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Self-Determination Theory
An Individual Differences Perspective

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Self-Determination Theory: An Individual Differences Perspective

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Thesis Abstract

Self-determination theory is a theory of personality and motivation that provides a perspective on the social-cognitive dimensions that underpin human behaviour. According to self-determination theory, there are three basic psychological needs that are universally fundamental for self-motivation and psychological well-being. The hypothesis of universal needs suggests that, when satisfied, autonomy, competence and relatedness are equally beneficial for all people, regardless of any potential individual differences in need strength (cf. Deci & Ryan, 1985; Ryan & Deci, 2002). However, other theories developed within personality and social psychology tend to view needs as learned and varied (e.g., McClelland, 1985; Murray, 1938). As such, there is some debate as to whether the needs described by self-determination theory are universal requirements, or whether they are learned dispositions that vary across individuals (Sheldon & Niemiec, 2006).

Sense of coherence theory (Antonovsky, 1979; 1987) is another perspective on psychological health and well-being. The core dimensions of sense of coherence appear to share some similarities with self-determination theory. However, the theories have different traditional foci. Research in sense of coherence theory is traditionally concerned with how a person survives despite the chaos and stress of life (e.g., the absence of ill health). Conversely, empirical research in self-determination theory has historically focused on how basic need satisfaction facilitates positive psychological well-being and growth orientated behaviour. Because of the difference in traditional foci, research within the framework of sense of coherence and basic needs satisfaction has taken place independently. As such, the relationship between the two theories and associated well-being is yet to be addressed.

Chapter 1 outlines the theoretical rationale on which the empirical chapters are based.

Chapter 2 of this thesis provides evidence that the benefits of need satisfaction are not always equal; rather, they are dependent on their relative intra-individual importance. Studies

1, 2 and *part one* of Study 4 show that the motivation benefits associated with need satisfaction gained via a specific activity depend on intra-individual differences in need importance. Studies 3 and *part two* of Study 4 show that for the general population, the effects of need satisfaction on general well-being are equal for all people regardless of the importance attached to each need. Those data support Deci and Ryan's (1985) universal benefits position. However, Studies 1 and *part one* of Study 4 show that when an individual's sense of identity is highly related to their investment in a specific activity, the association between need satisfaction (via an important activity) and general well-being depends on the intra-individual level of need importance. Those data counter self-determination theory's universal benefits position. Collectively, these findings support the position that self-determination theory's basic psychological needs are not always universally required for motivation and well-being.

First, Chapter 3 (Study 5) provided support for the credibility of a four-factor sense of coherence scale, with an additional dimension, termed *relationality.* Second, Study 5 provided evidence for a considerable conceptual overlap (60%) among the dimensions of sense of coherence and basic needs perspectives. Third, in a series of longitudinal mediation analyses, satisfaction of basic needs significantly mediated the relationship between sense of coherence and positive well-being, but failed to mediate the relationship between sense of coherence and the absence of psychiatric symptoms. In addition, those analyses showed that sense of coherence was directly associated lower levels of psychiatric symptoms. Collectively, these findings are in line with the origin of both theories, and suggest that the dimensional structure of sense of coherence more adequately explains the absence of psychiatric illness than basic need satisfaction, whereas basic need satisfaction only explains the presence of positive psychological well-being. Chapter 4 of this thesis discusses the results from the two experimental chapters (Chapter 2 and 3) in a broad theoretical context.

Chapter 1 – General Introduction

Researchers within personality and social psychology have sought to understand the social-cognitive constructs underpinning human behaviour since the nineteenth century (e.g., Eysenck, 1967; Carver & Scheier, 1998; James, 1890; Maslow, 1954; Murray, 1938). Decades of research have produced varying answers to this perennial endeavour (e.g., Social Learning Theory, Rotter, 1954; Personal Causation, deCharms, 1968; and Social Cognitive Theory, Bandura, 1986). Amongst the vast literature, psychological need theories provide one perspective to explain the basic motivations and desires that move people through life (Sheldon & Schuler, 2011). Indeed, the study of human needs has appealed to many researchers because *needs* as psychological constructs can provide explanations for a wide variety of behaviours, offer a way to integrate the fields of motivation and personality psychology and give focus to psychosocial interventions that aim to enhance well-being (Sheldon, Elliot, Kim & Kasser, 2001).

One of the most important contributions to the study of human needs was by Hull (1943), who specified a set of innate physiological needs that must be met for individuals to remain physically healthy (e.g., food, water, and sex). Further, Hull (1943) suggested that, when in deficit, these needs activate drive states that push people into action. Murray (1938) advanced the field of personality psychology by introducing the concept of needs at the psychological level. However, these needs were conceptualised as learned and acquired rather than innate. Murray's focus on psychological needs led to the empirical work of McClelland (1953), which focused on the needs for achievement, affiliation, and power. Later, in their seminal work, Deci and Ryan (1985; 2000) developed self-determination theory, which is a contemporary theory of motivation and personality that also specifies psychological needs (namely, autonomy, competence, relatedness). However, self-determination theory differs from the position of Murray (1938) and McClelland (1953) with

regards to the function of these needs. As in the Hullian tradition (e.g., Hull, 1943), self-determination theory conceptualises psychological needs as innate, organismic necessities, which when satisfied provide the necessary social-contextual support to facilitate cognitive growth (as manifest in self-determined motivation), integrity, and optimal forms of psychological well-being (Deci & Ryan, 1985). Whilst a number of psychological needs theories exist, self-determination theory is undeniably one of the most prominent and widely cited, receiving close to a reported 30,000 references (Howard, Gagne & Bureau, 2017) to its fundamental texts (e.g., Deci & Ryan, 1985; Ryan & Deci, 2002). The next section of this introduction outlines this theory.

