefore developed a reliable observational checklist system to assess treatment fidelity within a theoretically-grounded and empirically-derived brief autonomy-supportive intervention intended to modify tutor behaviours in a higher education context. The study further contributed to the literature by representing the first application of an autonomy-supportive intervention in a higher education setting and meeting the need for the provision of standardised intervention protocol (Abraham & Michie, 2008). The study also extended previous research (e.g., Tessier, Sarrazin, & Ntoumanis, 2008) by targeting both verbal and non-verbal autonomy-supportive behaviours, controlling for pre-intervention level of tutor autonomy support, and assessing effects on students' perceived autonomy support, motivation, and achievement. Results confirmed that a brief intervention can significantly increase autonomy support provision and significantly reduce the use of controlling behaviours. The intervention provides a framework for future autonomy-supportive interventions to follow and offers a reliable observational checklist system to be employed in the assessment of fidelity to the intervention protocol in delivery.

Methodological Limitations and Future Research

Despite the aforementioned contributions to the SDT literature, a number of limitations of the reported research should be acknowledged. The meta-analysis reported in Chapter 2 indicated that a substantial proportion of the variance in effects across studies was not attributable to methodological artifacts and therefore implied the presence of a number of moderating variables. Despite the identification and analysis of six potential moderators, substantial heterogeneity in effects remained and the magnitude of some moderating effects was comparable to the effect of autonomy support. The role of each of the six moderators was also obscured by the significant associations determined between the age of sample, design, provider, and presence of additional support moderators. Further research should aim to disentangle the effects of these moderator variables in order to elucidate the independent effect of each on associations between autonomy support and psychological and behavioural outcomes. Further, findings from both the main meta-analysis and the process model should be interpreted with caution because several effect sizes were based only on a small number of tests.

The study reported in Chapter 3 employed a cross-sectional design, which precluded inferences about causality in effects. The absence of a behavioural measure within this study also resulted in tentative conclusions about the likely effects of striving for appearance-related outcomes on physical activity, which were based on previous findings relating to introjected regulation and short-term behavioural persistence (e.g., Pelletier, Fortier, Vallerand, & Briere, 2001). The prospective designs used in the scale development and theoretical integration studies (presented in Chapters 6 and 4, respectively) permitted only short-term behavioural prediction as the waves of data collection were separated by three and four week intervals, respectively. Longer follow-up periods in future would allow the assessment of scale reliability and the dynamics of integrated regulation over time and enable tests of the integrated model in relation to the realisation of longer-term goals and behavioral outcomes. The short duration of the follow-up in the intervention study (Chapter 7) represented another significant limitation. Longer periods of time may be necessary for autonomy-supportive behaviours to be more fully implemented and for integration and concomitant effects on recipients' need satisfaction, motivation, and behaviour to occur. The brief nature of the tutors' training and the emphasis on modification of the subset of primary behaviours may have served to further restrict the effects of the intervention on the tutors' behaviour and the students' achievement behaviour (i.e., student grade). The intervention could also have been more effective in enhancing the perceived autonomy support, autonomous motivation, and achievement behaviour of the students if the context of delivery had assumed more importance to their overall academic programme. Furthermore, although there were no differences in the characteristics of the students that completed the study and those that dropped out at any stage, the possibility remains that these problems could have been connected to the high rate of student attrition.

The research reported in this thesis aimed to avoid over-reliance on student samples by recruiting participants from community and occupational settings in the studies reported in Chapters 3, 4, and 6. Nevertheless, a high proportion of the study samples comprised students, albeit from various disciplines and at different stages of their academic programmes. Replication of findings in entirely non-student samples would enable extended generalisation of findings and increase the robustness of effects.

Several measurement issues should be addressed in future research. Although the measure of chronically-accessible motives in physical activity is an important addition to existing measures of motivation, the dichotomous nature of the variable is likely to represent an oversimplification of motives underlying behavioural participation. This is particularly pertinent to the meta-analytic finding that the average effect of autonomy support on composite measures of controlled motivation was not significant. Such measures may mask the effects of the separate constructs, as the combination of positive effects of autonomy support on introjected regulation and negative effects on external regulation led to a nil effect size overall. Future research should therefore develop a more differentiated measure of chronically-accessible motives that allows representation of the various forms of behavioural regulation comprising the motivational continuum from organismic integration theory. This could be achieved through the use of a more precise system of coding than the dichotomy employed in Chapter 4. The coding could further explore the associations of self-reported behavioural regulation with chronically-accessible physical activity outcomes beyond those related to appearance and weight loss. In the studies reported in Chapters 4 and 6, and Appendix 3, behaviour was assessed through self-report measurement, which has been associated with social desirability bias in the reporting of health-related behaviour (e.g., Hebert, Clemow, Pbert, Ockene, & Ockene, 1995). Although emphasising participants' anonymity may have served to prevent this bias, objective behavioural measures should be employed in future replications to substantiate findings obtained through self-reports.

Further work should focus on revising the autonomy-supportive intervention (Chapter 7) to increase training duration and extend the follow-up period. The protocol could also be amended to incorporate structure and interpersonal involvement to support competence and relatedness needs (e.g., Edmunds, Ntoumanis, & Duda, 2008), although the findings of the meta-analysis reported in Chapter 2 suggest that this may not result in larger effect sizes on psychological and behavioural outcomes. An additional consideration for future research is the self-determination of the need support provider. Although this was not assessed in the current intervention study, Reeve (1998) determined that teachers' general tendency towards autonomous motivation affected their acceptance of the value of adopting an autonomy-supportive style. A full appreciation of providers' implementation of autonomy-supportive behaviours may therefore necessitate the assessment of their own autonomous motivation. This postulation is consistent with Roth, Assor, Kanat-Maymon, and Kaplan's (2007) finding that teachers' autonomous motivation for their work positively predicted students' autonomous motivation for learning, mediated by increased teacher autonomy support. A similar sequence of effects was determined by Taylor, Ntoumanis, and Standage (2008) in relation to the antecedents of physical education teachers' use of motivational strategies. Taylor and colleagues reported that teachers' autonomous orientation was a key predictor of psychological need satisfaction, which was associated with higher self-determination. In turn, teacher self-determination predicted the use of autonomy-supportive teaching strategies.

The intervention protocol and observational checklist are useful resources that can be modified and applied in further interventions to facilitate health-promoting and disease management behaviours through the provision of autonomy support. Future applications of the intervention should employ measures of integrated regulation, such as that developed in Chapter 6, to assess the process of integration and to explore the role of integrated regulation as a mediating mechanism in behaviour change. The measure of integrated regulation for dieting did not demonstrate predictive validity, which may reflect particular difficulty in internalising and integrating this behaviour and highlight the need for autonomy-supportive interventions. Alternatively, a single measurement of integrated regulation may not reflect the dynamic nature of the construct and repeated assessments could serve to illuminate the role of the construct in predicting behaviour over an extended period.

Future evaluation of more complex autonomy-supportive interventions that incorporate behaviour-change techniques derived from other theories should focus not only on ensuring fidelity to the intervention protocol but also on determining the causal mechanisms of behaviour change. The use of structural equation modelling to test the moderation of effects within mediation models, such as the SDT process model, would facilitate this insight into processes underpinning behaviour change consistent with the recommendations of Hagger and Chatzisarantis (2009). Research on autonomy support should also enable the separation of the correlated moderators found in the meta-analysis reported in Chapter 2. Further studies testing the effectiveness of autonomy-supportive interventions in particular subgroups may assist in establishing the moderating role of each in isolation on the effects of autonomy support on need satisfaction, motivational, and behavioural outcomes.

It is recommended that future research exploring the regulatory antecedents of behaviour employs measures of chronically-accessible motives alongside traditional scaled measures of behavioural regulation. In the study reported in Chapter 4, these spontaneous influences on behaviour affected the predictive utility of people's indicated readiness to maintain physical activity in the face of success and failure in goal striving. The assessment of chronically-accessible motives should therefore be used to inform intervention strategies that aid individuals in forming plans regarding their future behaviour, as the results of the study reported in Chapter 4 suggest that planning-based intervention strategies may be differentially effective for chronically autonomous and controlled individuals. Further research could test the moderating effects of chronically-accessible motives on the association between behaviour and implementation intentions (Gollwitzer, 1999). Implementation intentions function in a similar way to continuation intentions by bridging the documented gap between intentions and behaviour (e.g., Sniehotta, Scholz, & Schwarzer, 2005). The implementation intention strategy prompts individuals to furnish their intentions with detailed plans regarding where and when to engage in a desired behaviour. When implementation intentions have been formed behaviour is hypothesised to occur efficiently and automatically through the linking of action with critical contextual cues such that behavioural plans are initiated spontaneously upon encountering those cues. In light of recent empirical evidence indicating that the internalisation of behavioural regulation facilitates automatisation of behaviour, similar findings may emerge for implementation intentions as for continuation intentions rendering the construct superfluous in chronically autonomously-motivated individuals.

In contrast, the formation of implementation intentions may predict behavioural maintenance in chronically-controlled individuals by enabling behaviour at risk of termination to proceed automatically. In this respect, autonomy support could also serve to accelerate the automatisation of behaviour by facilitating the processes of internalisation and integration. There is preliminary support for the utility of implementation intention formation in controlled individuals. Chatzisarantis, Hagger, and Thøgersen-Ntoumani (2008) determined that implementation intentions were more effective in assisting the enactment of physical activity behaviour for self-discordant individuals, for whom behavioural goals reflected internal or external pressure to engage in physical activity, than for self-concordant individuals, whose goals were autonomously motivated. However, the formation of implementation intentions by chronically-controlled individuals may not result in enhanced psychological well-being. Recent research has reported a synergistic effect of controlled goal motives and implementation intentions on well-being, such that this combination resulted in lower well-being than was observed with controlled motives alone (Smith, Ntoumanis, & Duda, 2010).

Although the measure of chronically-accessible motives was intended to capture impulsive motivational influences on behaviour, it may not have adequately captured implicit and non-conscious internalised motivational orientations. The use of implicit measures of chronically-accessible motivation would also make a valuable contribution to this field by tapping the non-conscious motives driving behaviour. Implicit methods, such as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) and motivational primes paired with lexical decision tasks (e.g., Burton, Lydon, D'Alessandro, & Koestner, 2006) could be employed to corroborate the present finding that individuals can and do differentiate between intrinsic and extrinsic goals and to assess people's inclination towards a particular goal type. This would also enable exploration of the possibility that the differential effects of intrinsic and extrinsic goals are dependent upon individuals' awareness of the distinction. Such methods could additionally be used to explore whether people can go beyond the autonomous-controlled distinction to further distinguish between the four forms of extrinsic motivation.

