From Psychological Need Satisfaction to Intentional Behavior: Testing a Motivational Sequence in Two Behavioral Contexts

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*The present study tested a motivational sequence in which global-level psychological need satisfaction from self-determination theory influenced intentions and behavior directly and indirectly through contextual-level motivation and situational-level decision-making constructs from the theory of planned behavior. Two samples of university students (*N = *511) completed measures of global-level psychological need satisfaction, contextual-level autonomous motivation, and situational-level attitudes, subjective norms, perceived behavioral control, intentions, and behavior in two behavioral contexts: exercise and dieting. A structural equation model supported the proposed sequence in both samples. The indirect effect was present for exercise behavior, whereas both direct and indirect effects were found for dieting behavior. Findings independently supported the component theories and provided a comprehensive integrated explanation of volitional behavior.*

Keywords: *self-determination; planned behavior; hierarchical model; theoretical integration*

When we say that a person is highly motivated, we are often basing our judgment on the observation, erroneous or not, that in a number of different contexts the person exhibits behavior that is goal directed and persistent. Indeed, we often talk of motivation itself as a personality trait or an implicit characteristic that energizes behavior in a number of given contexts (Kehr, 2004). These phenomena raise questions as to the extent to which human behavior is dependent on global, generalized, stable, and trait-like motivational constructs (Vallerand, 1997). Modern theories of motivation and volition owe much to early humanists, such as Maslow (1943) and White (1959), whose theories emphasized the role of global, overarching needs that facilitate motivated behavior. Integrating the concept of need satisfaction into theories of motivation is desirable because it aims to answer questions regarding the relative contribution of global motives on situational-level behavior in a number of contexts. According to Sheldon, Elliot, Kim, and Kasser (2001), "need concepts are attractive because they can potentially provide genotypic explanations for the wide variety of phenotypic behaviors that individuals express" (p. 325). Thus, a comprehensive theory of motivation that is applicable across a range of goal-directed behaviors would do well to consider the influence of global psychological needs alongside contextual-level and situational-level motivational constructs.

Self-determination theory is a theory of motivation that explicitly endorses the role of a set of global psychological needs in determining human motivation and specific motivational styles (Deci & Ryan, 1985, 2000). At the core of self-determination theory is the hypothesis that humans strive to satisfy innate psychological needs. It is proposed that these needs determine the extent to

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which a person will identify, pursue, and persist in goal-directed behavior. Few studies have examined the extent to which global-level psychological need satisfaction drives goal-directed behavior at a contextual and situational level. Using Vallerand's (1997) hierarchical model of motivation as an integrative framework, the present study will model the processes by which the satisfaction of psychological needs from self-determination theory determine contextual-level motivation and situational-level intentions and behavior from a social cognitive model of decision making, the theory of planned behavior (Ajzen, 1991). It is expected that such a model will illustrate the extent to which psychological need satisfaction predicts behavior directly and indirectly through contextual- and situational-level motivation.

Self-Determination Theory and Psychological Need Satisfaction

Self-determination theory proposes that individuals strive to satisfy the basic psychological needs of autonomy, competence, and relatedness. The need for autonomy reflects an individual's desire to be a causal agent in his or her world, and if a behavior satisfies the need for autonomy, the individual feels a sense of personal choice, free will, and ownership of his or her actions. The need for competence is satisfied through the pursuit of autonomously motivated behaviors that lead to perceptions of success and control of outcomes. The need for relatedness reflects innate desires to be supported by others and be supportive of others when engaging in behaviors. Self-determination theory states that these needs are complementary. For example, the need for autonomy does not reflect overarching desires to be independent but rather interdependent through choice and cooperation as implied by the need for relatedness. Similarly, behaviors that provide a sense of personal control and efficacy are likely to satisfy the need for competence, but only if competence in that context is relevant to the individual's sense of true self or autonomy. Thus, for optimal psychological functioning and persistence in goal-directed behaviors, the social context must support all three psychological needs (Deci & Ryan, 2000).

Psychological Needs and Motivation at Different Levels of Generality

A central tenet of self-determination theory is that humans are active in their pursuit of fulfillment of their basic psychological needs (Deci & Ryan, 2000), and they do so by engaging in intrinsically motivated behavior in a variety of contexts. The degree of fulfillment of basic psychological needs therefore reflects global perceptions that give rise to motivated behavior in a variety of contexts and situations. Vallerand (1997; Vallerand & Ratelle, 2002) proposed a hierarchical model of motivation that aimed to integrate motivation at three levels of generality: global, context, and situational. It was proposed that generalized, trait-like constructs related to motivation at the global level, such as psychological need satisfaction, would influence autonomous motivation at the contextual and situational levels in a top-down fashion (Guay, Mageau, & Vallerand, 2003).

In the model, context refers to any "distinct sphere of human activity" (Vallerand & Ratelle, 2002, p. 44) and individuals form motivational orientations at the contextual level that are applicable to any volitional behaviors relevant to that context. Contextual-level motivation is less stable than global-level motivation and is a function of social factors as well as the global-level motivational orientations. Taking exercise behavior as an example, contextual-level motivational orientations would refer to motivation to participate in any type of behavior (e.g. sports, leisure-time activity, occupational activity) and on any occasion (e.g. in the gymnasium, at an aerobics class, getting to work) in the behavioral context.

Contextual-level motivation in Vallerand's model is usually characterized on a continuum of regulatory styles known as the perceived locus of causality (Ryan & Connell, 1989). The continuum distinguishes between intrinsic and extrinsic forms of motivation and amotivation. Intrinsic motivation lies at one extreme of the continuum, reflects engaging in a task in the absence of any external contingency, and is accompanied by a sense of interest, enjoyment, choice, and that the behavior reflects a true "sense of self." Intrinsic motivation constitutes a type of behavior that is distinct from extrinsic motivation and represents the prototypical case of autonomous behavior. Adjacent to intrinsic motivation lie three forms of extrinsic motivation, arranged in order of their degree of relative autonomy. These forms of extrinsic motivation reflect the varying degrees to which behaviors have been "taken in" or internalized by an individual because they are instrumental in servicing a personal value or goal. The least autonomous form of extrinsic motivation is external regulation and as such is the form of extrinsic motivation that lies furthest from intrinsic motivation on the continuum. External regulation reflects reasons for behaving based on external contingencies alone, such as the avoidance of punishment or receipt of rewards. Introjected regulation lies adjacent to external regulation on the continuum and represents motivation based on internal reinforcements, such as the pursuit of contingent self-esteem (pride) or avoidance of guilt and shame. Because introjected regulated reasons for behavioral engagement arise from within the individual, they are considered partially internalized, less external, and more autonomous than externally regulated reasons.

Identified regulation lies closest to the autonomous extreme of the continuum and is defined as reasons for acting based on one's own values or goals, even though they may be reinforced by forces that are, strictly speaking, external to the individual. Identified regulated reasons for acting reflect a more complete form of internalization because they are endorsed by the self and are therefore more likely to lead to behavioral persistence. Finally, adjacent to the three forms of extrinsic regulation and at the opposite extreme to intrinsic motivation on the continuum lies amotivation. Whereas autonomous and controlled types of motivation reflect intentional or motivated types of behavior, amotivation represents engaging in tasks and behaviors in the absence of intention or motivation. Amotivated individuals lack any sense of control or influence on the outcomes of their behavior and are therefore not able to regulate themselves. Although the motivation types delineated by the perceived locus of causality are viewed as independent, a weighted composite of construct scores provides an effective summary of an individual's contextual-level autonomous motivation (Vallerand & Ratelle, 2002).

Global motivational orientations affect motivation at the situational level via the mediation of contextual-level motivation (Vallerand, 1997). At the situational level, motivation is considered a state-like construct and less stable and enduring than motivation at superordinate levels of the hierarchy. Motivational constructs at this level reflect an individual's motivation toward a specific behavior in a clearly defined time frame. In essence, situational motivation refers to an individual's motivation in the "here and now" and as such is distinct from the enduring, dispositional motivational orientations from the contextual and global levels. Therefore, situational-level motivational states assist in "understanding why individuals engage in a specific activity at a particular time" (Vallerand & Ratelle, 2002, p. 45). Motivation at the situational level is likely to undergo frequent change and is strongly determined by environmental factors as well as contextual-level motivation. Taking exercise behavior as an example, motivation toward participating in a specific bout of exercise (e.g., attending an aerobics class) at a given time and in a given location reflects a motivational orientation at the situational level.

Three Premises for Theoretical Integration

The present study proposes an integrated model of motivation that incorporates hypotheses from three theories of motivation: self-determination theory (Deci & Ryan, 2000), the hierarchical model of motivation (Vallerand & Ratelle, 2002), and theory of planned behavior (Ajzen, 1991), a social cognitive model of volitional behavior. We provide the basis for an integrated model that extends recent research that has integrated self-determination theory and the theory of planned behavior to include psychological need satisfaction. The theoretical integration will be based on three premises. First, it is hypothesized that autonomous motives related to fundamental psychological needs form the social cognitive constructs involved in volitional behavior as theorized in previous integrative studies (Chatzisarantis & Biddle, 1998; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, in press; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). Second, the inclusion of psychological need satisfaction is justified on the basis that it provides evidence for the origins of motivational orientations and can assist in identifying both direct (impulsive) and indirect (reflective) routes to behavioral engagement. Third, Vallerand's (1997) hierarchical model of motivation will be used as a framework to map a motivational sequence in which global-level motivational orientations from self-determination theory influence contextual-level motivation and situational-level decision-making constructs and behavior from the theory of planned behavior in a top-down fashion. Of importance, it will be hypothesized that the effect of psychological need satisfaction at the global level will affect situational-level motivational constructs such as attitudes and perceived behavioral control indirectly via contextual-level autonomous motives.