Self-Determination Theory

Self-determination theory assumes that human beings are active growth orientated organisms that strive for opportunities to satisfy their basic psychological needs (Deci & Ryan, 1985; 2000). Deci and Ryan (2000) suggest that all three basic psychological needs must be satisfied for individuals to be integrated and psychologically well; satisfying "one or two is not enough" (pg. 229). Specifically, these three are the needs for autonomy, competence and relatedness. *Autonomy* refers to the need to experience volition and to self-regulate ones actions (deCharms, 1968; Deci & Ryan, 1985; 2000). A person feels autonomous when they can behave in ways that are in line with their own values and interests and in ways that reflect their true self (Sheldon & Prentice, 2017). *Competence* refers to the need to feel mastery in interacting within ones social-contextual environment (White, 1959; Deci & Ryan, 1985; 2000), and *relatedness* refers to the need to feel socially connected to and cared for by significant others (Baumeister & Leary, 1995; Harlow, 1958; Ryan & Deci, 1985).

Universal Basic Needs

At the heart of self-determination theory is basic psychological needs theory, which assumes that everybody needs autonomy, competence and relatedness (Deci & Ryan, 1985; 2000). That is to say, these needs are universally required (Deci & Ryan, 2000; Chen et al., 2015). Moreover, the *hypothesis of universal basic needs* suggests that the benefits of need satisfaction are equal for all people regardless of individual differences in need strength, or cultural background (Deci & Ryan, 2000; Chen et al., 2015). Self-determination theorists do not deny the existence of individual differences in the strength or preference of basic needs but argue that it is not a useful place to focus research attention (Deci & Ryan, 2000, p. 232). This is because, the universal benefits claim assumes that even those who develop a particularly strong orientation toward a specific need, still only benefit from the satisfaction of that need to approximately the same extent as those with a weak orientation towards that need (Chen et al., 2015). Consequently, rather than focus on the effects of individual differences in need strength, research within self-determination theory framework tends to focus on individual differences in the way people orient toward certain aspects of the social environments (also called causality orientations; Deci & Ryan, 1985), and individual differences that effect the extent to which people experience need satisfaction. However, the universality of basic needs hypothesis is not without is criticism. For example, Vallerand (2000) argued that "the jury is still out" on the issue of universal needs, and that it is a rather important problem to examine individual differences in basic need strength, because these differences may have important implications for understanding motivational processes.

Relative Autonomy Continuum

In the late 1980's self-determination theorists established the relative autonomy continuum (Ryan & Connell, 1989). According to self-determination theory, any and every motivated behaviour can be located on this continuum; ranging from controlled to

autonomous (Deci & Ryan, 1985, Sheldon & Prentice, 2017). Several types of motivation are considered; these include *intrinsic motivation,* which refers to when a person engages in activity for the sake of doing the activity itself (e.g., I exercise because I find it enjoyable and interesting); *identified motivation,* which refers to when a person personally values their engagement in an activity (e.g., I exercise because I value my health); *introjected motivation* which refers to when a person engages in an activity to avoid feelings of guilt and shame or to gain self-approval (e.g., I exercise because I don't want to be an unhealthy person) and finally, *external motivation,* which refers to when a person engages in a behaviour for the avoidance of controlled external contingencies (e.g., I exercise because if I don't my doctor will be disappointed; Deci & Ryan, 1985). However, recent empirical work has challenged the perspective that self-determined motivation is best represented along a continuum of relative autonomy (Chemolli & Gangé, 2013). More specifically, the findings from this work provides evidence against the continuum and instead suggests that motivational regulations in self-determination theory differ in kind instead of degree (as the relative autonomy continuum implies; Chemolli & Gangé, 2013).

Need Satisfaction and Self-Motivation

According to self-determination theory, satisfaction of the three basic needs is essential for self-determined motivation (Baard, Deci & Ryan, 2004). More specifically, social-contextual opportunities that satisfy autonomy, competence and relatedness, facilitate the internalisation of external contingencies into personally endorsed values and self-regulations (Ryan, Connell, & Deci, 1985; Baard, Deci & Ryan, 2004). Sustainable (i.e., enduring) motivation is experienced when the type of motivation that has taken place reflects self-determined regulations (e.g., intrinsic regulations and well internalised extrinsic regulations; Deci & Ryan, 2000). In contrast, controlling, excessively challenging, and rejecting environments that frustrate psychological needs can undermine motivation and have

negative consequences (e.g., depression; Soenens, Luyckx, Vansteenkiste, Luyten, Duriez, & Goossens, 2008). In line with self-determination theory, research has shown support for the importance of basic need satisfaction in the prediction of sustained motivation, maintained behaviour change (Standage, Sebire & Loney, 2008; Silva, Markland & Minderico et al., 2008; Vansteenkiste, Simons, Lens, Sheldon & Deci, 2004), and greater internalisation (Markland & Tobin, 2010).

Need Satisfaction and Well-being

Self-determination theory considers satisfaction of autonomy, competence, and relatedness as essential and equally important for positive outcomes (Ryan & Deci, 2001). Conversely, need dissatisfaction is suggested to lead to psychological ill-being (Ryan, 1995; Ryan & Deci, 2002). There is a substantial volume of research demonstrating the effects of need satisfaction on general well-being outcomes such as life satisfaction, vitality, and self-esteem (e.g., Adie, Duda & Ntoumanis, 2004; Chen et al., 2015; Deci, Ryan, Gagne, Leone, Usunov, Kornazheva, 2001), in a variety of contexts such as education (Vansteenkiste, Lens, & Deci, 2006), health care (Ng, Ntoumanis, Thøgersen-Ntoumani, Deci, Ryan, Duda & Williams, 2012), sport and exercise (Edmunds, Ntoumanis, & Duda, 2006), and the organisational domain (Broeck, Ferris, Chang & Rosen, 2016). Research has also demonstrated that daily fluctuations in need satisfaction are associated with daily levels of emotional well-being (e.g., Reis, Sheldon, Gable, Roscoe & Ryan, 2000).