Overall, the findings reported in the component studies of this thesis should encourage health practitioners and applied researchers to consider individuals' motivational orientations when attempting to modify their behaviour, and to direct the development of future behaviour-change interventions towards the facilitation of internalisation and integration of behavioural regulation.

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Appendix 1: Summary of Study Characteristics and Categorisation of Studies into Moderator Groups within the Meta-Analysis

Study	Design	Final sample for calculation of effect sizes	Mean (SD) age of sample and age range (years)	Outcomes	Provider of AS	Completeness of AS measure or manipulation	Provision of additional support within measure or manipulation	Comparison group
Adie, Duda, & Ntoumanis (2008)	CS	539 British adults engaged in a team sport.	22.75 (4.63), range 18-36. [AD]	Autonomy for sport. Competence for sport. Relatedness in sport. Subjective vitality. Emotional and physical exhaustion.	CO	[U]	AS	-
Amorose & Anderson-Butcher (2007)	CS	581 American athletes from individual and team sports. 263 males, 318 females.	17.50 (2.30), range 13-25. [E]	Autonomy for sport. Competence for sport. Relatedness in sport. RAI for sport.	CO	IAS	AS	-
Balaguer, Castillo, & Duda (2008)	CS	301 adult athletes from a range of sports. 171 males, 130 females.	24.1 (4.7). [AD]	Autonomy for sport. Competence for sport. Relatedness in sport. IM to know, IM to accomplish, IM to experience stimulation[a], ID, ER, AM for sport. Self-esteem. Life satisfaction.	CO	CAS	AS	-
Brickell, Chatzisarantis, &	P[b]	162 Canadian university	23.15 (6.05), range 18-44.	TPB intention. Autonomous	SO	IAS	AS	-

Pretty (2006)		students. 63 males, 99 females, 1 unspecified.[c]	[AD]	intention. Controlled intention. Core autonomous intention. LPA.[d]				
Chatzisarantis & Hagger (2009)	EXP	215 British secondary school pupils. 106 males, 109 females.	14.84 (0.48), range 14-16. [CH]	PAS for PE. RAI for PE. Intentions to engage in LPA. LPA.	T	IAS[e]	AS	[E][f]
Chatzisarantis, Hagger, & Brickell (2008)	P[g]	235 participants, comprising 70 high school pupils, 63 university students, and 102 adults. 97 males, 138 females.	20.28 (6.59). [B]	Intention. LPA.	SO	IAS	AS	-
Chatzisarantis, Hagger, & Smith (2007) study a	P[g]	177 school pupils and university students. 69 males, 108 females.	School pupils: 13.95 (0.61) University students: 18.98 (2.63) [E]	Intention to engage in LPA. LPA.	SO	IAS	AS	-
Chatzisarantis, Hagger, & Smith (2007) study b	P[g]	165 high school pupils. 86 males, 79 females.	14.56 (0.77). [CH]	Intention to engage in LPA. LPA.	SO	IAS	AS	-
Chatzisarantis, Hagger, & Smith (2007) study c	EXP	79 high school students. 40 males, 39 females.	14.53 (0.70). [CH]	PAS Intention to engage in exercise activity.	E	CAS IAS[h]	AS	CTL CLG[i]

Chatzisarantis, Hagger, Wang, & Thogersen-Ntoumani (2009)	P[g]	231 British high school pupils. 113 males, 118 female.	14.21 (0.90), range 15-16. [CH]	Intention to engage in PA. LPA.	T	CAS	AS	-
Chirkov, Ryan, & Willness (2005) study a	CS	127 Brazilian university students. 100 males, 27 females.	23.4, range 19-34. [AD]	Well-being, comprised of life satisfaction, self-actualisation, self-esteem, and depression.	[E][j]	[U]	ADS	-
Chirkov, Ryan, & Willness (2005) study b	CS	142 Canadian university students. 43 males, 99 females.	19.8, range 18-43. [AD]		[E][j]	[U]	ADS	-
Coatsworth & Conroy (2009)	P[k]	119 youth swimmers from community recreational swimming league. 40 males, 77 females, 2 unspecified.	12.07 (1.79), range 10-17 [CH]	Autonomy satisfaction through relationship with coach. Competence satisfaction through relationship with coach. Relatedness satisfaction through relationship with coach. Perceived competence for sport. Self-esteem.	CO	IAS[l]	AS	-
Conroy & Coatsworth (2007)	P	165 young athletic swimmers. 66	11.20 (2.2), range 7-18. [E]	Autonomy for swimming. Competence for	CO	IAS[l]	AS	-

		males, 99 females.		swimming in. Relatedness swimming.				
Daley & Maynard (2003)	EXP	26 physically active British adults from a university sport, leisure, and exercise department. 14 males, 12 females.	33.20 (6.00), range 29-49. [AD]	Positive affect. Negative affect.[m]	E	IAS	AS	CTL
Dupont, Carlier, Gerard, & Delens (2009)	CS	549 students from 13 secondary schools in Belgium. 317 males, 232 females.	18.1 (1.1). [E]	Autonomy for PE. Competence for PE. Relatedness in PE. IM to know, IM to accomplish, IM to experience stimulation[n], ID, IJ, ER, AM for PE. Perceived enjoyment of PE.[o] Perception of having learned in PE. Intention to engage in LPA.	T	[U][p]	AS	-
Dwyer (1995)	EXP	34 female adults.	27.4 (8.6). [AD]	IM for aerobic dance.	E	IAS	AS	CTL
Edmunds, Ntoumanis, & Duda (2006)	CS	106 regular participants in exercise classes. 37 males, 68 females, 1 unspecified.	30.24 (10.32), range 16-62. [E]	Autonomy for exercise. Competence for exercise. Relatedness for exercise. IM and ID for	IN	IAS	AS	-

				exercise.[q]				
Edmunds, Ntoumanis, & Duda (2008)	EXP	56 female exercise class participants comprised of university students and staff.	21.26 (3.80), range 18-53. [AD]	PAS for exercise class. Autonomy for exercise. Competence for exercise. Relatedness for exercise. IM, IG, ID, IJ, ER, AM for exercise. Positive affect. Negative affect. Intention to continue exercising and join next class. Attendance at exercise class.[r]	IN	CAS	ADS	CTL
Ferrer-Caja & Weiss (2000)	P	407 American senior high school pupils. 206 male, 201 female.	15.64 (0.96), range 14-19. [E]	Autonomous motivation for PE. Controlled motivation for PE.[s] Motivated behaviour, encompassing choice of challenging tasks, effort, and persistence.[t]	T	IAS[u]	AS	-
Fortier, Sweet, O'Sullivan, & Williams (2007)	EXP	120 adults from a primary care practice in Canada. 37 males, 83	IPAC group: 47.5 (11). BPAC group: 47.2 (11.3). [AD]	Autonomous motivation for LPA. Competence for LPA. Self-reported LPA.[v]	CN	CAS	ADS	[E][w]

		females.						
Gagne, Ryan, & Bargmann (2003)	P[x]	45 female gymnasts.	13.00 (2.35). [CH]	Daily IM, ID, IJ, ER, AM, RAI for gymnastics. Autonomy for gymnastics practices. Competence for gymnastics practices. Relatedness in gymnastics practices.[y] Attendance at practices.[z]	CO P	IAS	AS	-
Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski (2005) study a	P[aa]	222 British high school pupils. 104 males, 118 females.	14.68 (1.47) [CH]	RAI for PE. RAI for LT. Intention to engage in PA. LPA.	T	CAS	AS	-
Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski (2005) study b	P[aa]	93 Greek school pupils. 36 males, 57 females.	13.99 (0.80) [CH]	RAI for PE. RAI for LT. Intention to engage in PA. LPA.	T	CAS	AS	-
Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski (2005) study c	P[aa]	103 Polish secondary school pupils. 47 males, 56 females.	16.28 (1.12) [CH]	RAI for PE. RAI for LT. Intention to engage in PA. LPA.	T	CAS	AS	-
Hagger, Chatzisarantis, Barkoukis, Wang,	P[aa]	133 Singaporean junior college	13.32 (0.47) [CH]	RAI for PE. RAI for LT. Intention to engage	T	CAS	AS	-

& Baranowski (2005) study d		pupils 66 males, 67 females.		in PA. LPA.				
Hagger, Chatzisarantis, Culverhouse, & Biddle (2003)	P[ab]	295 British high school students. 132 males, 163 females.	14.5 (1.35), range 13-16. [CH]	IM, ID, IJ, ER for PE. IM, ID, IJ, ER for LPA. Intention to engage in PA. LPA.	T	IAS	AS	-
Hagger, Chatzisarantis, Hein, Pihu, Soos, & Karsai (2007)[ac]	CS	432 British high school pupils. 198 males, 234 females.	13.95 (1.51). [CH]	IM, ID, IJ, and ER for LPA.	T	CAS	AS	-
Hagger, Chatzisarantis, Hein, Soos, Karsai, Lintunen, & Leemans (2009) study a	P[aa]	404 British high school pupils.94 males, 116 females.	13.19 (1.12). [CH]	RAI for PE. RAI for LPA. Intention to engage in LPA. LPA.	T F P	CAS	AS	-
Hagger, Chatzisarantis, Hein, Soos, Karsai, Lintunen, & Leemans (2009) study b	P[aa]	361 Estonian high school pupils. 117 males, 151 females.	15.04 (0.91). [CH]	RAI for PE. RAI for LPA. Intention to engage in LPA. LPA.	T F P	CAS	AS	-
Hagger, Chatzisarantis, Hein, Soos, Karsai, Lintunen, & Leemans (2009) study c	P[aa]	158 Finnish high school pupils. 55 males, 72 females.	14.30 (0.49). [CH]	RAI for PE. RAI for LPA. Intention to engage in LPA. LPA.	T F P	CAS	AS	-
Hagger, Chatzisarantis,	P[aa]	286 Hungarian	14.02 (0.99). [CH]	RAI for PE. RAI for LPA.	T F	CAS	AS	-