Autonomous Motives and the Theory of Planned Behavior

Recent research has provided evidence that constructs from self-determination theory can be integrated into social cognitive theories of intentional behavior, such as the theory of planned behavior (e.g., Hagger et al., 2003; Hagger et al., in press). The theory of planned behavior (Ajzen, 1991) is a social cognitive model that specifies that volitional behavior is a function of an individual's personal (attitudes), social (subjective norms), and volitional (perceived behavioral control) beliefs regarding the behavior. Intention is a core construct in this model and reflects situational-level plans to engage in the behavior. It is hypothesized that intentions mediate the influence of attitudes, subjective norms, and perceived behavioral control on behavior. Studies integrating the theory of planned behavior with self-determination theory have noted that contextual-level autonomous motives have a significant influence on situational-level intentions to perform volitional behaviors (e.g., Chatzisarantis & Biddle, 1998; Hagger et al., 2003; Hagger et al., in press). Moreover, in accordance with Ajzen's (1991) theorizing, attitudes and perceived behavioral control have been shown to mediate the influence of autonomous motives on intention in a motivational sequence (Hagger, Chatzisarantis, & Biddle, 2002). However, subjective norms have not been implicated in the mediation of autonomous motives on

behavior. Therefore, this research shows that to understand the effects of autonomous motives on intentions to act, the specific and proximal social cognitive constructs that give rise to intentions must be considered.

The first premise for the proposed theoretical integration is based on the mechanisms behind the motivational sequence in the previously cited integrative research findings (Chatzisarantis & Biddle, 1998; Hagger et al., 2003; Hagger et al., in press). It is hypothesized that contextual-level motivational constructs from self-determination theory are integral to the formation of decision-making variables in social cognitive models, such as the theory of planned behavior. According to self-determination theory, individuals form contextual-level autonomous motives toward target volitional behaviors because they expect that future participation in these kinds of behaviors is likely to satisfy psychological needs. Such individuals are therefore likely to form positive expectancies regarding future behavioral engagement such as positive attitudes, subjective norms, and perceived behavioral control and, in turn, intentions (Ajzen, 1991). In this way, autonomous motives act as a source of information in the formation of the situational-level expectations to perform need-satisfying behaviors in the future. In addition, Ajzen (1991) hypothesized that attitudes, subjective norms, and perceived behavioral control were the sole proximal predictors of intentions and mediated the influence of all other external variables on intention. Therefore, the influence of autonomous motives on intentions and behavior is expected to be mediated by the theory of planned behavior constructs.

Reflective and Impulsive Routes to Behavior

Whereas the incorporation of contextual-level motivation from self-determination theory in models of social cognition has provided a more comprehensive and complementary explanation of intentional behavior, the precise role of psychological needs at the global level has yet to be established. Therefore, the second premise that underpins the present theoretical integration relates to the importance of global-level psychological need satisfaction in the integrated model and the two possible routes by which psychological need satisfaction can influence intentional behavior. The role of psychological need satisfaction as an underlying nutriment for autonomous motives is well supported in self-determination theory and in research on the effects of global-level motivation on contextual-level motivation in Vallerand's model (Kasser & Ryan, 1999).

However, psychological need satisfaction also may give rise to motivational patterns that are more impulsive and unconsciously executed than the reflective processes proposed by previous theoretical integrations of self-determination theory with social cognitive, decision-making models (Chatzisarantis & Biddle, 1998; Chatzisarantis, Biddle, & Meek, 1997). Elliot, McGregor, and Thrash (2002) hypothesize that psychological needs facilitate both impulsive (i.e., automatic or spontaneous behavioral engagement without the conscious processing of information) and reflective (i.e., deliberative, effortful approaches to action, requiring the evaluation of salient social information and the formation of intentions or plans to act) behavioral engagement (Fazio, 1990; Kehr, 2004; Strack & Deutsch, 2004). They suggest that basic psychological needs are generalized, dispositional motivational orientations that energize autonomously motivated behavior directly and automatically (see Levesque & Pelletier, 2003) but also can give rise to more reflective routes to behavioral engagement by facilitating the formation of autonomous types of motivational orientations and intentions to fulfill those behavioral goals. According to Elliot et al. (2002), "needs and motives can and often do lead directly to behavior, but these general dispositional desires sometimes need to be strategically channeled in a specific direction to be satisfied in an effective and efficient manner" (p. 373).

Recent conceptual models of motivation have corroborated this view, suggesting that social behavior is a function of both impulsive (spontaneous) and reflective (deliberative) processes (e.g., Strack & Deutsch, 2004). However, such dual route models are not a new development in social psychology. For example, Fazio (1990) promulgated a conceptual framework that specified a dual-route process toward social action that he called a "mixed model" of social behavior. In the model, all actions are said to be determined by automatic or deliberative processes or a hybrid of the two processes. Fazio's model suggests that automatic processes involve the activation of previously held beliefs that result in spontaneous behavioral engagement, whereas the deliberative route entails a conscious evaluation of beliefs regarding a future bout of the target behavior prior to forming an intention to act.

The proposed model in the present study therefore hypothesizes both direct and indirect influences of psychological need satisfaction on behavior in accordance with dual-route models and Elliot et al.'s (2002) premise. The indirect effect of a global-level psychological need satisfaction construct on behavior represents a reflective or deliberative process toward behavioral engagement. This is represented by a motivational sequence that includes contextual-level autonomous motives and the situational-level social cognitive constructs from the theory of planned behavior. Conversely, the direct effect of psychological need satisfaction reflects a more impulsive or spontaneous route to behavioral engagement that

does not require deliberation and influences behavior through an automatic process. This is consistent with recent research that suggests that global-level motivational orientations from self-determination theory can be implicitly primed and influence behavioral outcomes along with explicit, consciously regulated motivational orientations (Levesque & Pelletier, 2003).

From Global- to Situational-Level Motivation: A Motivational Sequence

The third premise put forward to justify the theoretical integration arises from Vallerand's (1997) hierarchical model of motivation that provides a framework to explain the top-down arrangement of the variables in the integrated model from the global to situational levels of generality. The proposed motivational sequence begins with psychological need satisfaction, a construct akin to the global level of autonomous motivation. Because autonomous motivation across many life contexts depends on whether the psychological needs for autonomy, competence, and relatedness are satisfied (Deci & Ryan, 2000), it is expected that the satisfaction of all of these needs will reflect a high level of self-determined motivation at the global level (Vallerand & Ratelle, 2002). The model explicitly states that motivation at the global level will affect motivation in different life contexts. Contextual motivation is reflected by the degree of relative autonomy perceived by the individual with respect to acting in that context. The model also hypothesizes that contextual motivation will influence motivation in given situations and mediate the influence of the more distal global motivational orientations on situational-level motivation.

Attitudes, subjective norms, perceived behavioral control, and intentions in the theory of planned behavior are considered social cognitive constructs located at the situational level in Vallerand's model. These constructs are not situational-level autonomous motivation as operationalized by Vallerand but reflect motivation at this level of generality because they refer to expectations regarding future behavioral engagement in terms of a specific action, target, context, and time. Furthermore, these constructs reflect autonomous motivation at the situational level because they encompass self-relevant evaluations of the behavior and personal sets of beliefs central to behavioral engagement. For example, attitudes are underpinned by positive outcome expectancies and perceived behavioral control by beliefs about competence (Sheeran, Norman, & Orbell, 1999).

The proposed model will therefore plot a motivational sequence in which psychological need satisfaction will influence autonomous motives to engage in volitional behavior in two behavioral contexts. Autonomous motives will be expected to influence intentions only via the mediation of attitudes and perceived behavioral control, and the effects of the latter constructs on actual behavior will be mediated by intention in accordance with the theory of planned behavior. Subjective norms at the situational level are not expected to mediate the impact of autonomous motives on intention in accordance with previous findings (Chatzisarantis & Biddle, 1998; Hagger et al., 2003; Hagger et al., in press). The most likely reason for this is that subjective norms reflect controlling, other-referenced beliefs regarding future behavioral engagement rather than personal beliefs.

Study Hypotheses

The purpose of the present study was to investigate the influence of global-level psychological need satisfaction on contextual-level autonomous motivation from self-determination theory and situational-level constructs from the theory of planned behavior. An integrated model using Vallerand's hierarchical model of motivation as a framework will be proposed to test these hypotheses in two behavioral contexts: exercise and dieting. These behaviors are the focal dependent variables in the present study because they represent social behaviors that are prevalent among a university student population and have been shown to contribute to similar desirable health goals such as losing weight (Conner & Armitage, 2002).