Historically, empirical research within self-determination theory has been concerned with understanding associations between need satisfaction and optimal forms of well-being. Comparatively less research has focussed on the relationship between need satisfaction and psychopathology (Pyszczynski, Greenburg & Solomon, 2000). Some research has indicated that low levels of need satisfaction are associated with maladaptive outcomes such as burnout (Hodge, Lonsdale, & Ng, 2008), bulimic symptoms (Pelletier, Dion & Levesque, 2004), and

emotional exhaustion (Reinboth & Duda, 2004). In contrast, other research suggests that need satisfaction has no little or no association with ill-being (Adie et al., 2008; Baard, Deci & Ryan, 2004; Bartholomew Gagne, Ryan & Bargmann, 2003). However, more recently, basic need thwarting (i.e., active obstruction of need satisfaction) has been shown to be a significant predictor of negative affect (Bartholomew, Ntoumanis, Ryan, Bosch & Thøgersen-Ntoumani, 2011; Gunnel, Crocker, Wilson, Mack & Zumbo, 2013).

The Competing Stances of Self-Determination Theory and Individual Differences

Historically, personality psychology has two paradoxical traditions, one that makes claims about a universal human psychology, and one that focuses on the existence of important individual differences (Buss, 1984; Tooby & Cosmides, 1990). This problem is familiar in the psychological need literature because the universality of basic needs hypothesis was developed in parallel with other personality theories that tend to view psychological needs differently. For example, the central tenet of motive disposition theory is that psychological needs (also called implicit motives) are learned and that different people develop stronger needs than others through early childhood learning experiences (McClelland, 1985; Murray, 1938). Maslow's (1954) need hierarchy views psychological needs as higher order needs, that vary in strength depending on available resources, individual differences, and cultural background (Maslow, 1954). Buttle (1989) challenged the existence of universal psychological needs altogether, with the view that psychological needs are constructs shaped by socio-cultural values (Vansteenkiste & Ryan, 2013). As such, there is a question as to whether the needs described by self-determination theory are universal requirements, or whether they are learned dispositions that vary across individuals (Sheldon & Niemiec, 2006).

From an individual differences perspective, one of the main problems with self-determination theory's universality claim is that it does not allow for the possibility that the

satisfaction of a particularly strong need may be especially beneficial relative to the satisfaction of another, weaker, basic need. Given the prominence of self-determination theory, it is useful to review whether the universality assumption is robust against empirical scrutiny, yet there are few published studies that directly support the claim that the basic needs are in fact universally beneficial. Several studies indirectly examine the universal benefits hypothesis. This research is briefly overviewed in the next section.

Support for Universal Basic Needs

Research grounded in self-determination theory has typically examined the universal benefits position by demonstrating the unique importance of each need. For example, Sheldon and Colleagues (2001) compared psychological needs from a number of popular need theories (e.g., Malsow, 1968 and Epstein, 1990) and consistently demonstrated that autonomy, competence and relatedness were the most important psychological needs with regard to life satisfaction. Further, balanced need satisfaction has been shown to contribute to optimal psychological well-being, over and above total amount of need satisfaction (Sheldon & Niemiec, 2006). More recent research (Chen et al., 2015) found that the need satisfaction-well-being association was not moderated by individual differences in need strength or cultural backgrounds.

Furthermore, motive disposition research (Sheldon & Schüler, 2011) shows that those who appear to *not* "want" a particular need (i.e., low motive disposition for that need) experience positive affect just as much from "having" the corresponding basic need (i.e., satisfying that need) as those who report "wanting" the need (i.e., high motive disposition for that need). Sheldon and Schüler (2011) suggest that these findings offer indirect support for self-determination theory's universality claim, namely that all people benefit equally from need satisfaction.

Support for the Individual Differences Perspective

In contrast to the above research, findings from other studies contradict the universal benefits position. For example, Harackiewicz, Sansone and Manderlink (1985) found that the relationship between competence feedback and task interest depends on the strength of an individual's orientation toward achievement incentives (i.e., achievement motivation). A series of studies in the motive disposition domain demonstrate that the effects of need satisfaction on motivation (Schüler & Kuster, 2011; Schüler, Sheldon & Frölich, 2010; Schüler, Wegner & Knechtle, 2014b) and domain-specific well-being (e.g., Hofer & Busch, 2011) are influenced by personality variables (i.e., implicit motives). Further, various studies have suggested that the benefits of need satisfaction (namely autonomy) are dependent on the nature of the self. That is, people who have an interdependent view of themselves (depicted by the cultural and social environment) gain relatively less benefit from autonomy satisfaction than those with an independent self-construal (Markus & Kitayama, 2003). In line with this perspective, Iyengar and Lepper (1999) suggest the effects of personal choice on intrinsic motivation depend on whether individual choice (i.e., autonomy) is consistent with a person's *sense of identity* deep-rooted in their cultural background.

Collectively, these contradictory findings may be explained by inappropriate operationalisations of need strength (cf. Chen et al., 2015) and statistical procedures based on nomothetically derived (inter-individual) importance scores (i.e., between-person effects; Hardy & Moriarty, 2006; Marsh & Sonstroem, 1995; Pelham & Swann, 1989). For example, Chen and Colleagues (2015) examined the effect of individual differences in need importance on the relationship between need satisfaction and well-being, using nomothetically derived generalized multiple regression. In this approach, well-being was predicted by need satisfaction scores, importance scores, and satisfaction × importance cross product terms. However, this approach fails to account for the effects of intra-individual (idiographic) need

importance (Pelham & Swann, 1989). Pelham and Swann (1989) argued that importance scores should be based on the relative differences within an individual (i.e., ‘‘the amount of importance people impute to particular attributes relative to their other attributes’’, p. 674), rather than relative differences across multiple individuals. In the self-esteem literature, within person importance effects derived from idiographic approaches have received support over the more commonly used inter-individual nomothetic approaches (cf. Hardy & Moriarty, 2006; Hardy & Leone, 2008; Lindwall, Asci, Palmeira, Fox & Hagger, 2011). Research in self-determination theory is yet to examine the effects of idiographically derived need importance scores (i.e., intra-individual effects) on the relationship between need satisfaction and positive/negative outcomes, as such, the universal benefits position is still up for debate.