Hein, Soos, Karsai, Lintunen, & Leemans (2009) study d		secondary school pupils. 114 males, 121 females.		Intention to engage in LPA. LPA.	P			
Halvari & Halvari (2006)	EXP	86 Norwegian adults from universities and colleges in Oslo. 30 males, 56 females.	27.34 (3.99), range 21-35. [AD]	Plaque. Gingivitis. Dental competence. Autonomous motivation for dental health behaviour. Dental health behaviour.	HCP	CAS	AS	CTL
Halvari, Ulstad, Bagøien, & Skjesol (2009)	CS	190 adult volunteer students. 106 males, 84 females.	21.79 (3.97). [AD]	Autonomous motivation for physical activity and sport. Competence for physical activity and sport. Competitive performance in sport. Participation in LPA and sport.	[E][j]	CAS	AS	-
Hollombeak & Amorose (2005)	CS	280 American university student athletes. 146 males, 134 females.	19.73 (1.36), range 17-25. [E]	Autonomy for sport. Competence for sport. Relatedness in sport. IM to know, IM to accomplish, IM to experience stimulation for sport.[a]	CO	IAS[ad]	AS	-
Huisman, de	EXP	51 overweight	Initial sample:	BMI.	HCP	IAS	ADS	CTL

Gucht, Maes, Schroevers, Chatrou, & Haak (2009)		Type 2 diabetes patients from Dutch hospitals.[ae]	58.14 (8.86), range 21-70. [AD]	Glycosylated hemoglobin. Diabetes quality of life. Exercise. Healthy eating. Unhealthy eating.[af]				
Julien, Senecal, & Guay (2009)	P	365 Canadian adult Type 2 diabetes patients.	> 18 years. [AD]	Autonomous motivation for adherence to dietary self-care activities. Controlled motivation for compliance to dietary self-care activities. Self-blame. Adherence to dietary self-care activities.	HCP	IAS	AS	-
Kellar, Sutton, Griffin, Prevost, Kinmonth, & Marteau (2008)	EXP	407 British adults without known diabetes.	Range 40-69. [AD]	Knowledge about screening for type 2 diabetes.[ag] Informed choice.[ah] Intention regarding undergoing screening for Type 2 diabetes.	WC	IAS	AS	CTL
Kennedy, Goggin, & Nollen (2004)	CS	201 adult HIV patients. 171 males, 28 females, 2 transgender.	40.0, range 18-66. [AD]	Autonomous motivation for adherence to medication Competence for adherence to medication. Psychological	HCP F FA	IAS	AS	-

				distress.[ai] Current symptoms. Medication doses taken. Deviance from prescribed dosing interval, subtracted from 1 to represent adherence.[aj]				
Kludt & Perlmuter (1999)	EXP	26 adult heroin addicts who voluntarily entered substance abuse treatment programme.	33.4 (5.3), range 25-40. [AD]	Urinalysis. Adherence to counseling. Depression. State anxiety. Trait anxiety.[r]	CN	IAS	AS	CTL
Kopke, Kasper, Muhlhauser, Nubling, & Heesen (2009)	EXP	150 patients with relapsing multiple sclerosis in three German treatment centres. 34 males, 116 females.	Intervention group: 37.3 (7.2). Control group: 38.8 (8.1). [AD]	Relapses over a two-year period with oral or without corticosteroid therapy. Active role in decision-making.[ak] Satisfaction with decision-making. Quality of life. Disability status.[al] Disease course.[am]	[E][an]	IAS	ADS	CTL
Langfitt, Wood, Brand, Brand, & Erba (1999)	CS	43 patients following temporal lobotomy. 18 males, 25	34.5 (9.5), range 16-56. [E]	Autonomous behaviour. Psychological distress/well-being.[ao]	FA	IAS[ap]	ADS	-

		females.						
Levy & Cardinal (2004) study a	EXP	17 male volunteers[aq] recruited from two communities, who reported exercising < 3 times per week and expressed intention to increase exercise.	Initial sample: 46.8 (12.8), range 22-79. [AD]	Autonomy for exercise. Competence for exercise. Relatedness for exercise. IM, IG, ID, IJ, ER, and AM for exercise. Exercise behaviour.[r]	WC [E]	IAS	ADS	CTL
Levy & Cardinal (2004) study b	EXP	49 female volunteers [aq]. recruited from two communities, who reported exercising < 3 times per week and expressed intention to increase exercise.	Initial sample: 46.8 (12.8), range 22-79. [AD]	Autonomy for exercise. Competence for exercise. Relatedness for exercise. IM, IG, ID, IJ, ER, and AM for exercise. Exercise behaviour.[r]	WC [E]	IAS	ADS	CTL
Levy, Polman, & Borkoles (2008)	CS[ar]	70 competitive or recreational athletes recruited from physiotherapy clinics. 44 males, 26	32.5 (10.2), range 18-55. [AD]	Attendance at rehabilitation appointments. Clinic-based adherence to prescribed exercises. Home-based adherence to	HCP	CAS	AS	-

		females.		prescribed exercises.[as]				
Lim & Wang (2009)	CS	701 Singaporean secondary school students. 325 males, 354 females, 22 unspecified.	15.0 (1.45), range 13-17. [CH]	IM, ID, IJ, ER, and AM for PE. Intention to engage in LPA.	T	IAS	AS	-
Lonsdale, Sabiston, Roedeke, Ha, & Sum (2009)	EXP	360 high school students in Hong Kong. 232 males, 296 females. Only top and bottom tertile on RAI were included in analyses.	Initial sample: 15.78 (0.91). [CH]	Step count during free choice portion of lesson.	T	IAS	AS	CTL
Markland & Tobin (2009)	CS	133 female former exercise referral scheme clients.	54.51 (12.94), range 23-80. [AD]	Autonomy for exercise. Competence for exercise. Relatedness in exercise.[at] IM, ID, IJ, ER, and AM for exercise. Exercise behaviour.	IN	IAS	ADS	-
Mildestvedt, Meland, & Eide (2007)[au]	EXP	176 Norwegian patients recruited from a cardiac	56.0 (9.3). [AD]	Smoking cessation. Avoidance of initiation of smoking. Fruit and vegetable	[E][aw]	IAS	ADS	CTL

		rehabilitation centre. Patients mainly had coronary heart disease. 138 males, 38 females.		intake. Weekly fish dinners. Low saturated fat diet.[av]				
Mildestvedt, Meland, & Eide (2008)	EXP	176 Norwegian patients recruited from a cardiac rehabilitation centre. Patients mainly had coronary heart disease. 138 males, 38 females.	56.0 (9.3). [AD]	Exercise frequency. Physical capacity. Exercise intensity.[aw]	[E][ax]	IAS	ADS	CTL
Milne, Wallman, Guilfoyle, Gordon, & Courneya (2008)	CS	558 female breast cancer survivors.	59.0 (11.23), 23-94. [AD]	Competence for exercise. IM, ID, IJ, ER, and AM for exercise.[ay]	SO	IAS	AS	-
Murcia, Rojas, & Coll (2008)	CS	399 Spanish high school pupils.	14.70 (0.71), range 14-16. [CH]	Relatedness in PE. Amotivation for PE.	T	CAS	AS	-
Ntoumanis (2001)	CS	428 British high school pupils. 206 males, 218 females.	14.84 (0.52), range 14-16. [CH]	Autonomy for PE. Competence for PE. Relatedness in PE. IM, ID, IJ, ER, and AM for PE. Effort in PE. Boredom in PE.[az]	T	IAS	AS	

				Intention to engage in LPA.				
Ntoumanis (2005)	P[ba]	302 British high school students.	All participants were 15 years old. [CH]	Autonomy for PE. Competence for PE. Relatedness for PE. IM, ID, IJ, ER, and AM for PE. Negative affect in PE. Intention to participate in PE. Teacher ratings of effort in PE. Participation status.[bb]	T	IAS	AS	
O'Connor & Vallerand (1994)	CS	129 elderly residents of care homes. 18 males, 11 females.	Range 65-96. [AD]	RAI for life domains. Average of life satisfaction, self-esteem, depressive symptoms, and perceived meaning in life representing well-being.[bc]	Nursing home staff [E][bd]	IAS	AS	-
Ommundsen & Kvalo (2007)	CS	194 Norwegian high school pupils. 100 males, 94 females.	All participants were 16 years old.	Autonomy for PE. Competence for PE. IM, AM, RAI for PE. Enjoyment of PE.[be] LPA.	T	CAS	AS	-
Parfitt & Gledhill (2004)	EXP	20 low-active adults. 10 males, 10 females.	20.55 (1.46). [AD]	Rated perceived exertion in exercise. Psychological well-being. Psychological	E	IAS	AS	CTL

				distress. Fatigue.			
Peddle, Plotnikoff, Wild, Au, & Courneya (2008)	CS	413 adult colorectal cancer survivors. 223 male, 190 female.	60.0 (7.5). [AD]	Autonomy for exercise. Competence for exercise. Relatedness for exercise. IM, ID, IJ, ER, AM for exercise. Exercise behaviour.	SO	[U]	AS	-
Pelletier, Fortier, Vallerand, & Briere (2001)	P[bf]	369 young competitive swimmers from 23 Canadian teams. 174 males, 195 females.	15.6, range 13-22. [E]	IM to know, IM to accomplish, IM to experience stimulation[a], ID, IJ, ER, and AM in sport. Persistence at 22 months.[bg]	CO	IAS	AS	-
Pihu, Hein, Koka, & Hagger (2008)	P[bh]	399 Estonian high school pupils. 123 males, 276 females.	14.7 (1.4), range 12-17. [CH]	IM for PE. IM for LPA. Intention to engage in LPA. LPA.	T	IAS	AS	-
Powers, Koestner, & Gorin (2008)	EXP[bi]	62 American female undergraduate students.	Initial sample: 19.54 (3.97), range 18-46. [AD]	Autonomous motivation for losing weight. Weight loss.[bj] BMI.	E[bk]. F, FA[bl]	IAS	AS	CLG
Prusak & Treasure (2004)	EXP	1110 American female junior high school students.	< 18 years. [CH]	IM, ID, ER, AM, and RAI for PE.[bm]	T	IAS	AS	CTL
Reinboth, Duda, &	CS	265 British	16.44 (1.32)	Autonomy for sport.	CO	[U]	ADS	-