The proposed model is depicted in Figure 1. On the far left of the model, a global psychological need satisfaction construct is envisaged as a function of the three psychological need satisfaction constructs central to self-determination theory: the needs for autonomy, competence, and relatedness. Given the complementarity hypothesis that suggests that the satisfaction of all three psychological needs is necessary to give rise to autonomously motivated behavior, it is hypothesized (H_1) that these needs can be subsumed into a single, higher-order construct (see paths $\gamma_{1,1}$, $\gamma_{2,1}$, and $\gamma_{3,1}$ in Figure 1). It is hypothesized (H_2) that this psychological need satisfaction factor will influence autonomous motives, as represented by a relative autonomy index (path $\gamma_{4,1}$ in Figure 1; Kasser & Ryan, 1999). This relationship reflects the top-down process from generalized, dispositional motivational orientations at the global level to more changeable motivational orientations at the contextual level (Vallerand, 1997). It is also hypothesized (H_3) that autonomous motives at the contextual level will influence situational-level attitudes (path $\beta_{5,4}$ in Figure 1) and perceived behavioral control (path $\beta_{7,4}$) but not subjective norms (path $\beta_{6,4}$), in accordance with previous research (Hagger et al., 2003; Hagger et al., in press). Of importance, it is also anticipated that the influence of psychological need satisfaction on the situational-level constructs from the theory of planned behavior also will

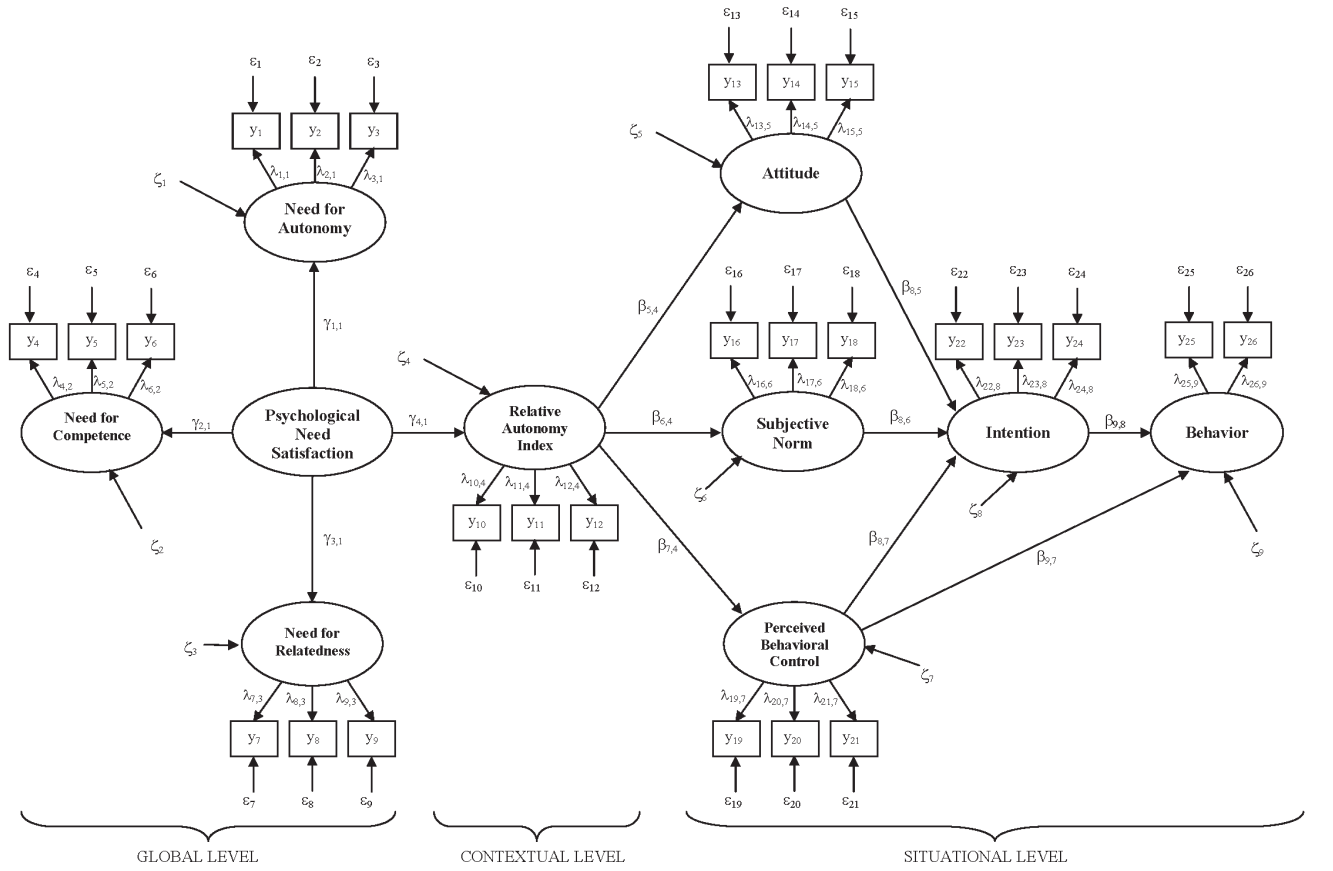

Figure 1 Hypothesized structural equation model.
NOTE: λ = standardized first-order factor loading; y = latent factor indicator; γ = structural paths among exogenous (independent) latent factors and second-order factor loadings; β = structural paths among endogenous (dependent) latent factors; ε = error variance of latent factor indicator; ζ = error variance (disturbance) of latent factor. The following direct effects are not shown in the diagram for clarity: second-order psychological need satisfaction construct on attitudes, subjective norms, perceived behavioral control, and behavior; relative autonomy index on intention and behavior.

be mediated by autonomous motives (H_4). This is concordant with Vallerand's hypothesis that global-level motivational constructs influence situational cognition only through the mediation of contextual-level motivational constructs. In Figure 1, only the indirect effects in the mediation relationship are shown.

In accordance with the theory of planned behavior (Ajzen, 1991), attitudes (path $\beta_{8,5}$ in Figure 1), subjective norms (path $\beta_{8,6}$), and perceived behavioral control (path $\beta_{8,7}$) are hypothesized (H_5) to predict intention. It is expected (H_6) that the effect of autonomous motives on intentions will be mediated by attitudes and perceived behavioral control, as observed in previous studies (Hagger et al., 2003; Hagger et al., in press). Theoretically, these effects explain how individuals form specific plans to engage in volitional behaviors likely to satisfy psychological needs using global- and contextual-level motivational orientations as sources of information. Only the indirect effects are shown in Figure 1. Intentions are assumed (H_7) to be the sole predictor of behavior (path $\beta_{9,8}$ in Figure 1), although a direct effect of perceived behavioral control (path $\beta_{9,7}$) is included because Ajzen (1991) proposed an alternative model with this direct effect when perceived behavioral control closely reflected actual control (H_8). Intentions will be expected (H_9) to mediate the direct influence of attitudes, perceived behavioral control, and subjective norms on behavior in accordance with the theory of planned behavior (Ajzen, 1991); again, only the indirect paths in this mediation relationship are shown in Figure 1. It is also hypothesized that psychological need satisfaction will have a direct effect on behavior but not intentions (H_{10}, this path is not depicted in Figure 1). This will reflect the impulsive route to behavior proposed by Elliot et al. (2002). Finally, it is anticipated (H_{11}) that there will be no direct effects of autonomous motives on intention or behavior because these effects have been proposed to be indirect via the proposed motivational sequence in accordance with previous research (Hagger et al., 2003; Hagger et al., in press).

Although the focal behaviors in the present study have been shown to have similar antecedents (Kremers, de Bruijn, Schalmaa, & Brug, 2004), research has suggested that the relative contribution of these antecedents may differ across behavioral contexts. It is therefore expected that the components making up the factor structure of the previously proposed model, known as the measurement aspects, will be similar in both behavioral contexts, but the hypothesized relationships among the model constructs, known as the structural components, may vary across contexts. Indeed, there is preceding evidence to suggest that some of the key relationships in the proposed integrated model may not be equivalent across behavioral contexts. For example, Hagger and Chatzisarantis (in press) have found that the dominant situational-level determinant of individuals' intentions to exercise is perceived behavioral control, whereas dieting intentions tend to be predominantly predicted by attitudes. It would therefore be reasonable to expect, based on this evidence, that the effect of attitudes on intentions may be stronger for dieting behavior, whereas the influence of perceived behavioral control on intentions may be greater in an exercise behavioral context.

In addition, previous research in exercise behavior has supported the positive influence of contextual-level motives on situational-level intentions (Chatzisarantis & Biddle, 1998; Chatzisarantis et al., 1997; Hagger et al., 2002), mediated by attitudes and perceived behavioral control, and a positive influence of global psychological needs on situational-level attitudes (Wilson, Rodgers, Blanchard, & Gessell, 2003). However, there is little precedence in the literature to support the effect of autonomous motives and psychological needs on dieting intentions and behaviors in a normal population. Frederick and Grow (1996) found that low levels of autonomous motivation influence dieting behaviors among individuals with disordered dieting behaviors, whereas Williams, Grow, Freedman, Ryan, and Deci (1996) found a positive relationship between autonomous motives and dieting behaviors in obese adults undergoing a program of dietary change. Therefore, no specific expectations regarding the relative influence of autonomous motives and psychological needs on situational-level intentions across behavioral contexts are proposed.