Other Perspectives on Human Functioning

Self-determination theorists have asserted that both optimal and sub-optimal forms of psychological functioning can to a large extent be explained by a single underlying principle (i.e., basic psychological need satisfaction and frustration; Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013). However, as previously alluded to, there exist many diverse views on the social-cognitive dimensions that underpin human functioning. Bandura (1977) suggests that self-efficacy is a fundamental cognitive construct that explains a substantial proportion of human functioning. Maslow’s (1943) theory of human motivation specifies a number of innate and growth-level needs that push people into action. Bowlby’s (1988) attachment theory hypothesises that behaviour can be explained by patterns reflecting early childhood relationships. Other perspectives adopt the view that human behaviour reflects psychological mechanisms shaped through evolutionary processes (Buss, 1991).

Another less well known perspective on human functioning is Antonovsky’s (1979; 1987) sense of coherence theory. Sense of coherence has received very little acknowledgment within self-determination theory literature. This is perhaps because the theory originated from

medical sociology and emerged from the study of malfunctioning following the extreme trauma of Holocaust war experience. Therefore, the dimensional structure of sense of coherence has a much darker origin than the humanistic, positive psychology, origin of basic psychological needs theory. Consequently, the empirical focus of sense of coherence theory differs from many conceptual frameworks within positive psychology literature. It is proposed that although research within self-determination theory and sense of coherence has taken place independently, examination of the possible similarities and differences of both theories may aid our understanding of what determines successful psychological functioning. The next section of this introduction outlines the dimensional structure of Antonovsky's (1979; 1987) sense of coherence theory and its association with psychological functioning. However, to minimise repetition, the detailed theoretical rationale pertaining to the relationship between the two theories is presented in Chapter 3 rather than in the present introduction.

Sense of Coherence Theory

Antonovsky, Maoz, Dowty and Wijenbeek (1971) sought to understand the extent to which maladaptation and malfunctioning characterised survivors of the unimaginably extreme, prolonged trauma of the Second World War concentration camps. This research found considerable evidence to suggest that despite the experience of severe suffering, some people were able to maintain relatively good mental health. These findings led to the *salutogenic* question as to how people maintain active adaptation and progress towards good mental health in the face of stress and adversity (Linstrom & Eriksson, 2009). Antonovsky (1979) suggested that a strong *sense of coherence* typifies such individuals; that is, the extent to which a person has a general disposition that his/her social environment is comprehensible, manageable and meaningful (Antonovsky, 1979; 1987).

Comprehensibility is the cognitive dimension of sense of coherence and refers to the perception that internal and external stimuli make cognitive sense, that is to say, information is clear and structured rather than disordered, random, and unexplained (Antonovsky, 1979; 1987; 1991). A person with a strong sense of coherence is able to make structure out of chaos and understand themselves in their social-contextual environment. *Manageability* is the behavioural dimension of coherence and refers to the perception that there are resources available to meet the demands posed by the internal and external stimuli confronting the organism (Antonovsky, 1979; 1987). Finally, *Meaningfulness* is the motivational dimension, which refers to the feeling that the stimuli in one's internal and external environment have emotional meaning, and that at least some of life's problems are worthy of emotional investment and commitment (Antonovsky, 1979; 1987).

Sense of Coherence and Well-Being

The foundational rationale underpinning sense of coherence theory is that the human environment causes strain, and that stress and chaos are universally experienced. As such, research based on sense of coherence has typically focussed on understanding how people function despite the chaos and stress of life, rather than how they attempt to control and manage such chaos and stress. In line with this position, research suggests that a strong sense of coherence acts as a stress buffer in the relationship between negative life events and psychopathology (Jorgenson, Frankowski & Carey, 1999). Similarly, clinical research shows that sense of coherence moderates the association between traumatic childhood experiences and posttraumatic stress (van der Hal-van Raalte, van IJzendoorn & Bakermans–Kranenburg, 2008).

Antonovsky (1979; 1987) originally hypothesised that sense of coherence would have a direct association with how a person feels about their level of functioning (i.e., the absence of poor mental health). A systematic and comprehensive review (Eriksson & Linström, 2006)

highlighted that a strong sense of coherence had longitudinal and cross-sectional associations with good mental health and the absence of depression. Further, research demonstrates that individuals with a reported weak sense of coherence (i.e., the perspective that life is chaotic, unmanageable, and meaningless) are more vulnerable to feelings of anxiety, anger, and hostility (Amirkhan & Greaves, 2003; Eriksson & Linström, 2005; Ristkari, Sourander, Ronning, & Helenius, 2006; Surtees, Wainwright, Luben, Khaw, & Day, 2003; Von Bothmer & Fridlund, 2003), because they are more likely to interpret stressors as threatening (Anson et al., 1993, Antonovsky & Sagy, 1986).

Antonovsky (1987) suggested that sense of coherence indirectly relates to positive forms of psychological well-being. He hypothesised that this is because many of the resources that promote a strong sense of coherence may directly relate to this well-being dimension (e.g., life satisfaction, vitality, morale, and positive affect). Indeed, some research has found associations between sense of coherence and positive outcomes (e.g., positive affect and life satisfaction; Dezutter, Wiesmann, Apers, Luyckx, 2013; Moksnes, Løhre, Espnes, 2013; Von Bothmer & Fridlund, 2003). However, to date, little is known about the mechanisms underpinning the sense of coherence–positive well-being relationship (Mittlemark, Bull & Bouman, 2017).