Ntoumanis (2004)		male adolescent athletes engaged in soccer or cricket.	[CH]	Competence for sport. Relatedness for sport. Subjective vitality. Intrinsic satisfaction with and interest in sport. [bn] Physical symptoms.				
Resnicow, Davis, Zhang, Konkel, Strechel, Shaikh, Tolsma, Kalvi, Alexander, Anderson, & Wiese (2008)	EXP	423 African American adults. 120 males, 303 females.	48.2, range 22-69. [AD]	Autonomous motivation for fruit and vegetable intake. Controlled motivation for fruit and vegetable intake. Intention to eat more fruit and vegetables.[bo] Self-efficacy for eating fruit and vegetables. Fruit and vegetable intake.	E	IAS	ADS	CTL
Shen, McCaughtry, Martin, & Fahlman (2009)	P	253 students. 132 males, 121 females.	Range 12-14. [CH]	RAI for PE. Competence for PE. Relatedness in PE. Learning achievement in PE. Cardio-respiratory fitness.	T	IAS	AS	-
Simoneau & Bergeron (2003)	CS[ar]	136 adults in treatment programme	Initial sample: 35.6, range 22-53. [AD]	Competence for treatment. Goal attainment.[bp]	HCP SO	IAS	AS	-

		for substance-related disorders at a Canadian outpatient public readaptation centre.		Internalisation score representing relative autonomous motivation.[bq] Problems with alcohol. Problems with drugs. Medical problems. Psychological problems.				
Smith, Ntoumanis, & Duda (2007)	CS	210 British adult athletes in regular training across a variety of sports. 104 males, 103 females.	21.02 (2.88), range 18-37.	Autonomous goal motive in sport. Controlled goal motive in sport.[br] Goal effort. Goal attainment.[bp] Autonomy for sport. Competence for sport. Relatedness for sport. Positive affect. Negative affect. Life satisfaction. Physical and emotional burnout.	CO	CAS	AS	-
Smith, Ntoumanis, & Duda (2010)	P[bs]	184[bt] regularly training British athletes. 87 males, 95 females, 7 unspecified.	23.97 (9.77), range 18-67.[bu]	Autonomous goal motives. Controlled goal motives. Goal progress. Relative well-being.	CO	CAS	AS	-

Soenens, Vansteenkiste, & Sierens (2009)	CS	495 Belgian undergraduate university students. 129 males, 366 females.	19.30 (0.95), range 17-25. [E]	Self-esteem. Depressive symptoms.	P	IAS[bv]	AS	-
Spray, Wang, Biddle, & Chatzisarantis (2006)	EXP	147 British secondary school pupils, all novice golf players. 80 males, 67 females.	13.43 (1.26). [CH]	Autonomy for golf.[bw] Enjoyment of golf task.[bx] Number of successful putts. Free choice behaviour for golf. Enjoyment of free choice behaviour on golf task.	E	IAS	AS	CLG
Standage & Gillison (2007)	P[by]	300 British secondary school pupils. 138 males, 162 females.	13.51 (0.77), range 12-15. [CH]	Autonomy for PE. Competence for PE. Relatedness for PE. RAI for PE. Self-esteem. Health-related quality of life.	T	IAS	AS	-
Standage, Duda, & Ntoumanis (2003)	CS	328 British secondary school pupils. 160 males, 138 females, 30 unspecified.	13.56 (0.59), range 12-14. [CH]	Autonomy for PE. Competence for PE. Relatedness in PE. RAI, IJ, and AM for PE. Intention to engage in LPA.	T	IAS	ADS	-
Standage, Duda, & Ntoumanis (2005)	CS	950 British secondary school	12.14 (0.91), range 11-14. [CH]	Need satisfaction (autonomy, competence, and	T	CAS	ADS	-

		students. 443 male, 490 female, 17 gender not specified.		relatedness) in PE. IM, ID, IJ, ER, and AM for PE. Positive affect. Preference for challenge.[bz]				
Standage, Duda, & Ntoumanis (2006)	P[ca]	394 British secondary school pupils. 204 males, 189 females, 1 unspecified.	11.97 (0.89). [CH]	Autonomy for PE. Competence for PE. Relatedness in PE. IM, ID, IJ, ER, AM, and RAI for PE. Teacher rating of motivated behaviour in PE.	T	IAS	AS	-
Taylor & Ntoumanis (2007)	CS	787 British high school students. 399 males, 371 females, 17 unspecified.	12.81 (1.42), range 11-16. [CH]	Autonomy for PE. Competence for PE. IM, ID, IJ, ER, AM, and RAI for PE.	T	IAS	AS	-
Thompson & Wankel (1980)	EXP	36 adult female member of physical fitness club. Desire to lose weight and free of physical limitations.	Median = 28, range 18-55 [AD]	Intention to exercise. Attendance at club.	IN	IAS	AS	CTL
Trouilloud, Sarrazin, Bressoux, & Bois (2006)	P	421 French high school students. 191 males, 230 females.	13.42 (1.73) [CH]	Competence for PE.	T	IAS	AS	-

Turner, Irwin, Tschann, & Millstein (1993)	CS	189 American public middle school students. 110 males, 79 females.	Range 11-14. [CH]	Self-esteem. Sexual risk behaviour. Fighting behaviour. Substance use.	P	IAS	AS	-
Valimaki, Leino-Kilpi, Gronroos, Dassen, Gasull, Lemonidou, Scott, & Benedicta (2004)	CS	1043[cb]surgical patients in five European countries (Finland, Spain, Greece, Germany, and Scotland). All patients had stayed in hospital for 3 days or more. 756 males, 698 females.	54.00 (16.58). [AD]	Independence[cc] Subjective health status.	HCP	IAS	AS	
Vandereycken & Vansteenkiste (2009)	EXP[cd]	174 eating disorder patients; 87 treated under intervention strategy and 87 selected from files of patients treated under older strategy.	21.00, range 15-45. [E]	Drop-out from treatment. Change in BMI.[ce]	HCP	IAS	ADS	CTL
Vansteenkiste, Simons, Soenens, & Lens (2004)	EXP	501 Belgian students. 269 males, 232	[CH]	Autonomy for exercise activity. IM, ID, IJ, and ER	E	IAS	AS	CLG

		females.		for exercise activity. Effort in exercise activity. Teacher graded performance on exercise activity. Free choice persistence.[cf] Club membership.				
Vierling, Standage, & Treasure (2007)	CS	237 predominantly low socio-economic status Hispanic students. 120 males, 119 females.	12.11 (1.21), range 9.81-14.41. [CH]	Autonomy for LPA. Competence for LPA. Relatedness in LPA. IM, ID, IJ, ER for LPA. Average step count per day. BMI.	T PA	CAS	AS	-
Ward, Wilkinson, Graser, & Prusak (2008)	EXP	122 American adolescent female middle school pupils.	[CH][cg]	RAI for PE. Step count within daily fitness activity classes.	T	IAS	AS	CTL
Williams, Cox, Hedberg, & Deci (2000)	CS	271 high school pupils.	[CH]	Risk behaviour index, representing alcohol use, smoking, marijuana use, chewing tobacco, and sex.[ch]	P	IAS	AS	-
Williams, Freedman, & Deci (1998)	P	128 medicated diabetic patients. 56 males, 72 females.	54.5 (13.8), range 18-80. [AD]	HbA1c[cf ci]	HCP	[U]	AS	-
Williams, Gagne,	EXP	239 adult	> 18 years of	Autonomous	HCP	CAS[cj]	AS	CLG

Ryan, & Deci (2002)		outpatient smokers.	age. [AD]	motivation for smoking cessation. Competence for smoking cessation. Continuous abstinence from smoking.				
Williams, Grow, Freedman, Ryan, & Deci (1996)	P[ck]	103 severely obese individuals. 35 males, 93 females.[cl]	43.00 [AD]	Autonomous motivation for weight loss programme. Controlled motivation for weight loss programme. Attendance at programme. LPA.	HCP	CAS	AS	-
Williams, Levesque, Zeldman, Wright, & Deci (2003) study a	CS	1060 American physicians. 850 male, 210 female.	50.0 [AD]	Autonomy for counseling patients in smoking cessation. Competence for counseling patients in smoking cessation. Use of training in counseling patients in smoking cessation. Time spent implementing training in counseling patients in smoking	[E][cm]	IAS	AS	-

				cessation.[cn]				
Williams, Levesque, Zeldman, Wright, & Deci (2003) study b	P[co]	220 American HCPs. 72 males, 148 females. 61 physicians, 159 other HCPs.	[AD]	Autonomy for counseling patients in smoking cessation. Competence for counseling patients in smoking cessation.[cp] Use of training in providing smoking cessation counseling to patients. Time spent counseling patients in smoking cessation.	[E][cq]	IAS	AS	-
Williams, Lynch, & Glasgow (2007)	EXP[cr]	886 adults with type 2 diabetes.	> 25 years of age. [AD]	PAS Competence HbA1c Lipid ratio Diabetes distress Depressive symptoms	HCP	IAS	ADS	CTL
Williams, Lynch, McGregor, Ryan, Sharp, & Deci (2006)	P[cs]	197 adult smokers with above average cholesterol level.[ct]	> 18 years of age. [AD]	Autonomous motivation for diet. Competence for diet. % calories from fat. % calories from saturated fat. Soluble dietary fibre. % calories from monounsaturated fats.	SO HCP	IAS	AS	-

				Total calories.				
Williams, McGregor, King, Nelson, & Glasgow (2005)	CS	591 diabetic patients from primary care practices. 293 males, 298 females.	Range 28-90. [AD]	Perceived competence for daily aspects of diabetes care. Depression. Patient satisfaction. HbA1c.	HCP	[E][cu]	AS	-
Williams, McGregor, Sharp, Kouides, Levesque, Ryan, & Deci (2006)[cv]	EXP	1006 American adult smokers. 363 male, 643 female.	45.5. [AD]	12 month prolonged abstinence from tobacco. 6 month point prevalence abstinence.[cw] Serious quit attempt by 6 months. Medication use.[cx]	CN	CAS	AS	CTL
Williams, McGregor, Sharp, Levesque, Kouides, Ryan, & Deci (2006)	EXP	1006 adult smokers. 363 male, 643 female.	45.5. [AD]	6 month prolonged abstinence.[cy]	CN	CAS	AS	CTL
Williams, McGregor, Zeldman, Freedman, & Deci (2004)	P[cz]	159 diabetes patients from diabetes care centre with poorly controlled Type 2 diabetes. 79 male, 80 female.	55.99 (10.95), range 24.23 – 79.77 [AD]	Autonomous motivation for following diabetes care. Competence for diabetes care. HbA1c. Dieting behaviour. Exercise behaviour. Glucose testing.	HCP	IAS	AS	-
Williams, Niemiec, Patrick, Ryan, & Deci	EXP	1006 adult smokers who had smoked >	> 18 years. [AD]	24 month prolonged abstinence from tobacco.	CN	CAS	ADS	CTL