METHOD

Participants and Design

Five hundred and eleven university undergraduate and graduate students participated in the study. Participants were recruited from classes in a variety of undergraduate and graduate degree programs of study. A three-wave prospective design was employed. Participants were assigned to either the leisure-time exercise or dieting target behavior groups on an arbitrary basis. Participants in the exercise sample ($n = 261$; 166 women, 95 men; M age = 24.93, $SD = 9.69$) were informed they were taking part in a survey on exercise habits. The target behavior was defined for the participants in a standardized set of instructions as

> vigorous physical activities such as sports and active pass times that raise your heart rate/pulse and make you breathe deeply for 20 minutes at a time.

Participants in the dieting behavior sample ($n = 250$; 141 women, 109 men; M age = 24.64, $SD = 6.39$) were notified they were participating in a survey on watching your diet. Watching your diet was defined as

> cutting down on sugary foods, cutting down on fatty foods, avoiding snacks between meals, decreasing food intake in general by eating lighter meals, not having seconds and not overeating, taking diet pills or liquid diet formula to control weight, eating diet foods, and fasting. It does not necessarily imply being on a specific diet or dietary program.

In the first wave of data collection, a questionnaire measuring psychological need satisfaction was administered (Sheldon et al., 2001). One week later, participants were required to complete measures of perceived locus of causality in their appropriate behavioral context (Ryan & Connell, 1989) and standard measures of the theory of planned behavior constructs (Ajzen, 1991). A 1-week delay was employed to allay the potential confounding effects of common method variance. Two weeks later, participants' behavioral engagement in leisure-time physical activity or dieting behaviors was assessed using self-report measures. Data were collected by three research assistants in quiet class conditions. Questionnaires were completed anonymously to preserve confidentiality and prospective responses were matched with baseline responses by using birth date and gender.

Measures

Psychological need satisfaction. Sheldon et al.'s (2001) validated measures of the three psychological needs from self-determination theory were administered at the first wave of data collection. Items measuring the satisfaction of the needs for self-determination or autonomy (e.g., "I feel that my choices are based on my true interests and values"), for competence (e.g., "I feel that I can successfully complete difficult tasks and projects"), and for relatedness (e.g., "I feel a sense of contact with people who care for me, and whom I care for") were measured by three items each on 7-point Likert-type scales with endpoints of *not true at all* (1) and *very true* (7).

Participants were given a standard set of instructions asking them to rate the scales according to how they generally felt in their life.

Perceived locus of causality. Autonomous motives were measured using an adapted version of Ryan and Connell's (1989) perceived locus of causality at the second wave of data collection. Participants were presented with a common stem: "Why do you participate in active sports and/or vigorous physical activities in your spare time?" or "Why do you watch your diet?" Respondents were then asked to rate several reasons pertaining to four regulation styles: intrinsic motivation (e.g., "because I enjoy exercise/watching my diet"), identified regulation (e.g., "because I value the benefits of exercise/watching my diet"), introjected regulation (e.g., "because I will feel guilty if I don't exercise/watch my diet"), and external regulation (e.g., "because others want me to exercise/watch my diet"). There were three items for each regulation style measured on 4-point Likert-type scales ranging from *not true at all* (1) to *very true* (4). Because the aim of the present study was to examine the relationship of contextual-level autonomous motives with global-level psychological need satisfaction and situational-level decision-making constructs, scores on the perceived locus of causality scales were used to form a single index of autonomous motivation, or relative autonomy index, by assigning weights to each of the constructs according to their relative level of autonomy (Guay et al., 2003; Vallerand & Ratelle, 2002).

The theory of planned behavior. Measures of the theory of planned behavior constructs were developed according to standard instructions (Ajzen, 1991). The content of the items was identical for the exercise and dieting samples but, for brevity, only example items from the exercise context are given. Behavioral intentions were measured by three items using 6-point Likert-type scales (e.g., "I intend to participate in vigorous physical activities for 20 minutes at a time at least three times in the next fortnight"). Three items using 6-point semantic differential scales measured attitudes in response to a common stem: "For me, doing physical activities for 20 minutes at a time at least three times per week in the next fortnight is. . . ." Items had endpoints reflecting the affective (*happy-sad*), instrumental (*satisfying-unsatisfying*), and moral (*good-bad*) components of attitude. Previous research using belief-based measures has shown that these simple, direct measures of attitude reflect the multiple components of the attitude construct in the theory of planned behavior (e.g., Trafimow & Sheeran, 1998). Furthermore, there is evidence that aggregating these components into a global attitude factor provides a strong basis for evaluating individuals' general orientations toward the target behavior while making the distinction between the components at the subordinate level (Hagger & Chatzisarantis, in press). Subjective norms were assessed by three items with endpoints of *extremely false* (1) and *extremely true* (6) (e.g., "Most people who are important to me would want me to do physical activities for at least 20 minutes at a time at least three times in the next fortnight"). Perceived behavioral control was assessed on three items using 6-point Likert-type scales (e.g., "How much personal control do you think you have in doing vigorous physical activities for 20 minutes at a time at least three times per week?") with scale endpoints of *no control at all* (1) and *complete control* (7).

Self-reported behavior. Self-reported exercise/dieting behavior was measured at the third wave of data collection. Participants rated their 2-week behavioral frequency on two items (e.g., "In the course of the past 2 weeks, how often have you participated in vigorous physical activities for 20 minutes at a time?") using 6-point Likert scales with scale endpoints of *never* (1) and *everyday* (6). The concurrent and criterion validity of these self-report measures has been confirmed against more objective measures such as heart rate monitoring (Cale, 1994) and food diaries (Conner & Armitage, 2002). Furthermore, factor analytic studies have shown these items to indicate latent behavioral measures with high factor loadings and average variance extracted supporting their construct validity (Hagger & Chatzisarantis, in press).

Data Analysis

Data were analyzed using the factor analytic–structural equation modeling (FASEM) approach using the EQS program (Version 6.1; Bentler, 2004). This approach advocates initially estimating a confirmatory factor analytic (CFA) or measurement model that tests the hypothesis that each proposed latent factor can explain the covariances among its observed items. Pending the adequacy of the measurement model, a structural equation model (SEM) is estimated to test hypothesized structural relations among the latent variables. We applied the FASEM procedure to data from the exercise sample in the first instance and cross-validated the hypothesized models using data from the dieting sample.

Multiple criteria of overall goodness-of-fit of the estimated models with the covariance matrices were adopted (Hu & Bentler, 1999). The comparative fit index (CFI), the nonnormed fit index (NNFI), and the root mean square error of approximation (RMSEA) were utilized as a means of evaluating model fit because these fit indexes display restricted random variation under conditions of model misspecification and small sample size (Fan, Thompson, & Wang, 1999). Values approaching .95 for the CFI and NNFI and .05 for the RMSEA are considered indicative of adequate fit of the

TABLE 1: Goodness-of-Fit Statistics for Single- and Multi-Sample Confirmatory Factor Analysis and Structural Equation Models

Model	*SB*-χ^{2a}	df	*CFI*	*NNFI*	*RMSEA*
Single-sample analyses					
Exercise					
Measurement CFA model	355.798**	262	.976	.971	.037
Measurement CFA model, higher-order PNS factor	365.174**	274	.977	.973	.036
Structural equation model	359.300**	277	.978	.974	.035
Dieting					
Measurement CFA model	385.562**	262	.958	.948	.044
Measurement CFA model, higher-order PNS factor	400.560**	274	.957	.949	.043
Structural equation model	420.281**	277	.951	.943	.046
Multisample analyses					
Baseline	781.180**	554	.966	.960	.029
λ's/γ's[b] invariant	820.224**	573	.963	.658	.029
λ's/γ's[b] and ξ's/ζ's invariant	885.606**	583	.955	.950	.032
λ's/γ's[b], ξ's/ζ's, and ζ_{cov}'s invariant	890.092**	586	.955	.950	.032
λ's/γ's[b], ξ's/ζ's, ζ_{cov}'s, and γ^c/β's invariant	946.136**	601	.949	.944	.034

NOTE: CFA = confirmatory factor analysis; PNS = psychological need satisfaction; *df* = model degrees of freedom; CFI = comparative fit index; NNFI = non-normed fit index; RMSEA = root mean squared error of approximation; λ = factor loadings; ξ = exogenous factor variances; ζ = factor disturbance (error of endogenous latent variable); ζ_{cov} = covariance between endogenous factor disturbances; γ = structural paths from exogenous to endogenous factors; β = structural paths between endogenous factors.

a. Sattora-Bentler scaled chi-square.

b. In this case, the γs refer to the loadings of the second-order PNS factor on the first-order PNS factors because they are, strictly speaking, part of the measurement model.

c. In this case, the γs refer to the structural parameters of the model.