Objectives of the Present Research

Chapter 1 has outlined self-determination theory and identified an area of philosophical disagreement that raises question as to whether self-determination theory's universality of basic psychological needs hypothesis is in fact valid. Little empirical effort has been made to directly examine this question and the scant research has produced contradictory findings. As such, examining this question would appear to be of theoretical significance. Chapter 1 has also outlined sense of coherence theory as an alternative perspective on the dimensions underpinning psychological functioning. The origin of sense of

coherence theory differs from many theories within motivation and personality psychology, and to our knowledge no research has integrated self-determination theory and sense of coherence perspectives. Therefore, examining the relationship between both theories provokes worthy research.

Structure of the thesis. This thesis comprises the current introductory chapter, two in-depth empirical chapters (Chapters 2 and 3), and a general discussion chapter. The empirical chapters have been prepared as standalone manuscripts for submission to peer-review academic journal. As such, there is some unavoidable overlap and repetition of topics.

Chapter 2 examines the universality of basic need hypothesis. Specifically, across four studies, the chapter assesses the influence of intra-individual differences in basic need importance on the relationship between need satisfaction, self-determined motivation and psychological well-being. The theoretical and applied implications of the four studies are then discussed.

Chapter 3 (Study 5) outlines some similarities and differences between self-determination theory and sense of coherence theory. The degree of conceptual overlap amongst the dimensions of both theories is examined. Then, this chapter assesses the longitudinal associations between basic need satisfaction, sense of coherence and a range of psychological health outcomes. Due to dimensionality issues reported in the available literature, the first phase of this research examined the factor structure of the “orientation to life questionnaire” (i.e., sense of coherence scale) and proposes the existence of a fourth previously unconsidered dimension.

Chapter 2: The Benefits of Basic Need Satisfaction Depend on Their Relative Importance: An Idiographic Analysis[1]

Abstract

Self-determination theory proposes three needs (autonomy, competence and relatedness) that when satisfied, are equally beneficial for all people (cf. Deci & Ryan, 1985; Ryan & Deci, 2002). In the present study, we demonstrate that the benefits of need satisfaction are in fact not always equal; rather they are dependent on their relative intra-individual importance. In Studies 1 and 2 and *part one* of Study 4 we show that the motivation benefits associated with need satisfaction gained via a specific activity depend on intra-individual differences in need importance. In Studies 3 and *part two* of Study 4 we show that for the general population, the effects of need satisfaction on general well-being were equal for all people regardless of the importance attached to each need. Those data support Deci and Ryan's (1985) universal benefits position. However, in Studies 1 and *part one* of Study 4 we show that when an individual's sense of identity is highly related to their investment in a specific activity, the association between need satisfaction (via an important activity) and general well-being depends on the intra-individual level of need importance. Those data counter the universal benefits position. We conclude that these findings collectively support the position that the basic psychological needs are not always universally required for motivation and well-being.

[1] Based upon Glendinning, F., Hardy, L., Woodman, T., & Ong, C, W. (2018). *The Benefits of Basic Need Satisfaction Depend on Their Relative Importance: An Idiographic Analysis.* Manuscript under review.

Introduction

Self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2002) is a theory of human motivation that focuses on understanding and enhancing self-motivation and psychological health. Integral to self-determination theory are three basic psychological needs, which are proposed to be innate and universal as opposed to learned and individually varied (Deci & Ryan, 1985). Specifically, these are the needs for *autonomy*, which is feeling volitional and responsible for one's own behavior (Deci & Ryan, 1985, 2000); *competence*, which is feeling effective in bringing about desired outcomes (Ryan & Deci, 2002); and *relatedness*, which is feeling securely connected to and understood by others (Ryan & Deci, 2002).

The Hypothesis of Universal Basic Psychological Needs

Self-determination theory's *universality of basic psychological needs hypothesis* (Deci & Ryan, 1985; Ryan & Deci, 2002) suggests that the benefits of need satisfaction are equal for all people regardless of individual differences in the strength or preference of each need (Sheldon & Niemiec, 2006). That is, even those who develop a particularly strong orientation toward a specific need, still only benefit from the satisfaction of that need to approximately the same extent as those with a weak orientation towards that need. Further emphasis is placed on the requirement that each need must be fulfilled for psychological health to occur and if any one of these three needs is not fulfilled, psychological health will suffer (Deci & Ryan, 1985). Recent research offers some support for this universality hypothesis regarding basic psychological needs (e.g., Chen et al., 2015; Sheldon & Niemiec, 2006; Sheldon & Schüler, 2011). Importantly, this perspective does not allow for the possibility that the satisfaction of a particularly strong need may be especially beneficial relative to the satisfaction of another, weaker, basic need.

Although self-determination theorists acknowledge the possibility of the existence of individual differences in the strength or preference of basic psychological needs, they maintain that under the hypothesis of universal basic needs, these differences are not the most important for research attention (Deci & Ryan, 2000). As such, self-determination theorists' empirical focus has been on the effects of need satisfaction rather than on relative need strength. However, other personality theorists argue that it is important to examine the strength of basic needs because if there are individual differences in the strength of these needs, these differences should influence the relationship between need satisfaction and psychological health (Hofer & Busch, 2011).

The universality of basic needs hypothesis has led to tension and confusion in the psychological need literature, because the study of universal needs shares the same research domain as the study of individual differences in the strength of other, arguably similar psychological needs (e.g., the need for achievement and affiliation; McClelland, 1965). As a result, there is some debate as to whether the basic needs described by self-determination theory are innate and inherited universals that remain the same for all human beings or are acquired and learned dispositions that vary across people (Sheldon & Niemiec, 2006). This tension leads to several questions of interest, the first of which is:

Q1. Do individual differences in the strength of the needs for autonomy, competence and relatedness influence the relationship between need satisfaction and psychological outcomes?