(2009)		100 cigarettes in their lifetime.		7 day point-prevalence abstinence from tobacco.[da] Autonomous motivation for smoking cessation. Perceived competence for smoking cessation. Medication use.				
Williams, Patrick, Niemiec, Williams, Divine, Lafata, Heisler, Tunceli and Pladevall (2009)	P	2038[db] adult patients with Type 2 diabetes. 1076 males, 962 females.	64.6 (9.9). [AD]	Autonomous motivation for medication use. Competence for diabetes self-management. Quality of life. Pharmacy-reported antidiabetic medication adherence. Self-reported antidiabetic medication adherence.[dc] Pharmacy-reported lipid-lowering medication. Self-reported lipid-lowering medication.[dc] HDL cholesterol.[dd]	HCP	IAS	AS	-
Williams, Rodin, Ryan, Grolnick, &	P[de]	126 adults taking at least	56.30 (7.52), range 37-65.	Autonomous motivation for	HCP	[U][df]	AS	-

Deci (1998)		one prescription medication for previous month and expected continue for following month. 31 males, 95 females.		medication-taking. Controlled motivation for medication-taking. Adherence to medication.				
Wilson & Rodgers (2004)	CS	232 female university staff and students from a team-based intramural physical activity event at a Canadian university.	20.86 (2.21), range 17-31. [E]	IM, ID, IJ, ER, and AM for exercise. Intention to engage in exercise.	F	IAS	AS	-
Wilson, Evans, Williams, Mixon, Sirard, & Pate (2005)	EXP	44 American underserved school pupils.	11.00 (0.6), range 11-14 [CH]	Autonomous motivation for PE. Moderate, moderate-vigorous, and vigorous PA.[dg]	E	IAS	ADS	CTL
Zeldman, Ryan, & Fiscella (2004)	P[dh]	74[di] participants. 38 males, 36 females.	41.2 (7.14)	Autonomous treatment motivation. Controlled treatment motivation. Relapse.[dj] Attendance at clinic. Take-home status for medication.	HCP	CAS	AS	-

Zoffmann & Lauritzen (2006)	EXP	50 Danish Type 1 diabetes patients with persistent poor glycemic control.	Range 18-49. [AD]	PAS. Autonomous motivation for diabetes self-care. Controlled motivation for diabetes self-care. Amotivation for diabetes self-care. Competence for diabetes self-care. Problem areas in diabetes.[dk] Frequency of self-measured blood glucose.	HCP	IAS	ADS	CTL

Note. SD = standard deviation; [E] = excluded due to overlapping two or more moderator groups; [U] = unclassified due to insufficient information/data; CS = cross-sectional; P = prospective; EXP = experimental; [AD] = adult sample; [CH] = child/adolescent sample; IM = intrinsic motivation; IG = integrated regulation; ID = identified regulation; IJ = introjected regulation; ER = external regulation; AM = amotivation; RAI = autonomous motivation; TPB = theory of planned behaviour intention; PE = physical education = LPA = leisure-time physical activity; PAS = perceived autonomy support; CO = coach; SO = significant other; T = teacher; E = experimenter; IN = exercise instructor; P = parents; F = friend; FA = family; HCP = health care professional; WC = written communication; CN = counsellor; CAS = complete autonomy support; IAS = incomplete autonomy support; AS = autonomy support alone; ADS = additional support; CTL = control group; CLG = controlling group. [a]Intrinsic motivation to know, to accomplish, and to experience stimulation were averaged to produce a single score for IM. [b]Effect sizes for the four forms of behavioural intention were based on cross-sectional associations and the effect size for behaviour was prospective. [c]N for the various associations varied between 149 and 162, so the median value was used in effect size calculations (156). [d]The measure of physical activity behaviour used in the calculation of the effect size was the measure at the third wave of data collection. [e]It should be noted that the control group in this study received a more incomplete form of AS (rationale only) than the experimental group (choice, rationale, and acknowledgment of perspective). [f]The comparison group was neither a standard control or controlling; it was also autonomy-supportive, although to a lesser extent than the experimental condition. [g]The association between AS and intention was cross-sectional, while that between AS and behaviour was prospective. [h]The effects of both complete and incomplete provision of AS were assessed; one experimental group received the former and the other received the latter. [i]Neutral control and controlling comparison conditions were evaluated. [j]PAS from two sources combined was assessed, therefore the independent effect of each could not be disentangled. [k]The assessment of autonomy, coach-related competence, and relatedness was cross-sectional, while competence for sport and self-esteem were measured prospectively. [l]Effect sizes were based on the average effect of the interest and praise subscales of the AS measure on each dependent variable. [m]Effects of AS on positive and negative effect were averages of effects on each 15 minutes into the exercise session and 5 minutes after the end of the exercise session. [n]The effect sizes for IM to know, IM to accomplish, and IM to experience stimulation were averaged to provide a single effect size. [o]Perceived enjoyment of PE was taken as an additional indicator of IM and averaged with the IM effect size. [p]The measure of AS employed was an integrative negotiation scale, which represents an autonomy-supportive form of negotiation. [q]The other behavioural regulation subscales (IJ and ER) were measured but the corresponding data was not available. [r]Effect sizes for all dependent variables were averaged across two waves of follow-up data. [s]"IM" was coded as autonomous motivation, as some of the items reflected identified regulation, e.g., "Because I want to improve in physical education" and "Because it is important for me to do well in physical education". "Extrinsic motivation" was likewise coded as controlled motivation. [t]Competence for PE was also assessed but the data were not available to compute an effect size. [u]The measure of AS was an assessment of non-directive teaching that was analogous to AS. [v]PAS was measured but excluded from the meta-analysis because of distortion arising from the multiplication of total PAS score by minutes spent in counselling. [w]The study was excluded from the moderator analysis for comparison group, as the comparison group for the intensive autonomy-supportive intervention was a group that received a brief autonomy-supportive intervention. [x]Only the prospective associations from this study were included in the meta-analysis; cross-sectional associations between PAS and the motivational constructs were excluded. [y]The need satisfaction and motivation measures are averages of daily post-gymnastic practice assessments. [z]The effect size for PAS on attendance was based on coach PAS, as data was not provided for the effect of parent PAS on attendance. [aa]The effect size for PAS on RAI for PE was based on a cross-sectional association, while the effect sizes for RAI for LT, intention, and behaviour were based on prospective associations. [ab]Effect sizes for PAS on IM, ID, IJ, and ER for PE were based on cross-sectional associations, while effect sizes for PAS on these IM, ID, IJ, and ER for leisure-time physical activity, intention, and behaviour were based on prospective assessments of the dependent variables. [ac]Only the first study reported in this paper was included within the meta-analysis, as the second was not relevant to the research questions. [ad]The measure of AS was an assessment of democratic behaviour from the coach, which was analogous with AS. [ae]96 patients were initially recruited, and the total sample size varied between 36 and 51 across follow-ups. Precise numbers providing data at each follow-up were used in effect size calculations. [af]Effect sizes for all outcomes were averaged across two follow-ups. The number of participants retained at the last wave of data collection was used in effect size calculations to ensure a conservative estimate. [ag]This outcome was classified as "learning". [ah]This was used as an indicator of IM, as intrinsically motivated behaviour is characterized partly by choice. [ai]Effect sizes of PAS on psychological distress in three different affective domains were averaged to provide a single effect of PAS on psychological distress. [aj]Effect sizes for the two measures of adherence were averaged to provide a single effect size. Both measures of adherence were coded such that higher scores represented greater adherence. [ak]Active role in decision-making was classified as autonomy. [al]Disability status was classified as an indicator of ill-being. [am]Disease course was categorized as a physiological indicator of behavioural adherence. [an]This study was excluded from the moderator analysis for provider of AS, as AS was provided by both a nurse and an expert patient. [ao]The psychological distress/well-being measure was categorised as relative positive affect, as items related to positive and negative affective dimensions and a score of relative positive affect was produced. [ap]AS was rated through observation of the autonomy-supportive behaviours of the patients' families. [aq]This was a subsample of the original sample, as only the autonomy-supportive and control conditions of the intervention were relevant to the meta-analysis. [ar]The study was prospective, but associations reported in the meta-analysis were cross-sectional in nature. [as]Clinic- and home-based measures of adherence were averaged. [at]The effect size for PAS on relatedness was the average of effects on two dimensions of relatedness: personal relatedness and social assimilation. [au]This study reported data from the same intervention study as Mildestvedt, Meland, and Eide (2008). [av]Effect sizes on these outcomes were averaged across two waves of follow-up data collection. Data on other study variables (PAS, autonomous motivation, negative affect, and self-efficacy) were not available. [aw]AS was provided by a psychologist, nurse, or social worker, but this varied across recipients and the independent effects of each source could not be identified. The study was therefore excluded from the moderator analysis of provider of AS. [aw]Effect sizes for AS on exercise intensity and frequency were averaged to produce a single effect size estimate. [ax]AS was provided by a psychologist, nurse, or social worker, but this varied across recipients and the independent effects of each source could not be identified. [ay]Exercise behaviour was also assessed but the data could not be obtained. [az]Boredom was classified as an indicator of negative affect. [ba]Effect sizes for PAS on all variables but participation status were based on cross-sectional associations. [bb]The concentration outcome was excluded. [bc]Depressive symptoms were generally categorised as negative affect, but in this case it was encompassed in an overall assessment of well-being. [bd]As this was the only study that reported perceived provision of AS from nursing home staff, it was excluded from the provider moderator analysis. [be]The effect size for PAS on enjoyment was averaged with the effect size for IM. [bf]Effect sizes for PAS on the regulatory constructs were based on cross-sectional associations, while the behavioural measure was based on a prospective association. [bg]Persistence at swimming at 22 months was used for the effect size calculation. [bh]The effect size for PAS on IM for PE was based on a cross-sectional relationship, while all other effect sizes were based on prospective associations. [bi]Effect sizes for weight loss and BMI were based on experimental data, while the effect size for autonomous motivation was based on a correlation with PAS. [bj]The association between PAS and weight loss was also included in the meta-analysis. [bk]The experimenter was the provider of AS within the intervention component of the study. [bl]Friends and family were the providers of the AS for the correlational component of the study. [bm]Only situational and not contextual level data was available. Effects were averaged over three follow-ups. [bn]Intrinsic satisfaction with and interest in sport was classified as intrinsic motivation, as these are representative of key facets of the construct. [bo]Intention to eat more fruit and vegetables comprised the average of two separate measures; one pertaining to fruit and the other to vegetables. [bp]Goal attainment was classified as behaviour. [bq]The internalisation score reported is equivalent to the RAI. [br]Autonomous and controlled goal motives in sport was taken as indicators of composite autonomous and controlled motivation, respectively. [bs]Effect sizes for composite autonomous and controlled motivation were based on cross-sectional measures, while those for goal progress and relative well-being were based on prospective associations. [bt]Originally 189 but 5 athletes were excluded due to injury that precluded regular training. 108 athletes remained and time 2 and contributed to prospective measures. [bu] These demographics pertain to the sample remaining at time 2. [bv]Only effect sizes pertaining to the promotion of volitional functioning measure were included, as this was clearly grounded in SDT while the promotion of independence measure was not. [bw]The effect size of AS on autonomy comprised the average of effect sizes of AS on the choice and responsibility subscales of the autonomy measure. [bx]The effect size for AS on enjoyment of the golf task was averaged with the effect size for the measure of enjoyment of free choice behaviour on the golf task to provide an indicator of IM. [by]Effects of PAS on all variables were based on cross-sectional associations, with the exceptions of general self-esteem and health-related quality of life. [bz]The effect size for PAS on preference for challenge was averaged with the effect size for PAS on IM. Concentration was excluded, as this outcome was not pertinent to the main research questions. [ca]All effect sizes of PAS on dependent variables were cross-sectional, with the exception of the effect of PAS on teacher-rated motivated behaviour. [cb]Only 1017 patients provided data on subjective health status. [cc]The measure of independence was synonymous with autonomy in daily activities. [cd]The intervention group in this study was compared with the records of a matched group who had previously been through the old system at the eating disorder unit. [ce]Effect sizes for AS on dropout were averaged across four follow-ups, and for BMI were averaged across six follow-ups. The number of people contributing to the effect size at the final wave was used as the representative sample size in the meta-analysis, in order to ensure a conservative estimate. [cf]The effect size for AS on persistence was averaged across three follow-ups. [cg]The sample consisted of seventh- and eighth-grade adolescent girls from a middle school. [ch]An effect size for PAS on relative extrinsic aspirations was not included, as this measure was not directly health-related. [ci]Autonomous motivation and perceived competence were also measured, but the data could not be obtained. [cj]AS measure was rated autonomy support from physicians, provided by three trained raters responding to five items on the short form health care climate questionnaire (HCCQ, Williams, Grow, Freedman, Ryan, & Deci, 1996). [ck]Only prospective associations between PAS and dependent variables were included in the analyses. [cl]The number of males and females pertains to the original sample, as this information is not available for the final sample. [cm]PAS was provided by insurers, and only this paper reported provision from this source. [cn]Although the dependent variables were not related to the physicians' own health, this study was health-related and therefore included in the analyses. [co]All effects of PAS on dependent variables were based on prospective associations, except for those of workshop instructor PAS on autonomy and competence (these were cross-sectional). [cp]Effect sizes for PAS on autonomy and competence were also calculated for workshop instructor PAS following the delivery of a workshop on implementation of smoking cessation counselling. [cq]PAS was provided by insurers and workshop instructors, and only this study reported PAS from these sources. The paper was therefore excluded from moderator analyses for provider of AS. [cr]The effect sizes for AS on PAS and competence were based on experimental between-groups data. Effects on HbA1c, lipid ratio, diabetes distress, and depressive symptoms were all based on PAS and prospective associations. [cs]This was based on an experimental intervention study but the paper reported scale validation analyses which were based on prospective associations. [ct]The main intervention study sample consisted of 865 smokers; a subsample of 197 participants was employed for the scale validation component. [cu]PAS was assessed using both the short and long forms of the HCCQ; the former provides a measure of IAS and the latter an assessment of CAS. [cv]This paper reported data from the same intervention study as reported in Williams, McGregor, Sharp, Levesque, Kouides, Ryan, & Deci (2006). [cw]The two measures of abstinence were averaged with the measure of abstinence reported in Williams, McGregor, Sharp, Levesque, Kouides, Ryan, & Deci (2006), as all measures pertained to the same outcome variable within a single intervention study. [cx]Further dependent variables were assessed but standard deviations for group scores could not be obtained. [cy]This effect size was averaged with the two abstinence effect sizes reported in Williams, McGregor, Sharp, Kouides, Levesque, Ryan, & Deci (2006), as it derived from the same intervention study. [cz]This was a randomised controlled trial but group means and standard deviations were not available so prospective correlations were used in the calculation of effect sizes. [da]Effect sizes for the two measures of abstinence were averaged to provide a single effect of AS on abstinence from tobacco. [db]The number of participants contributing to each correlation was not available, so the lowest sample size (1783) was used to calculate each effect size. [dc]Effect sizes for pharmacy-reported and self-reported adherence were averaged to provide a single effect size. [dd]Glycosylated hemoglobin and blood glucose were also measured but the necessary data was not available for the calculation of effect sizes. [de]Effect sizes for composite autonomous and controlled motivation were based on cross-sectional associations, while that for adherence to medication was based on a prospective association. [df]Information on the exact items used to measure PAS were not available, so the study was excluded from the moderator analyses for completeness of AS. [dg]Effect sizes for moderate, moderate-to-vigorous, and vigorous physical activity were averaged to provide a single effect size.