**$p < .01$.

proposed model with the observed covariance matrix (Hu & Bentler, 1999), although caution must be exercised when using a hypothesis-testing approach with such fit indexes to evaluate model adequacy (Marsh, Hau, & Wen, 2004). In addition to the evaluation of proposed models based on overall goodness-of-fit, model integrity also was assessed according to the solution estimates, including the factor loadings, factor correlations, reliability coefficients, and average variance extracted.

RESULTS

Confirmatory Factor Analysis

Prior to commencing the FASEM analyses of the proposed models, we conducted a preliminary analysis to reduce the number of variables in the analyses without losing vital information. Specifically, we aimed to integrate the four constructs from the measure of perceived locus of causality into a single index of autonomous motivation by calculating a relative autonomy index (RAI; Vallerand & Ratelle, 2002). Following the method advocated by previous researchers (e.g., Guay et al., 2003), weights were assigned to each item from the intrinsic motivation (+2), identified regulation (+1), introjected regulation (–1), and extrinsic regulation (–2) scales, and three RAI items were calculated based on the weighted composite of these scores. These items were used as indicators of a single latent autonomous motives factor in subsequent analyses.

Focusing on the data from the exercise sample in the first instance, a confirmatory factor analytic (CFA) model was estimated to test the construct and discriminant validity of the study variables. This measurement model comprised nine factors representing the three fundamental psychological need constructs, the RAI construct, attitudes, subjective norms, perceived behavioral control and intention from the theory of planned behavior, and self-reported behavior. Each factor was indicated by three items that were made to load solely on their appropriate latent factor, with the exception of the self-reported behavior factor, which was characterized by two indicators. As with all CFA models, one indicator was arbitrarily set to unity to define the scale of the factor and all the factors were set to covary. It was assumed that the constructs would achieve discriminant validity in accordance with Bagozzi and Kimmel's (1995) criterion. However, it was expected that the psychological need satisfaction constructs from self-determination theory would exhibit strong intercorrelations in accordance with the hypothesis that such needs are complementary.

Goodness-of-fit statistics for the measurement model in the exercise sample are given in Table 1. The fit indexes indicated that the hypothesized model adequately described the data. An examination of the correlations among the latent factors indicated strong relations among the psychological need satisfaction constructs (*Mdn* ϕ = .543). On the basis of these correlations and in accordance with the premise of

TABLE 2: Standardized First- and Second-Order Factor Loadings for Measurement Parameters in the Structural Equation Models in Both Samples

	Parameter Estimate				*Parameter Estimate*	
Factor	*Parameter*	*Exercise*	*Dieting*	*Factor*	*Parameter*	*Exercise*	*Dieting*
N_{AUT}	λ_y1,1	.767	.821	ATT	λ_y13,5	.830	.882
	λ_y2,1	.771	.836		λ_y14,5	.885	.850
	λ_y3,1	.763	.831		λ_y15,5	.925	.873
N_{COMP}	λ_y4,2	.853	.855	SN	λ_y16,6	.488	.780
	λ_y5,2	.824	.678		λ_y17,6	.857	.877
	λ_y6,2	.804	.658		λ_y18,6	.876	.775
N_{REL}	λ_y7,3	.890	.917	PBC	λ_y19,7	.907	.777
	λ_y8,3	.875	.795		λ_y20,7	.763	.751
	λ_y9,3	.711	.758		λ_y21,7	.922	.833
PNS	γ1,1	.901	.967	BI	λ_y22,8	.920	.778
	γ2,1	.716	.770		λ_y23,8	.848	.779
	γ3,1	.584	.816		λ_y24,8	.963	.853
RAI	λ_y10,4	.848	.715	B	λ_y25,9	.959	.867
	λ_y11,4	.899	.643		λ_y26,9	.947	.659
	λ_y12,4	.879	.675				

NOTE: N_{AUT} = need for autonomy; N_{COMP} = need for competence; N_{REL} = need for relatedness; PNS = second-order psychological need satisfaction factor; RAI = relative autonomy index; ATT = attitude; SN = subjective norms; PBC = perceived behavioral control; BI = behavioral intention; B = behavior; λ_y = first-order factor loading; γ = second-order factor loading.

TABLE 3: Factor Correlations (ϕ) and Composite Reliability Estimates (ρ_c) for the Factors From the Measurement Confirmatory Factor Analysis Model With a Higher-Order Psychological Need Satisfaction Factor for Both Samples

Factor	ρ_c [a]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	ρ_c [b]
1. Psychological need satisfaction	.865	—	.402**	.136*	–.027	.250**	–.084	–.323**	.930
2. Relative autonomy index	.908	.168*	—	.402**	.110	.412**	.362**	.018	.720
3. Attitude	.912	.185*	.337**	—	.413**	.259**	.695**	.251**	.902
4. Subjective norm	.746	.188*	.057	.333**	—	.287**	.504**	.170*	.851
5. Perceived behavioral control	.900	.218**	.387**	.421**	.349**	—	.424**	.050	.832
6. Behavioral intention	.939	.198**	.544**	.568**	.394**	.729**	—	.538**	.843
7. Behavior	.952	.151*	.439**	.462**	.207**	.559**	.787**	—	.784

NOTE: Coefficients above the principal diagonal are for the dieting sample and below the diagonal are for the exercise sample.
a. Composite reliability coefficients (ρ_c) for the exercise sample.
b. Composite reliability coefficients for the dieting sample.
*$p < .05$. **$p < .01$.

complementarity among psychological needs, we hypothesized (H_1) that the need constructs could be subsumed by a global psychological need satisfaction factor while still making the distinction at the subordinate level. This also had the advantage of minimizing the number of parameters in subsequent structural models and reducing the possibility of multicolinearity effects. We therefore respecified the measurement CFA model, this time including a higher-order factor to explain the covariances among the three psychological needs factors. This CFA model exhibited marginally superior fit with the data (see Table 1). Furthermore, the standardized factor loadings of the indicators on their respective latent factors in the CFA model (see Table 2) were significantly positive and exceeded the widely accepted minimum of .40 (Ford, MacCallum, & Tait, 1986). The second-order factor loadings also were high and significant, suggesting that the higher-order psychological need satisfaction factor accounted for the majority of the shared variance among the constructs. Furthermore, the average variance extracted (ρ_v) (Fornell & Larcker, 1981) that represents the amount of variance in the first-order psychological need satisfaction factors captured by the higher-order factor relative to the variance due to measurement error was high (ρ_v = .591) and exceeded the proposed .50 cut-off criterion. Overall, this supports the hypothesis (H_1) that the psychological need satisfaction construct could be subsumed by a higher-order factor.

Correlations among the latent constructs in the measurement CFA model with the higher-order psychological need satisfaction factor for the exercise sample are given in Table 3. The correlations were all significantly different from unity supporting the discriminant validity of the hypothesized constructs (Bagozzi & Kimmel, 1995). In addition, only two of the factor correlations exceeded .60, and none exceeded .80, suggesting that

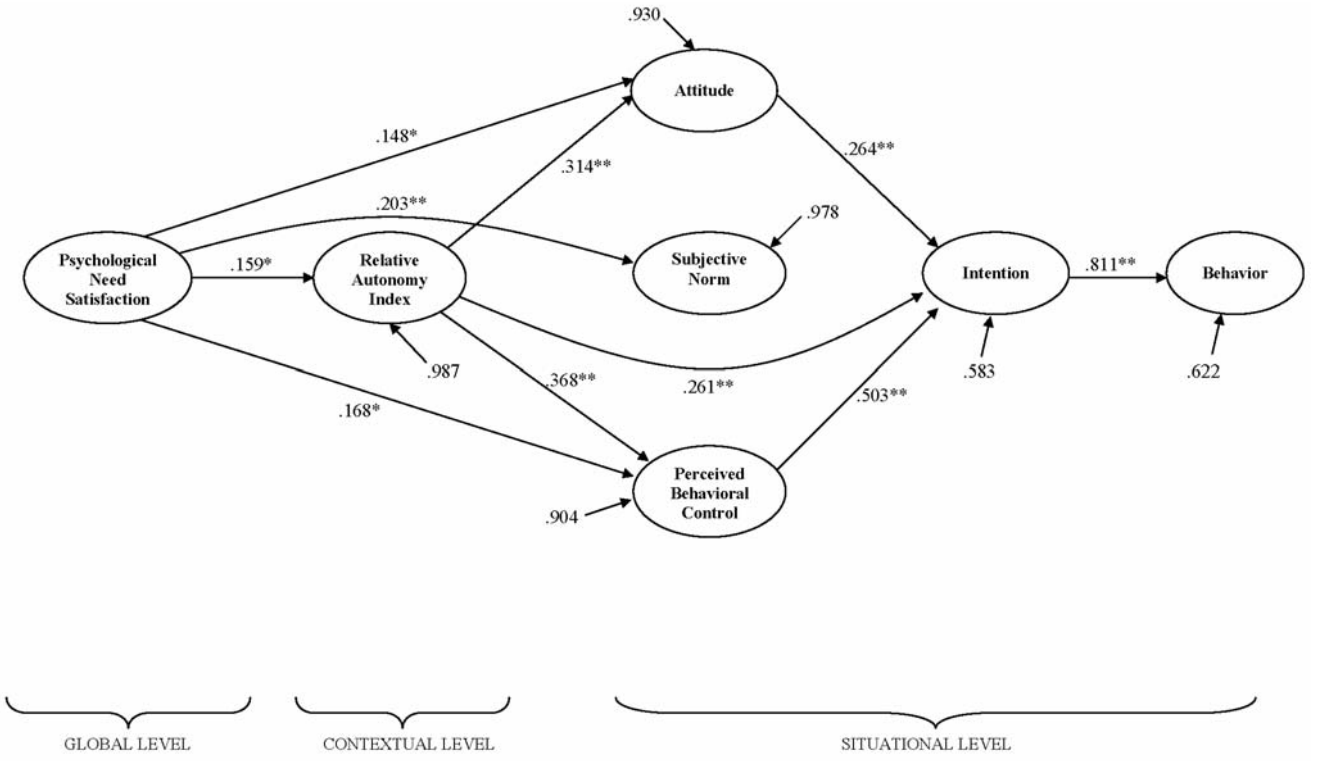

Figure 2 Structural equation model of the effects of global-level psychological need satisfaction on contextual-level autonomous motives and situational-level constructs from the theory of planned behavior for the exercise sample.
NOTE: Covariances among disturbance terms for the attitudes, subjective norm, and perceived behavioral control (ζ_{cov}) are not shown.
*$p < .05$. **$p < .01$.