The Individual Differences Hypothesis of Basic Psychological Needs

Motivated behavior. The individual differences in basic needs perspective is particularly important to consider in the context of motivated behavior, because according to (Deci & Ryan, 1985) the satisfaction of basic psychological needs facilitates a person's self-motivation, regulatory processes, and the internalization of personal values (Baard, Deci &

Ryan, 2004). Research has shown support for the importance of basic need satisfaction in the prediction of self-determined motivation (Deci & Vansteenkiste 2004; Edmunds et al., 2006), and that if satisfaction of the basic needs is hindered, when one's context is controlling, excessively challenging and rejecting, self-determined motivation suffers (Deci and Ryan, 2008). However, to the best of our knowledge, no research has directly examined the influence of individual differences in the strength of basic psychological needs on the relationship between need satisfaction and motivated behavior. Thus our second question is:

Q2. How do individual differences in the strength of basic psychological needs influence the relationship between need satisfaction and subsequent motivation?

Vallerand (2000) suggested that ''individual differences in needs may serve various functions, including that of determining which type of perceptions (autonomy, competence, and relatedness) will influence motivation" (p. 316). To illustrate, according to an individual differences perspective on basic psychological needs, an individual with a strong need for competence and a relatively weak need for relatedness should experience more motivation benefits as a result of competence satisfaction (e.g., performing better) and experience relatively less motivation benefits as a result of relatedness satisfaction (e.g., making a new friend).

A series of recent studies in the motive disposition domain attempted to examine the moderating role of individual differences in need strength (indirectly measured via implicit motives) on the relationship between need satisfaction and motivation. This research revealed that individuals with a strong motive for a particular type of experience gain greater benefit from the basic psychological need satisfaction that corresponds to that type of experience (Hofer & Busch 2011; Schüler & Kuster, 2011; Schüler, Sheldon & Frölich, 2010; Schüler, Wegner & Knechtle, 2014b). Results from Schüler and colleagues' research show that individuals with high motives for *freedom* (the need for free self-integration; Kuhl, Scheffer,

& Eichstaedt, 2003), *achievement* (the need for surpassing standards of excellence; McClelland, Atkinson & Clark, 1953), and *affiliation* (the need for building and maintaining stable and friendly interpersonal relations; French & Chadwick, 1956) gain greater motivation benefits (i.e., flow, goal commitment, goal progress and intrinsic motivation) from corresponding feelings of autonomy, competence and relatedness, respectively, compared with individuals low in these motives. They concluded that these results "suggest that the effects of need satisfaction are not universal, but are influenced by personality variables (implicit motives)" (Schüler et al., 2014b, p. 300). These results from motive disposition research seemingly contradict self-determination theory's universality hypothesis and suggest that the motivational benefits of need satisfaction depend on the core elements of an individual's personality (i.e., strength of implicit motive dispositions; Hofer & Busch, 2011).

Psychological well-being. As well as being important for understanding motivation, self-determination theory has generated a substantial volume of research demonstrating the effects of need satisfaction on a wide range of psychological well-being outcomes such as vitality, life satisfaction, and self-esteem across many life domains and cultures (e.g., Adie et al, 2008; Chen et al., 2015; Jang, Reeve, Ryan & Kim, 2009; Thøgersen-Ntoumani & Ntoumanis, 2007; Williams, Niemiec, Patrick, Ryan, & Deci, 2009). Furthermore, recent research has shown that failure to satisfy basic psychological needs (i.e., need frustration) is associated with depressive symptoms (Chen et al., 2015). However, despite the heuristic appeal of the individual differences in basic psychological needs hypothesis, relatively little research appears to have examined how differences in the strength of basic needs might influence the effects of need satisfaction on well-being. Consequently, a third important question arises:

> *Q3. How do individual differences in the strength of basic psychological needs influence the relationship between need satisfaction and subsequent well-being?*

Recent motive disposition research by Hofer and Busch (2011) has shown support for the moderating effect of individual differences in the strength of implicit motives on the relationship between need satisfaction and domain-specific well-being (i.e., job satisfaction and relationship satisfaction). These findings are in accordance with Schüler and colleagues' research on the effects of individual differences in the strength of implicit motives on motivation. However, self-determination theorists have criticized the motive disposition research on the grounds that it does not directly measure individual differences in the strength of the specific basic psychological needs described in self-determination theory (Chen et al., 2015). Instead, they argue that the motives described in motive disposition theory and the basic needs described in self-determination theory are underpinned by different theoretical concepts and are therefore conceptually incompatible (cf. Chen et al., 2015). Further, Chen et al. (2015) highlight that in motive disposition theory, motives are measured implicitly and tentatively suggest that using implicit motives as an operationalization of need strength may not be the most appropriate way to examine the universality of basic psychological needs. They instead suggest that the most appropriate way to examine the universality hypothesis is to measure individual differences in the strength of basic psychological needs with an explicit assessment of how much people value or desire having their basic needs met (Chen et al., 2015).

As a result of their criticisms of the motive disposition research, Chen et al. (2015) examined explicit need strength as a moderator of the relationship between need satisfaction and general well-being. Need strength was operationalized as the explicit value of "importance*"* that people attached to the satisfaction of each specific need (Chen et al, 2015). Consistent with the universality hypothesis, Chen et al. (2015) found that the relationship between need satisfaction and well-being was not moderated by explicit need importance (i.e., need strength). They concluded that these findings provided support for self-

determination theory's universality of basic needs hypothesis. Specifically, even those who expressed less importance for the satisfaction of autonomy, competence or relatedness, benefitted from having their needs met just as much as those who explicitly expressed a higher value for particular needs.

Although Chen et al. (2015) revealed no evidence for moderation in their analyses, their design and analysis did not allow them truly to test for the effects of individual differences in need importance. This issue is described in more detail below.