[dh]Associations between PAS and autonomous and controlled motivation were based on retrospective associations and effect sizes for these variables were therefore excluded from the moderator analyses for study design. [di]60 participants remained at follow-up and provided data for relapse, attendance, and take-home status. [dj]Relapse was coded as a behavioural outcome. [dk]The problem areas in diabetes variable was categorised as negative affect, as it incorporated problems related to emotion.

Appendix 2: Computing the Adjusted Ratio of Clustering Index (ARC, Roenker, Thompson, & Brown, 1971) for Participants' Self-Generated and Recalled Physical Activity Goals (Chapter 5)

$$\text{ARC} = \frac{R - E(R)}{\text{max}R - E(R)}$$

R = total number of observed category repetitions (i.e., the frequency with which a category item follows an item from the same category), maxR = maximum possible number of category repetitions, and E(R) = expected (chance) number of category repetitions.

maxR = N-k

N = total number of items listed, k = number of categories represented in the recall protocol.

$$E(R) = \frac{\sum n_i^2}{N} - 1 \qquad \text{or } (((i*i) + (e*e)/N) - 1$$

n_i = number of categories recalled from category i.

i = intrinsic goal, e = extrinsic goal

Example list of physical activity goals:

Toned body (e), physical attractiveness (e), lower stress (i), social interaction (i), good health (i), impress others (e), weight loss (e).

i = 3

e = 4

R = 4

N = 7

k = 2

$\sum n_i^2 = 3^2 + 4^2$

$\sum n_i^2 = 25$

maxR = 7-2 = 5

$$E(R) = \frac{25}{7} - 1$$

$$E(R) = 2.57$$

$$ARC = \frac{4 - 2.57}{5 - 2.57}$$

$$ARC = \frac{1.43}{2.43}$$

$$ARC = 0.59$$

Appendix 3: Replication of the Factorial, Nomological, and Discriminant Validity of a Scale Measuring Integrated Regulation in a Dieting Context

Self-determination theory (SDT; Deci & Ryan, 1985, 2000) has been adopted to explain the influences on health related behaviour in a number of domains, including dietary behaviour (e.g., Palmeira et al., 2007). Autonomous behavioural regulations have been shown to significantly predict desirable dietary behaviour changes, including attendance at weight-loss programmes, and greater maintained weight loss over time (Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004; Williams, Grow, Freedman, Ryan, & Deci, 1996). As dieting is a behaviour that is unlikely to be intrinsically-motivated, the process of internalisation of externally-based regulation may underlie successful dieting and the construct of integrated regulation is pertinent.

However, a paucity of research on integrated regulation in a dieting behaviour context is evident. Pelletier and colleagues (2004) included an integrated regulation sub-scale within the Regulation of Eating Behaviour Scale (REBS) but did not explore the relative importance of this construct as a predictor of eating behaviour. The integrated regulation sub-scale of the REBS is also limited by its development in a sample consisting entirely of female students and the absence of detail regarding the generation of items. Additionally, this scale focuses on healthy eating rather than dieting behaviour.

In order to achieve a comprehensive understanding of motivational forces underlying dieting behaviour, it is necessary to employ an instrument incorporating all behavioural regulation types from OIT, including an integrated regulation scale developed from first principles. The predictive validity of such an instrument should also be enhanced by the addition of a measure of integrated regulation, through increasing the proportion of explained variance in behaviour.

The aim of the current study is to extend the findings of previous detailing the development of a scale measuring integrated regulation in physical activity (see Chapter 6) by evaluating the factorial, nomological, and discriminant validity of the measure in a dieting context. Four items measuring integrated regulation were modified for dieting behaviour and confirmatory factor analyses were used to replicate the effects determined in physical activity data. The predictive validity of the scale was also tested through regressing dieting behaviour on integrated regulation and the remaining five regulatory constructs from the continuum of behavioural regulation specified by SDT.

The research hypotheses were as follows:

(1) The integrated regulation scale is expected to show discriminant validity with measures of constructs that are most proximal on the continuum of behavioural regulation, i.e., intrinsic motivation and identified regulation. The integrated regulation items are hypothesized to load solely on the respective latent factor in confirmatory factor analyses with no cross-loadings on factors representing intrinsic motivation and identified regulation. The regulatory constructs will also show discriminant validity with other factors on the continuum.

(2) A simplex-like pattern of relationships will emerge among the regulatory constructs such that constructs situated closer to each other on the continuum will exhibit stronger associations than constructs situated further away. This will provide evidence of the nomological validity of the integrated regulation scale and situate it appropriately relative to the other constructs on the continuum.

(3) Integrated regulation will account for a significant proportion of variance in prospectively-measured dieting behaviour, beyond that accounted for by the other regulatory constructs and while statistically controlling for age.