problems due to multicolinearity or suppressor effects were unlikely. Composite reliability estimates (ρ_c) were above the recommended .70 minimum for each factor (see Table 3).

Structural Equation Model

Given the robust fit of the measurement CFA model, the hypothesized relations among the psychological need satisfaction, RAI, and the theory of planned behavior constructs were tested in an SEM (see Figure 1). Goodness-of-fit statistics for the SEM are given in Table 1. The fit of the model met the multiple criteria for adequate model fit and was virtually identical to the fit exhibited by the measurement model, indicating few discrepancies in fit due to the introduction of the hypothesized structural relationships. Standardized path coefficients for the single-sample SEM in the exercise sample are given in Figure 2. As hypothesized (H_2), the global-level psychological need satisfaction construct significantly influenced contextual-level autonomous motives, as represented by the RAI ($\beta = .159$, $p < .05$). Autonomous motives significantly influenced attitude ($\beta = .314$, $p < .01$) and perceived behavioral control ($\beta = .368$, $p < .01$) at the situational level in accordance with the hypothesized motivational sequence (H_3). As expected, there was no effect of autonomous motives on subjective norms. However, there also were significant direct effects of psychological need satisfaction on attitudes ($\beta = .148$, $p < .01$), subjective norms ($\beta = .203$, $p < .01$), and perceived behavioral control ($\beta = .168$, $p < .05$). This suggested that the hypothesized (H_4) mediation of the effects of psychological need satisfaction on the attitude, subjective norm, and perceived behavioral control constructs by autonomous motives would only be partial if at all. To confirm this hypothesized mediation effect (H_4), we adopted the procedures advocated by Baron and Kenny (1986).[1] The tests confirmed that the direct effects of psychological need satisfaction on attitudes and perceived behavioral control were attenuated with the inclusion of the autonomous motives construct. Furthermore, the indirect effects of psychological need satisfaction on attitudes and perceived behavioral control were significant. Therefore, autonomous motives partially mediated the effects of psychological need satisfaction on attitude and perceived behavioral control.

As a final addendum to this part of the analysis, we tested the adequacy of the second-order psychological need satisfaction construct to account for the variance among the first-order need satisfaction constructs that is also shared with other variables in the motivational

sequence. To test this, unique effects of the three first-order psychological need constructs on the autonomous motives, attitude, subjective norm, perceived behavioral control, intention, and behavior constructs were freed and the SEM reestimated. As expected, these effects were nonsignificant, suggesting that the variance shared by the three first-order psychological need satisfaction constructs and other model variables was accounted for by the higher-order factor.

Attitudes ($\beta = .264$, $p < .01$) and perceived behavioral control ($\beta = .503$, $p < .01$) at the situational level significantly predicted behavioral intentions in accordance with theory of planned behavior (H_5). There was, however, no effect of subjective norms, a finding that is not unique to this study (e.g., Hagger et al., 2003), so the hypothesis (H_5) was only partially supported. In contrast to hypotheses, there was also a significant direct effect of autonomous motives on intention ($\beta = .261$, $p < .01$). Again, adopting the procedures offered by Baron and Kenny (1986), we tested the hypothesis (H_6) that the attitude and perceived behavioral control constructs mediated the overall effect of autonomous motives on intention. The tests revealed that the direct influence of autonomous motives on intention was attenuated by the attitude and perceived behavioral control constructs. Furthermore, the indirect effects of autonomous motives on intention via attitude and perceived behavioral control were significant. This confirmed the partial mediation of the effect of autonomous motives on intention and the hypothesis (H_6) was therefore partially supported. Finally, intentions significantly predicted exercise behavior ($\beta = .811$, $p < .01$), as hypothesized (H_7), but perceived behavioral control did not (H_8). The hypothesis (H_9) that intentions completely mediated the influence of attitudes, subjective norms, and perceived behavioral control on behavior in accordance with the theory of planned behavior was tested according to Baron and Kenny's (1986) criteria. The tests revealed no direct effects of attitudes or perceived behavioral control on behavior and the indirect effects of attitude and perceived behavioral control on behavior via intention were significant. Because subjective norms did not predict intention, mediation for this variable was not tested. Overall, the mediation hypothesis (H_9) was partially supported.

In terms of the overall effects of the distal global- and contextual-level constructs, significant total effects of psychological need satisfaction on intention (total effect = .210, $p < .01$) and behavior (total effect = .153, $p < .05$) were evident. This is in keeping with Vallerand and Ratelle's (2002) hypothesis that global, generalized factors distal to behavior only have small overall effects due to their generality. There also were significant total effects of autonomous motives on intentions (total effect = .530, $p < .01$) and behavior (total effect = .426, $p < .01$). However, there was no direct effect of psychological need satisfaction on behavior so this hypothesis had to be rejected (H_{10}). There was also no direct effect of autonomous motives on behavior as hypothesized (H_{11}), but as reported earlier, the direct effect of autonomous motives on intentions was only partially mediated by attitudes and perceived behavioral control, so this hypothesis could not be unequivocally rejected.

Cross-Validation

The proposed CFA models and the SEM were cross-validated in the dieting sample using the FASEM approach as before. Initially, the first-order, nine-factor CFA model was estimated. This model attained adequate fit with the data (see Table 1) and exhibited significant correlations among the psychological need satisfaction factors (*Mdn* $\phi = .764$). These factors were then subsumed by a higher-order psychological need satisfaction factor in a second CFA model that fit the data marginally better than the first-order model (see Table 1). For the higher-order psychological need satisfaction factor, the second-order factor loadings (see Table 2) and average variance extracted ($\rho_v = .803$) were large and significant. This supported the hypothesis that these constructs could be accounted for by one higher-order psychological need satisfaction construct (H_1). Examining the other parameters in the model, the first-order factor loadings were all large and significant (see Table 2) and the correlations among the factors in this model supported the discriminant validity of the study constructs according to Bagozzi and Kimmel's (1995) criterion (see Table 3). Only one factor correlation was greater than .60, minimizing the potential for multicolinearity and suppressor effects. Finally, the composite reliability estimates for the study constructs were all acceptable (see Table 3).

The adequate replication of the second-order CFA model in the dieting sample permitted the subsequent estimation of the hypothesized SEM to test study hypotheses (see Figure 1). The model exhibited adequate fit with the data (Table 1) and was almost identical in fit to the measurement model. Standardized structural parameter estimates for the SEM are given in Figure 3. The proposed motivational sequence was supported with the global-level second-order psychological need satisfaction construct significantly predicting contextual-level autonomous motives represented by the RAI construct ($\beta = .405$, $p < .01$) as hypothesized (H_2). Autonomous motives significantly predicted the situational-level constructs of attitude ($\beta = .426$, $p < .01$) and perceived behavioral control ($\beta = .382$, $p < .01$) but not subjective norms from the theory of planned behavior (H_3). In contrast to the model in the exercise sample, there were no signifi-