Nomothetic versus Idiographic Design and Analysis

As is common in moderated hierarchical regression analyses, Chen et al. (2015) created interaction terms between need satisfaction and need strength by multiplying the two variables together to produce *needs satisfaction* × *importance* interaction terms for each of the three basic needs. A Structural Equation Model was then used to analyze need importance cross products as possible indicators of moderation in the need satisfaction – well-being relationship. In this analysis, individual differences in need importance were operationalized nomothetically (i.e., between individuals); that is to say, the hypothesis tested was: if Need 1 is more important for Person A than for Person B, then the satisfaction of Need 1 will have more beneficial impact for Person A than it will for Person B. However, we believe that such a nomothetic approach misses the central point of individual differences in the importance of basic needs; namely, that such individual differences are idiographic in nature. Specifically, the hypothesis that should be tested is: if Need 1 is more important than Need 2 for Person A, then the satisfaction of Need 1 should have more beneficial impact for Person A than the satisfaction of Need 2. The idiographic versus nomothetic argument with regard to individual differences is, of course, not peculiar to self-determination theory. A similar debate has taken place in the self-esteem literature with regard to the impact of competence in different

domains of self-esteem upon global self-esteem (cf. Hardy & Leone, 2008; Hardy & Moriarty, 2006; Marsh, 1995, 2008; Pelham, 1995).

Despite its strong and robust theoretical rationale (James, 1890), the moderating effect of importance on the impact of domain-specific competence upon global self-esteem had failed to receive any support in the self-esteem literature when conceptualized and analyzed nomothetically (e.g., Marsh, 1986; Marsh & Sonstroem, 1995). However, Pelham and Swann (1989) argued that, in order to demonstrate such a moderating effect for importance, it was necessary to examine the intra-individual (i.e., idiographic) patterning of people's importance ratings. Specifically, a person should be considered to have a high importance rating for a particular self-concept domain if that importance rating was higher than his/her importance scores for other self-concept domains. In other words, importance scores should be based on the relative differences within an individual, rather than relative differences across multiple individuals. Subsequent studies examining the relative importance of importance hypothesis in relation to global self-esteem found support for the moderating effects of importance when using an idiographic approach to operationalize domain-specific importance (Hardy & Moriarty, 2006; Hardy & Leone, 2008; Lindwall, Asci, Palmeira, Fox & Hagger, 2011; Pelham & Swann, 1989).

Overview of the Studies

We aim to address the preceding three research questions over a series of four studies. As in Schüler and Colleagues' motive disposition research, our initial examination of these questions was within the context of sport participation. Specifically, the participants in Study 1 were individuals who were highly committed to their participation in a specific sport activity (rock climbing). Furthermore, in order to address the aforementioned analytical concerns, we assessed the influence of need importance with both a nomothetic (between-person) analytical approach and an idiographic analytical approach (intra-individual) in all

four studies. We hypothesized that when relative need importance is operationalized nomothetically, need importance will not moderate the relationship between need satisfaction (gained via rock-climbing) and self-determined motivation (Hypothesis 1), or between need satisfaction (gained via rock-climbing) and well-being (Hypothesis 2). Conversely, when need importance is operationalized idiographically, satisfaction (gained via rock-climbing) of the intra-individually more important needs will predict a larger proportion of variance in self-determined motivation (e.g., domain specific outcome; Hypothesis 3), and well-being (general outcome; Hypothesis 4) than will the satisfaction of less important needs. As in the self-esteem literature, we termed this hypothesis the "importance of importance" hypothesis.

The aim of Study 2 was to re-examine the research questions in a more general population of recreational sports participants, as opposed to a single specific sport. Then, in Study 3, we aimed to extend our predictions beyond sport to cross-cultural general populations. Importantly, our findings from Studies 1, 2 and 3 suggested that the effects of need importance on *general well-being* were influenced by the extent to which the participants in each study identify themselves by their chosen sport activity. This idea is in line with previous research in social psychology. For example, Iyengar and Lepper (1999) hypothesized that the benefits of need satisfaction depend on whether the needs are satisfied via means that are consistent with the person's sense of identity. Specifically, individuals with a sense of identity that is fundamentally independent benefited more from contexts that provide a sense of personal autonomy (i.e., personal choice), compared with people who had an interdependent sense of identity (i.e., individuals who were more motivated by contexts that satisfy the wishes of their social groups).

The above research highlights the potential significance of self-identity in the relationship between need satisfaction and positive outcomes. Thus, in Study 4, we attempted to clarify our previous findings by directly measuring participants' sense of identity with

regard to engagement in specific activities (e.g., sport, occupation, parenting, etc.). Then, we re-examined our research questions according to varying categories of self-identity (we provide a more detailed discussion of this idea in the Study 4 *Introduction*).

Study 1

Method

Participants

We recruited 377 rock climbers. Participants' abilities ranged from highly competent to professional athlete. Participants took part in rock climbing at least twice per week. Any person who took part in a climbing discipline less than twice per week was deemed less than highly committed to this activity and was removed from the study. The opportunity to win £100 was offered as an incentive to complete an on-line inventory. The final sample comprised 337 participants; (n = 228 men; 109 women; M_{age} = 27.03 years; SD = 8.99).

Measures

Need importance. We designed the need importance inventory to measure the importance that individuals attached to the satisfaction of the three basic psychological needs. The Basic Need Importance Scale consisted of 12 items which were adapted from the Basic Need Satisfaction in General Scale (BNSG-S; Gagné, 2003). The introductory paragraph of the BNSG-S was adapted to instruct participants explicitly to consider the *importance* of each statement (rather than the satisfaction of each statement) in relation to their life. The original BNSG-S comprised 21 items, nine of which are negatively worded. For this study, we used only the 12 positively worded items because the wording of the introductory importance paragraph did not fit well with the wording of the negatively phrased items. These 12 positively worded items measured 3 subscales: (a) autonomy (n_{items} = 4); (b) competence (n_{items} = 3); (c); relatedness (n_{items} = 5). Example items included: for autonomy, "I feel like I am

free to decide for myself how to live my life"; for competence, "most days I feel a sense of accomplishment from what I do"; and for relatedness, "people I interact with on a daily basis tend to take my feelings into consideration". The Likert scale anchors were adapted from how *true* to how *important*, forming a scale ranging from 1 (*not at all important*) to 7 (*very important*). Higher mean scores indicate higher levels of importance.