Method

Participants

A sub-sample from the study reported in Chapter 6 (N = 153, Males = 38, Females = 115, *M* age = 23.60, *SD* = 10.21) provided data from a dieting context and follow-up behavioural data for dieting at the second wave of data collection.

Design

The motivational data were collected in a cross-sectional survey, with a prospective follow-up behavioural measure.

Measures[1]

Behavioural regulations in dieting. The motivational constructs from the regulatory continuum with the exception of the integrated regulation subscale were measured using a modified version of the BREQ-2 (Markland & Tobin, 2004) measure, adapted for dieting behaviour.

Integrated regulation for dieting. The four core items selected in the main physical activity study, based on their representation of the essence of integrated regulation and high representativeness ratings from the expert judges, were adapted for dieting behaviour in the dieting instrument (e.g., "Watching my diet is consistent with the other things I feel are important in my life").

Past dieting behaviour. Past dieting behaviour was measured through a single item, taken from Harris and Hagger (2007). The item presented the participant with the introductory statement "I watched my diet in the past four weeks with the following regularity" and responses were made on a six-point response scale, consisting of the following points: *never, very seldom, occasionally, some days, most days,* and *everyday.*

Prospective dieting behaviour. Two items were used for the prospective measure of dieting behaviour. The first item was "In the course of the past four weeks, how often have you engaged in dieting behaviours?" with responses made on a six-point scale ranging from *never to everyday.* The second item was "I engaged in watching my diet with the following regularity over the past four weeks" with responses made on a six-point scale ranging from *everyday to almost never".*

Procedure

Participants completed the initial questionnaire in a quiet environment. The questionnaire was presented as a survey on dieting and participants were informed of their right to withdraw from the study at any time. All data were collected anonymously to preserve confidentiality. A definition of dieting behaviour was provided. The prospective behavioural follow-up was administered after a four week interval and responses for each participant were matched using date of birth and the first three letters of mother's maiden name to preserve anonymity.

Results

Factorial Validity in the Dieting Context

The CFA examining the validity of the new integration subscale was replicated in a dieting context. The same four items that comprised the final integrated regulation scale for physical activity behaviour adapted for dieting behaviour were set to load on a single integrated regulation factor. The model showed good fit to the data, S-B χ^2 = 3.37, df = 2, p = .19; CFI = .99; NNFI = .98; SRMR = .02; RMSEA = .06, 90% CI = [.00, .18]. Almost all items demonstrated acceptable factor loadings, and variance accounted for by the factor in each item was satisfactory (median λ = .83, range .61 to .89, median R^2 = .68). The only exception was integration item 13 (see Table 6.1, Chapter 6 for content) that exhibited slightly lower than expected statistics (λ = .61, R^2 = .38)

Nomological and Discriminant Validity for Dieting Behaviour

The CFA model testing nomological and discriminant validity of the new integrated regulation scale for dieting behaviour with respect to the other PLOC continuum constructs and the presence of a simplex-like structure for the regulatory constructs was estimated. The structure of the model mirrored that for physical activity behaviour. The model showed adequate fit with the data, S-B $\chi^2 = 326.17$, df = 174, $p < .001$; CFI = .90; NNFI = .87; SRMR = .08, RMSEA = .07, 90% CI = .06 (LB), .08 (UB). Covariances among latent factors were examined in order to determine whether the simplex-like structure characteristic of the PLOC continuum and found that the relationships followed the simplex-like pattern as hypothesised. (see Table A3.1). However, there was an exception to the pattern with the existence of a stronger negative association between introjected regulation and amotivation than between intrinsic motivation and amotivation. Discriminant validity for integrated regulation was determined as none of the 95% confidence intervals for the inter-factor covariances encompassed unity.

Regression Analysis

The predictive validity of the integrated regulation measure was tested through multiple regression analysis. In the regression model, dieting behaviour was regressed on to the six regulatory constructs and age. The regression model for dieting was significant, $F(7,144) = 12.31$, $p < .001$. A total of 37.4% of the variance in dieting behaviour was accounted for by the six regulatory constructs and age. Identified ($\beta = .31$, $p < .01$) and introjected ($\beta = .27$, $p < .01$) regulations emerged as significant independent predictors of dieting behaviour. Diagnostics did not indicate any problems with multicollinearity.

Table A3.1.

Covariances Among The Regulatory Factors for Dieting Behaviour

Regulation	1	2	3	4	5	6
1. Intrinsic motivation	-					
2. Integrated regulation	.33**	-				
3. Identified regulation	.22**	.18**	-			
4. Introjected regulation	.26**	.31**	.34**	-		
5. Extrinsic regulation	.11**	.15**	.05	.16**	-	
6. Amotivation	-.08*	-.03	-.21**	-.27**	.04	-

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

Discussion

In addition to supporting the validity of the integrated regulation scale developed for physical activity, the adapted scale for dieting represents, to the best of our knowledge, the first instrument to assess integrated regulation in a dieting context. The newly-developed four-item integrated regulation scale exhibited factorial validity for dieting behaviour through confirmatory factor analyses thereby replicating the pattern of findings obtained in the physical activity domain.

Nomological validity was also demonstrated for the scale, using the dieting data. Consistent with the pattern of effects for the physical activity data, a simplex-like structure was evident for the regulatory constructs, with the integrated regulation factor appropriately situated regulatory continuum, evidenced by positive and strong covariances with the most proximal constructs of intrinsic motivation and identified regulation. Also congruent with theoretical predictions, negative associations were observed with constructs located at the distal end of the continuum. Furthermore, despite significant factor covariances, none of the covariance confidence intervals encompassed unity providing evidence for the discriminant validity for the integrated regulation scale in the dieting context.

However, integrated regulation did not predict dieting behaviour in this sub-sample of individuals; only identified and introjected regulations emerged as significant independent predictors. This could be a result of the nature of dieting behaviour, which may be less likely to be regulated by highly autonomous forms of motivation than physical activity, or even healthy eating, and more likely to be governed by the expectation of valued outcomes such as weight loss or improved health or the avoidance of shame and guilt (Strong & Huon, 1999).

Conclusions and Recommendations for Further Research

Further research regarding the possible difficulty involved with assimilating dieting behaviour with the self may facilitate understanding of the role of integrated regulation in this context. Comparisons with healthy eating behaviour may elucidate this further as this is potentially a behaviour that is more willingly adopted to become a lifestyle choice and could show greater alignment with values, beliefs, and life goals. Further, the results on the prediction of prospective dieting behaviour should be interpreted with caution until findings are replicated using objective behavioural measures as common method variance may represent a problem in the use of such self-report measures (Pedhazur & Schemlkin, 1991). Incorporating the present measure of integrated regulation within questionnaires on dieting behaviour that are grounded in SDT will also increase the fidelity of measurement instruments to theory. The measure could also be employed alongside dietary interventions in order to evaluate the sensitivity of the scale to the process of internalisation and to illuminate the potential role of integrated regulation as a mediator of behavioural change.

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Appendix 4: Scales for the Development of the Integrated Regulation Measures for Physical Activity and Dieting Behaviour.

Questionnaire About Your Leisure-Time Physical Activity (1)

Gender: Male ( ) Female ( )

Age: ___________ Date of Birth: Date:_______ Month_________ Year_________

Do you have any chronic illnesses or disabilities that prevent you from participating in regular active sports and/or vigorous physical activities? Yes ( ) No ( )

This questionnaire asks you some questions about your leisure-time physical activity and some more general questions. Physical activity during your leisure-time includes all sports and physical activities that are really active, such as swimming, jogging, sports training etc. There are no right or wrong answers so please answer the questionnaire as honestly as you can. The information you give will not be shown to anyone else. On the following items, please circle the number that best describes you.

During the last SIX MONTHS, I have been doing active sports, and/or vigorous physical activities

Not at all	**Once per week**	**A couple of days per week**	**Several days per week**	**Many days per week**	**Most of the days per week**
1	2	3	4	5	6

During the last TWO WEEKS, I have been doing active sports, and/or vigorous physical activities

Not at all	**Once per week**	**A couple of days per week**	**Several days per week**	**Many days per week**	**Most of the days per week**
1	2	3	4	5	6

Please read the statements below and circle the appropriate number to represent your feelings about participating in active sports and/or vigorous physical activities in your leisure-time.

1 = Not true at all **4 = Very true**

I enjoy exercise	1	2	3	4

I value the benefits of exercise	1	2	3	4
I will feel guilty if I do not exercise	1	2	3	4
I do it because significant others want me to exercise	1	2	3	4
I don’t see why I should exercise	1	2	3	4
It is fun to exercise	1	2	3	4
I think it is important to make the effort to exercise regularly	1	2	3	4
I will feel bad with myself if I do not exercise	1	2	3	4
I do it because people I know well say I should exercise	1	2	3	4
Exercise gives me a sense of well-being	1	2	3	4
I can’t see why I should bother exercising	1	2	3	4
It is important to me to exercise regularly	1	2	3	4
I will feel ashamed if I do not exercise	1	2	3	4

I feel under pressure to exercise from people I know well	1	2	3	4
I think exercising is a waste of time	1	2	3	4
It's part of the way in which I have chosen to live my life	1	2	3	4
I don't see the point in exercising	1	2	3	4
I participate in exercise because I gain a lot of benefits that are important to me	1	2	3	4
It is an important part of who I am	1	2	3	4
It is essential to my identity and sense of self	1	2	3	4
It is part of my 'true self'	1	2	3	4
Doing exercise is consistent with my deepest principles	1	2	3	4
It is an extension of me	1	2	3	4
Participating in exercise is an integral part of my life	1	2	3	4
It is genuinely part of me	1	2	3	4
It is an expression of my essential self	1	2	3	4

It contributes to my sense of personal well-being	1	2	3	4
I fully accept exercise as an activity which is truly my own	1	2	3	4
Doing physical activity is consistent with the other things I feel are important in my life	1	2	3	4
I do it freely and entirely out of my own volition and choice	1	2	3	4
It is consistent with my values, goals and aims in life	1	2	3	4
I feel truly myself and authentic in my actions when I exercise	1	2	3	4
Doing exercise is a fundamental part of who I am	1	2	3	4
Doing exercise is part of the way I have chosen to live my life	1	2	3	4
Doing exercise and being myself are inseparable	1	2	3	4
Participating in exercise is congruent with other important aspects of my life	1	2	3	4
Doing exercise is a means to satisfy my need to choose the activities I do for myself	1	2	3	4

Below are five statements with which you may agree or disagree. Please indicate your agreement with each item by circling the appropriate number on the response scale below each statement.