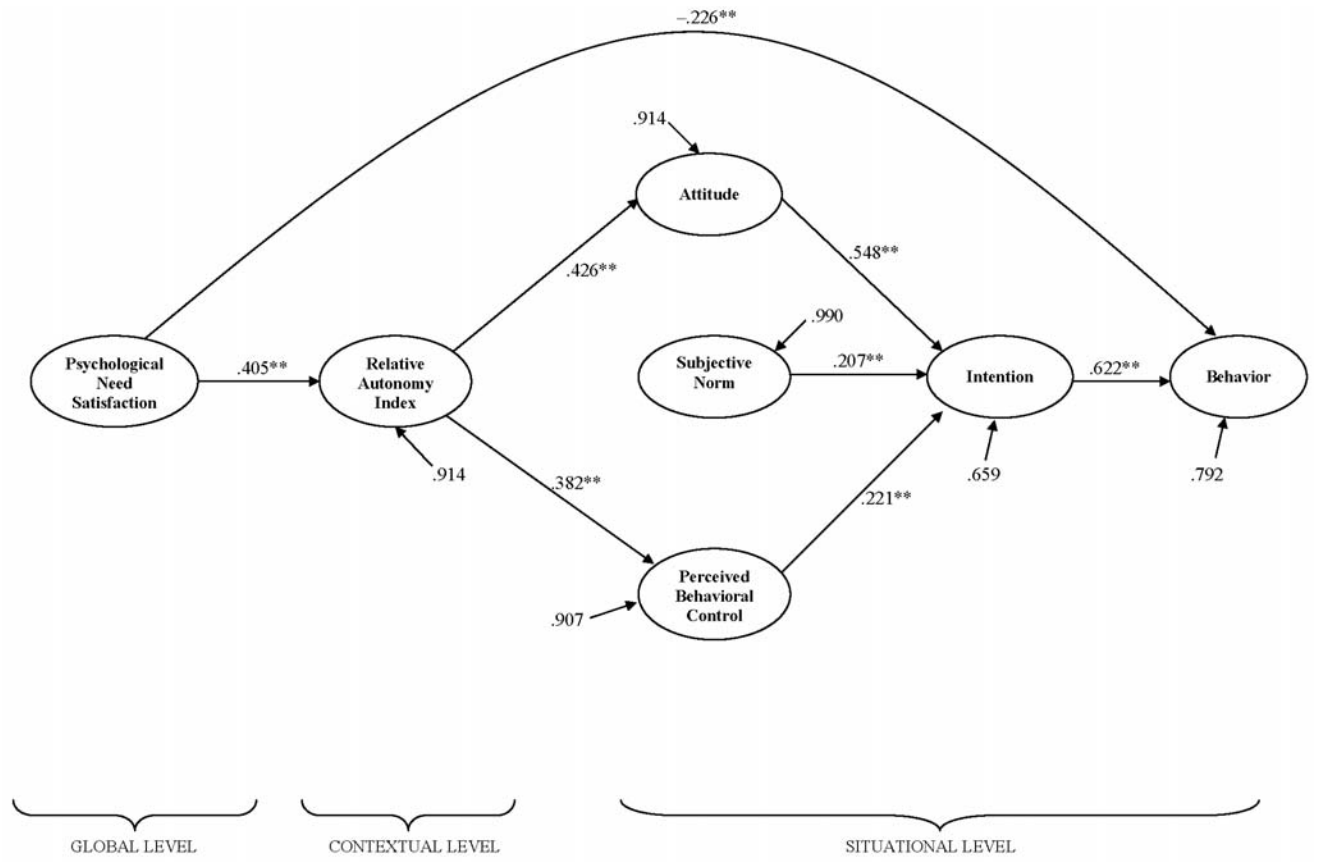

Figure 3 Structural equation model of the effects of global-level psychological need satisfaction on contextual-level autonomous motives and situational-level constructs from the theory of planned behavior for the dieting sample.
NOTE: Covariances among disturbance terms for the attitudes, subjective norm, and perceived behavioral control (ζ_{cov}) are not shown.
**$p < .01$.

cant direct effects of psychological need satisfaction on attitudes and perceived behavioral control. Tests of mediation in accordance with Baron and Kenny's (1986) criteria revealed that the effects of psychological need satisfaction on attitude and perceived behavioral control were completely attenuated by autonomous motives, and the indirect effects of psychological need satisfaction on attitudes and perceived behavioral control via the mediation of autonomous motives were significant. The mediation hypothesis (H_4) was therefore supported. Finally, as in the exercise sample, direct effects of the first-order psychological need satisfaction factors on the other constructs in the model were introduced. None of these effects were significant, further supporting the validity of the higher-order psychological need satisfaction factor.

In accordance with the theory of planned behavior (H_5), intention was significantly predicted by attitudes ($\beta = .548$, $p < .01$), subjective norms ($\beta = .207$, $p < .01$), and perceived behavioral control ($\beta = .221$, $p < .01$). Unlike the SEM for the exercise sample, there was no significant direct effect of autonomous motives on intention. The hypothesized mediation of the direct autonomous motives → intention relationship by attitude and perceived behavioral control was tested (H_6) using Baron and Kenny's (1986) criteria. The tests indicated that overall effect of autonomous motives on intention was completely mediated by the attitude and perceived behavioral control constructs and the indirect effects of autonomous motives via attitude and perceived behavioral control were significant. This supported the hypothesis (H_6).

Finally, intentions significantly predicted dieting behavior ($\beta = .622$, $p < .01$) as hypothesized (H_7), but there was no significant direct effect of perceived behavioral control on behavior (H_8). Baron and Kenny's (1986) procedures were used to test the hypothesis (H_9) that intention mediated the effect of attitudes, subjective norms, and perceived behavioral control on behavior. The tests revealed that the direct effects of attitudes and subjective norms on behavior were completely attenuated with the inclusion of the intention construct. Furthermore, the indirect effects of attitude and subjective norms on behavior were both significant. However, per-

ceived behavioral control was uncorrelated with behavior so the mediation hypothesis was not supported for this variable and perceived behavioral control therefore only explained variance in intention alone. Overall, the mediation hypothesis (H_9) was partially supported.

Turning to the hypothesized overall effects of the global- (H_{10}) and contextual-level (H_{11}) constructs in the model, there was a significant direct effect of psychological need satisfaction on behavior, although contrary to hypotheses this effect was negative ($\beta = -.226$, $p < .01$). The overall effect of psychological need satisfaction on behavior, which comprises the direct and the indirect effect through the current motivational sequence, also was significant and negative (total effect = –.205, $p < .01$). However, the indirect effect of psychological need satisfaction on behavior was small and nonsignificant. Therefore, the direct effect of psychological need satisfaction on behavior in the dieting sample was primarily responsible for the total effect. There were significant total effects of autonomous motives at the contextual level on intentions (total effect = .333, $p < .01$) but the overall effect on behavior was small and nonsignificant and there were no direct effects. This provides only partial support for the hypothesized overall effects of autonomous motives on situational-level constructs (H_{11}).

Invariance Analyses

To test the invariance of the measurement and structural parameters of the SEM across samples, we conducted a multisample SEM using an invariance routine advocated by Byrne, Shavelson, and Muthén (1989). Such an analysis is important because it confirms whether the measurement elements of the model are identical across the behavioral contexts and aims to establish whether the structural paths between the hypothesized factors vary across behavior types. Although it was expected that the measurement elements would be the same, some structural variations across contexts were anticipated in accordance with previous research (e.g., Hagger & Chatzisarantis, in press). In the invariance analyses, an initial baseline model was estimated with no constraints on the hypothesized parameters to ensure that the factor pattern (i.e., same number of factors and parameters) was tenable across the behavioral contexts. Assuming satisfactory fit of the baseline model, equality constraints were subsequently added to the model that constrained factor loadings, factor variances and disturbances, the disturbance covariances, and the structural paths to be equal. This invariance routine systematically tested for the invariance of all the model parameters. A difference in the fit indexes of –.01 or less when comparing the baseline model with a constrained model was considered a robust indicator of multisample invariance (Cheung & Rensfold, 2002).

Goodness-of-fit statistics for the multisample SEMs are shown in Table 1. The baseline model fit the data adequately according to the criteria adopted, which suggested that the factor pattern was equivalent in the two behavioral contexts. Changes in the fit indexes of the subsequent nested models in the invariance routine indicated that only the model in which the factor loadings were constrained to equality did not exceed the critical difference of –.01. This suggests that the number of factors and relationships between the factors and their indicators exhibited differences across these behavioral contexts that were largely unsubstantial (Cheung & Rensfold, 2002). However, introducing constraints on the factor variances, disturbances, disturbance covariances, and structural parameters across the contexts resulted in goodness-of-fit indexes that fell outside of the acceptable range in relation to the baseline model. Most interesting of these sets of noninvariant parameters were the structural paths. Examination of the LM test that flagged any constraints that should be freed to restore model fit indicated that four structural parameters were noninvariant: the perceived behavioral control → intention, intention → behavior, subjective norms → intention, and RAI → intention paths.

DISCUSSION

Hypotheses from self-determination theory (Deci & Ryan, 2000), Vallerand's (1997; Vallerand & Ratelle, 2002) hierarchical model of motivation, and the theory of planned behavior (Ajzen, 1991) provided a multitheory framework to test a motivational sequence in which global-level psychological need satisfaction affected contextual-level autonomous motives and situational-level intentions and behavior in exercise and dieting contexts. In the model, psychological need satisfaction influenced contextual-level autonomous motives and autonomous motives significantly predicted intentions via the mediation of attitudes and perceived behavioral control in both behavioral contexts. This sequence provided independent support for the top-down effects of motivation from global to situational as proposed by Vallerand (1997) and corroborated elsewhere (Guay et al., 2003; Hagger et al., 2003; Hagger et al., in press). In addition, the effects of attitude and perceived behavioral control on behavior mediated by intentions provided independent support for Ajzen's (1991) theory, although the effect of subjective norms varied across contexts. The integration of the theories provided a comprehensive explanation of the processes by which global psychological need satisfaction influenced decisions to engage in specific behaviors at the situational level. This is corroborated by the direct and indirect effects of the global-level and contextual-level motivational constructs on intention and behavior in the models tested in the present

study. It also indicated that more proximal motivational constructs at the contextual level had a more pervasive influence on situated intention and behavior than did distal constructs at the global level.