1) In most ways my life is close to my ideal.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree

2) The conditions of my life are excellent.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree

3) I am satisfied with my life.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree

4) So far I have gotten the important things I want in life.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree

5) If I could live my life over, I would change almost nothing.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree

Please read the following statements and circle the appropriate number on each response scale to represent how these statements apply to you and your life at the present time.

1 = Not at all true **7 = Very true**

1) I feel alive and vital.	1	2	3	4	5	6	7
2) I don't feel very energetic.	1	2	3	4	5	6	7
3) Sometimes I feel so alive I just want to burst.	1	2	3	4	5	6	7
4) I have energy and spirit.	1	2	3	4	5	6	7
5) I look forward to each new day.	1	2	3	4	5	6	7
6) I nearly always feel alert and awake.	1	2	3	4	5	6	7
7) I feel energised.	1	2	3	4	5	6	7

Please answer the following items in relation to your most recent leisure-time active sport/vigorous physical activity experience. These items relate to the thoughts and feelings you may have experienced during the event. There are no right or wrong answers. Think about how you felt during the event and respond to the items using the rating scale below. Circle the number that best matches your experience from the options to the right of each item.

Rating scale:

1	**2**	**3**	**4**	**5**
Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**

I was challenged, but I believed my skills would allow me to meet the challenge	1	2	3	4	5
I made the correct movements without thinking about trying to do so	1	2	3	4	5
I knew clearly what I wanted to do	1	2	3	4	5
It was really clear to me that I was doing well	1	2	3	4	5
My attention was focused entirely on what I was doing	1	2	3	4	5
I felt in total control of what I was doing	1	2	3	4	5
I was not concerned with what others may have been thinking of me	1	2	3	4	5

Time seemed to alter	1	2	3	4	5
I really enjoyed the experience	1	2	3	4	5
My abilities matched the high challenge of the situation	1	2	3	4	5
Things just seemed to be happening automatically	1	2	3	4	5
I had a strong sense of what I wanted to do	1	2	3	4	5
I was aware of how well I was performing	1	2	3	4	5
It was no effort to keep my mind on what was happening	1	2	3	4	5
I felt like I could control what I was doing	1	2	3	4	5
I was not worried about my performance during the event	1	2	3	4	5
The way time passed seemed to be different from normal	1	2	3	4	5

I loved the feeling of that performance and want to capture it again	1	2	3	4	5
I felt I was competent enough to meet the high demands of the situation	1	2	3	4	5
I performed automatically	1	2	3	4	5
I knew what I wanted to achieve	1	2	3	4	5
I had a good idea while I was performing about how well I was doing	1	2	3	4	5
I had total concentration	1	2	3	4	5
I had a feeling of total control	1	2	3	4	5
I was not concerned with how I was presenting myself	1	2	3	4	5
It felt like time stopped while I was performing	1	2	3	4	5
The experience left me feeling great	1	2	3	4	5
The challenge and my skills were at an equally high level	1	2	3	4	5
I did things spontaneously and	1	2	3	4	5

automatically without having to think

My goals were clearly defined	1	2	3	4	5
I could tell by the way I was performing how well I was doing	1	2	3	4	5
I was completely focused on the task at hand	1	2	3	4	5
I felt in total control of my body	1	2	3	4	5
I was not worried about what others may have been thinking of me	1	2	3	4	5
At times, it seemed like things were happening in slow motion	1	2	3	4	5
I found the experience extremely rewarding	1	2	3	4	5

Thank you very much for your help!

Questionnaire About Your Dieting Behaviour (1)

Gender: Male ( ) Female ( )

Age: ___________ Date of Birth: Date:_______ Month_________ Year_________

This is a questionnaire about your dieting behaviour. Watching your diet means cutting down on sugary foods (e.g. sweets, soft drinks, chocolate); cutting down on fatty foods (e.g. butter, bacon, chips); forbidding snacks between meals; decreasing food intake in general by eating lighter meals, not having seconds and not overeating, taking diet pills, liquid diet formula, or medications to control weight, eating lots of diet foods (e.g. reduced calorie salad dressing, diet soft drinks etc.); fasting, i.e. purposefully skipping one or more meals" Dieting does not necessarily imply being on a specific diet or dietary programme. There are no right or wrong answers so please answer the questionnaire as honestly as you can. The information you give will not be shown to anyone else. On the following items, please circle the number that best describes you.

I watched my diet in the past four weeks with the following regularity:

Never	**Very seldom**	**Occasionally**	**Some days**	**Most days**	**Every day**
1	2	3	4	5	6

Please read the statements below and circle the appropriate number to represent your feelings about watching your diet.

	1 = Not true at all		**4 = Very true**	
I enjoy watching my diet	1	2	3	4
I value the benefits of watching my diet	1	2	3	4
I will feel guilty if I do not watch my diet	1	2	3	4
I watch my diet because significant	1	2	3	4

others want me to				
I don't see why I should watch my diet	1	2	3	4
It is fun to watch my diet	1	2	3	4
I think it is important to make the effort to watch my diet regularly	1	2	3	4
I will feel bad with myself if I do not watch my diet	1	2	3	4
I do it because people I know well say I should watch my diet	1	2	3	4
Watching my diet gives me a sense of well-being	1	2	3	4
I can't see why I should bother watching my diet	1	2	3	4
It is important to me to watch my diet regularly	1	2	3	4
I will feel ashamed if I do not watch my diet	1	2	3	4

I feel under pressure to watch my diet from people I know well	1	2	3	4
I think watching my diet is a waste of time	1	2	3	4
It's part of the way in which I have chosen to live my life	1	2	3	4
I don't see the point in watching my diet	1	2	3	4
I watch my diet because I gain a lot of benefits that are important to me	1	2	3	4
It is essential to my identity and sense of self	1	2	3	4
It is genuinely part of me	1	2	3	4
It is consistent with my values, goals and aims in life	1	2	3	4
Watching my diet and being myself are inseparable	1	2	3	4

Thank you very much for your help!

Questionnaire About Your Leisure-Time Physical Activity (2)

The following two questions relate to your leisure-time physical activity over the last four weeks. Physical activity during your leisure-time includes all sports and physical activities that are really active, such as swimming, jogging, sports training etc. There are no right or wrong answers so please answer the questionnaire as honestly as you can. The information you give will not be shown to anyone else. On the following items, please tick the box that best describes you.

In the course of the past four weeks, how often have you participated in leisure-time physical activity for 20 minutes at a time?

Never	Very seldom	Occasionally	Some days	Most days	Everyday

I engaged in leisure-time physical activity for 20 minutes at a time the past four weeks with the following regularity.

Everyday	Most days	On about half the days	A few times, but less than half	A few times	Almost never

Please provide the following details. They are to help us describe the sample as a whole, and your answers will not be used individually.

Gender: Male ( ) Female ( )

Age: ___________ Date of Birth: Date_____ Month______Year_____

What are first three letters of your mother's maiden name?____________
(This information will enable us to match this questionnaire with your previous questionnaire).

Thank you for your help!

Questionnaire About Your Dieting (2)

The following two questions relate to your dieting behaviour over the last four weeks. Watching your diet means cutting down on sugary foods (e.g. sweets, soft drinks, chocolate); cutting down on fatty foods (e.g. butter, bacon, chips); forbidding snacks between meals; decreasing food intake in general by eating lighter meals, not having seconds and not overeating, taking diet pills, liquid diet formula, or medications to control weight, eating lots of diet foods (e.g. reduced calorie salad dressing, diet soft drinks etc.); fasting, i.e. purposefully skipping one or more meals" Dieting does not necessarily imply being on a specific diet or dietary programme. There are no right or wrong answers so please answer the questionnaire as honestly as you can. The information you give will not be shown to anyone else. On the following items, please tick the box that best describes you.

In the course of the past four weeks, how often have you engaged in dieting behaviours?

Never	Very seldom	Occasionally	Some days	Most days	Everyday

I engaged in watching my diet with the following regularity over the past four weeks

Everyday	Most days	On about half the days	A few times, but less than half	A few times	Almost never

Please provide the following details. They are to help us describe the sample as a whole, and your answers will not be used individually.

Gender: Male ( ) Female ( )

Age: ___________ Date of Birth: Date_____ Month______Year_______

What are first three letters of your mother's maiden name?____________
(This information will enable us to match this questionnaire with your previous questionnaire).

Thank you for your help!

Appendix 5: Observational Checklist Employed in Autonomy-Supportive Intervention Study (Chapter 7)

Time ____

Tutor code ____________

Primary behaviours for teachers to promote internalisation and autonomy in students

1. Offering encouragements: Frequency of statements to boost or sustain the student's engagement, such as "Almost" and "You're close".

2. Time allowing student to work in own way: Cumulative number of seconds the teacher allowed the student to work independently and engage in the task in his or her own way.

3. Time student talking: Duration of utterances from students (excluding group work).

4. Avoid asking controlling questions: Frequency of directives posed as a question and voiced with the intonation of a question, such as “Why don’t you go ahead and tell me?”

5. Avoid making “should” / “got to” statements: Frequency of statements that the student should, must, has to, got to, or ought to do something.

6. Providing a meaningful rationale: Providing students with a personally meaningful explanation for what they are doing. (Yes/No)

Secondary behaviours for teachers to promote internalisation and autonomy in students

1. Time listening: Frequency with which the teacher carefully and fully attended to the student’s speech, as evidenced by number of verbal or nonverbal signals of active, contingent and responsive information processing.

2. Praise as informational feedback: Frequency of statements to communicate positive effectance feedback about the student's improvement or mastery, such as "Good job" and "That's great".

3. Offering hints: Frequency of suggestions about how to make progress when the student seems stuck.

4. Being responsive to student-generated questions: Frequency of contingent replies to a student-generated comment or question, such as "Yes, you are right" and "Yes, you have a good point".

5. Making perspective-acknowledging statements: Frequency of empathic statements to acknowledge the student's perspective or experience, such as "Yes, this is difficult".

6. Minimise time holding/monopolising learning materials: Cumulative seconds the teacher physically holds or possesses learning materials.

7. Avoid uttering solutions/answers: Number of solutions or answers the teacher provides before the student has the opportunity to discover the answer for himself or herself.

8. Avoid uttering directives/commands: Frequency of directing (in a controlling manner) or commanding students to engage in a task.