An important initial finding of the present study was the support for the discriminant validity of psychological needs of autonomy, competence, and relatedness that has been empirically confirmed in previous self-determination theory research (Kasser & Ryan, 1999; Sheldon et al., 2001). Moreover, a higher-order psychological need satisfaction factor could account for the strong and significant correlations among the first-order need satisfaction factors. This supports the proposed complementary nature of the fundamental psychological needs proposed by Deci and Ryan (2000). In addition, we also supported the discriminant validity of the higher-order measure of psychological need satisfaction with the set of contextual- and situational-level motivational constructs measured in the present study. This lends support to Vallerand (1997) and others' hypotheses (e.g., Deci & Ryan, 2000; Hagger et al., 2003; Hagger et al., in press) that motivational constructs can be abstracted at different levels of generality.

The present study is unique because it provided a comprehensive test of the role of global psychological need satisfaction from self-determination theory on behavior when contextual-level motivation and situational-level social cognitive, decision-making variables from the theory of planned behavior were considered. Of importance, we opted to test this integrated model in two behavioral contexts in which the factor pattern and measurement parameters were likely to be the same but the arrangement of the proposed effects in the structural model different. As expected, the measurement parameters of the model were invariant across the two behaviors, suggesting that the proposed number of factors and makeup of the model were the same in both behavioral contexts. However, as anticipated, the structural parameters of the model varied across behaviors. This is congruent with expectations that behaviors with similar underlying goals would have similar antecedents but differences in the pattern of influence (Hagger & Chatzisarantis, in press; Kremers et al., 2004). This also supports the validity of the study measures for use in different behavioral contexts. Furthermore, the invariance of the measurement parameters suggests that the structural variations found across the behavioral contexts in the present study reflect valid variations unconfounded by measurement variance.

We also hypothesized that global-level psychological need satisfaction would affect behavior via two processes: a direct, impulsive route and an indirect, reflective route via the mediation of contextual-level motivation and situational-level social cognitive constructs from the theory of planned behavior–attitudes, perceived behavioral control, and intentions (Elliot et al., 2002; Fazio, 1990; Strack & Deutsch, 2004). In the dieting sample, both effects were evident, although contrary to hypotheses, the direct effect was negative and much larger than the indirect effect. To speculate, one interpretation of these two routes is that some individuals reporting a high degree of psychological need satisfaction may engage in dieting for autonomous reasons. They subsequently form autonomous motives and intentions to diet as indicated by the indirect, reflective route or motivational sequence in the present model. Other individuals with high levels of psychological need satisfaction may exhibit low levels of dieting behavior or avoid it altogether without the need for deliberation as indicated by the direct, impulsive route in the present model.[2] This impulsive route does not rely on the formation of specific plans to avoid dieting. This is consistent with recent research that suggests that abstract, higher-order motivational orientations such as constructs at the global level can be "activated automatically and regulated without people's conscious guidance and lead to the same outcomes obtained through conscious self-regulation of these motivations" (Levesque & Pelletier, 2003, p. 1582).

In contrast to the dieting sample, the structural model for exercise behavior was different in that the effects of psychological need satisfaction on the situational-level constructs were not completely mediated by contextual-level autonomous motives, the effect of autonomous motives on intentions was not completely mediated by the attitude and perceived behavioral control constructs, and there was no direct effect of psychological need satisfaction on behavior. For this behavior, it seemed that the constructs at the most proximal level did not completely explain the influence of constructs at the most distal level as hypothesized by Vallerand (1997). This may be due to methodological artifacts, for example, it is possible that autonomous motives did not adequately capture the processes involved in the formation of plans to engage in need-satisfying exercise behavior in the future. Therefore, the direct effect may represent aspects of autonomous motivation involved in planning future behavioral engagement in need satisfying behavior that are not mediated by attitude or perceived behavioral control. Other constructs may mediate this relationship, such as belief-based measures of more controlling forms of motivation unmeasured in the present study.

Furthermore, the overall effect of psychological need satisfaction in the exercise sample was indirect and positive, whereas in the dieting sample, the total effect was negative. One possible reason for this is that individuals with high levels of psychological need satisfaction also will tend to report higher levels of autonomous motivation to engage in exercise behavior and are also more

likely to form plans to engage in exercise behavior in the future. However, individuals reporting high levels of psychological need satisfaction are likely to avoid dieting without the need for deliberation, as indicated by the direct negative relationships between psychological need satisfaction and dieting behavior. A possible reason for this is that dieting behavior is the type of behavior that is spontaneously avoided when psychological needs are satisfied and that an individual is compelled to consciously deliberate over his or her values and goals with respect to dieting if the behavior is to be performed autonomously on the basis of his or her psychological needs. Conversely, exercise behavior does not exhibit a spontaneous route to behavioral engagement. Instead, the individual engages with these behaviors as a consequence of his or her need satisfaction by deliberating over the activities involved, such as sports and games that are likely to reflect autonomous values or goals and make plans to engage in exercise accordingly. Therefore, although both behaviors are useful in terms of their effects on health-related outcomes, such as the maintenance of a healthy body composition, different routes exist that underpin people's engagement in these behaviors.

Although we found significant total effects of psychological need satisfaction on intentions and behavior in the present study, the effect sizes were small. Furthermore, correlations among psychological need satisfaction and the contextual- and situational-level constructs also were weak. One possible reason for this may be that the level of abstraction of the measures may be too great. Future studies may examine psychological need satisfaction in the context of the environmental conditions in which the psychological needs are supported or thwarted. This may moderate the effect of psychological need satisfaction on motivation and intentions, such that in contexts likely to support psychological needs, people may draw more from their global psychological need satisfaction in their formation of motivational tendencies.

Limitations and Future Directions

There are a number of limitations of the present study that restrict the generalizability of the findings. First, the study was conducted on a sample of undergraduate students. Although exercise and dieting behaviors are important to the health of young people at a university, findings from such a relatively homogeneous group may not generalize well to the wider population. Further replication of this integrated theory in the general population and in other target populations is warranted, particularly in clinical populations where exercise and dieting behavior may be of vital importance, such as in patients undergoing rehabilitation from coronary heart disease or in morbidly obese people.

Second, although the present study adopted a powerful longitudinal design, these data are correlational in nature and future studies may attempt to replicate these findings experimentally. For example, a possible study may manipulate autonomous motives at the contextual level and examine the effect of such a manipulation on situated behavior under conditions of high and low psychological need satisfaction.

Finally, although the proposed top-down motivational sequence was justifiable theoretically, the present findings do not rule out the existence of other possible alternative sequences. For example, Vallerand and Ratelle (2002) suggest that some bottom-up processes may operate within the hierarchical model such that repeated experiences of behaviors at the situational level affect psychological need satisfaction at the global level. Future studies may adopt a cross-lagged panel design in which the constructs at all three levels of generality from the present integrated model are measured at two time points. Such a study would permit the examination of both top-down and bottom-up effects in the proposed motivational sequence. However, this proposed model may not be optimal in mapping the bottom-up effects because it does not account for repeated experiences of need satisfying behavior and the situational social cognitive constructs do not achieve temporal correspondence with the global and contextual motivational orientations in keeping with a bottom-up causal direction. Another avenue for future research would be to combine the recently developed methods for the automatic activation of higher-level autonomous motives (Levesque & Pelletier, 2003) within the contexts of the current model to try to further identify the conditions under which psychological need satisfaction automatically influences behavior and the conditions that result in a more reflective or deliberative route to behavioral engagement.

NOTES

1. The hypothesized mediation effects in the present study were tested according to the procedures outlined by Baron and Kenny (1986). There are four criteria that require satisfaction for mediation to be supported: (a) the dependent variable should be correlated with the independent or predictor variable, (b) the mediator should be correlated with the independent variable, (c) the mediator should have a significant unique effect on the dependent variable when it is included alongside the independent variable in a multivariate test of these relationships, and (d) the effect of independent variable on the dependent should be significantly attenuated or nullified when the mediator is included as an independent predictor of the dependent variable. Confirmation of the first two criteria was ascertained by examination of the zero-order factor correlations among the variables of interest given in Table 3. The third criterion was established by examining whether the mediator had a significant direct effect on the dependent variable in the final structural equation model. Finally, to confirm the fourth criterion, the path from the mediator variable to the dependent variable was independently fixed to zero and the model was reestimated. If the direct effect of the independent variable on the dependent variable

was restored or increased in this alternative model, then complete or partial mediation was confirmed. For completion, Sobel (1982) tests indicated whether the indirect or mediated effect of the independent variable on the dependent via the mediator was significant.

2. One characteristic of autonomous individuals is that they prefer behaviors that maintain coherence between aspects of their personality system, such as psychological needs and their biological needs, compared to behaviors that result in a conflict between their personality system and biological needs (Sheldon & Kasser, 1995). Because dieting behaviors conflict with the biological need for hunger, autonomous individuals would tend avoid dieting behaviors to develop a more coherent sense of self.

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