Need satisfaction. We used the Basic Need Satisfaction at Work Scale (BNS-W; Deci et al., 2001) to measure the extent to which participants felt their basic psychological needs were satisfied by rock-climbing. The BNS-W comprises 21 items and 3 subscales assessing the satisfaction of the need for autonomy ($n_{\text{items}} = 7$), competence ($n_{\text{items}} = 6$), and relatedness ($n_{\text{items}} = 8$). For the present study, we replaced the word *work* with *climbing* in all instances (e.g., "most days I feel a sense of accomplishment from *climbing*"). Participants' responses were measured on a seven-point Likert scale, ranging from 1 (*not at all true*) to 7 (*very true*).

Self-determined motivation. The Sport Motivation Scale (SMS-II: Pelletier, Rocchi, Vallerand, Deci & Ryan, 2013) is an 18-item scale designed to assess participants' level of motivation toward sport within the self-determination theory framework. For the purpose of the current study we replaced the word *sport* with the word *climbing* in all instances (e.g., "because *climbing* reflects the essence of whom I am"). The SMS-II includes the following regulation subscales: (a) amotivation ($n_{\text{items}} = 3$); (b) external motivation ($n_{\text{items}} = 3$); (c); introjected motivation ($n_{\text{items}} = 3$) (d) identified motivation ($n_{\text{items}} = 3$); (e) integrated motivation ($n_{\text{items}} = 3$) and (f) intrinsic motivation ($n_{\text{items}} = 3$). Items are measured on a Likert scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds completely*). Self-determined motivation was calculated using the Relative Autonomy Index (RAI) following the procedure proposed by Vallerand et al. (2008): $\sum$ [(amotivation * (-3)) + (external * (-2)) + (introjected * (-1)) + (identified * (+1)) + (integrated * (+2)) + (intrinsic * (+3))]. We used

this calculation to produce a weighted sum of items. Higher total scores represent greater self-determined motivation. The factor structure of the SMS-II was supported in the original study (Pelletier et al., 2013).

Well-being. We used Rosenberg's (1965) 10-item General Self-esteem (RSE) inventory as an indicator of participants' well-being. Participants responded to statements (e.g., "I have certainly felt useless at times") on a Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The 5 negatively worded items were reverse scored so that higher total scores reflected higher levels of self-esteem. This inventory has been widely used as an indicator of well-being in the self–determination theory literature (e.g., Hein & Hagger, 2007; Chen et al., 2015).

Procedure

We combined all inventories into a single omnibus survey administered using Qualtrics (2011) online survey software. We invited participants to take part in the study via advertisements posted in climbing specific groups on social media websites, online climbing forums, and on websites hosted by major climbing brands. On the first page of the questionnaire, participants indicated full informed consent and then completed demographic questions regarding their climbing history. These questions included the level of participation from 1 (*beginner*) to 14 (*professional athlete*), and frequency with which they took part from 1 (*once per week*) to 5 (*five times per week*). Participants then completed the following sequence of questionnaires: the need importance scale (in general life), the adapted BNS-W (i.e., satisfaction of basic needs within climbing), the adapted SMS-II scale (i.e., self-determined motivation for participation in climbing) and the RSE scale (general self-esteem). We instructed participants to think about their *participation in climbing* before responding to questions on the BNS-W and SMS-II scales, then instructed participants to think about their *life in general* when responding to questions about their self-esteem.

Analyses

We tested the factor structure of the need importance questionnaire using Bayesian structural equation modelling (BSEM; cf. Asparouhov, Muthén & Morin, 2015). The first phase of the analysis examined the factorial validity of the basic psychological need importance scale developed specifically for the study (using a BSEM approach). The second phase examined Hypothesis 1 (nomothetic; self-determined motivation), Hypothesis 2 (nomothetic; well-being), Hypothesis 3 (idiographic; self-determined motivation) and Hypothesis 4 (idiographic; well-being).

Factorial Validation of the Need Importance Measure

Model-testing strategy. To assess the factorial validity of the 12-item basic need importance scale a series of three Bayesian structural equation models were estimated (BSEM; Muthén & Asparouhov, 2012). The estimation of the first model incorporated non-informative priors for the major loadings, exact zero cross-loadings and exact zero residual correlations. The estimation of the second model incorporated the addition of informative approximate zero cross-loadings. The estimation of the final model incorporated the addition of both informative approximate zero cross-loadings and residual correlations. The present study specified small prior variances for cross loadings with a mean of zero and a variance of 0.01, corresponding to 95% small cross-loading bounds of ± .02 (Muthén & Asparouhov, 2012). For the correlated residuals we specified an inverse-Wishart prior distribution *IW* (0, *df*) with *df* = p + 6 (where p = number of items), which corresponds to prior zero-means and variances of 0.01 (MacKinnon, 2008).

All BSEM models were estimated with Markov Chain Monte Carlo (MCMC) simulation procedure with a Gibbs sampler and a fixed number of 100,000 iterations for two MCMC chains. This allowed for the examination of model convergence. Model convergence was assessed by the potential scale reduction factor (PSR), where evidence for convergence is

shown when the PSR value lies between 1.0 and 1.1 for all parameters (Gelman, Carlin, Stern & Rubin, 2004). In addition, a visual inspection of trace plots was performed for each parameter to check that the parameter values in each MCMC chain mixed well (i.e., converged to a similar target distribution; van de Schoot & Depaoli, 2014). Next, a sensitivity analysis was employed because the specification of different prior variances may influence the posterior predictive *p* value (PP*p*) and increase the variability of the estimates (Muthén & Asparouhov, 2012). Consequently, the present research compared parameter estimates in the final model, with variance priors specified at .015, .01, and .005 for the cross-loadings to check for any important discrepancies.

Model-data fit was assessed according to the PP*p* value where a good-fitting model is indicated when values are around .50, whereas values of $p < 0.05$ indicate an unacceptable model-data fit (Muthén & Asparouhov, 2012). Finally, model-data fit was also assessed with the symmetric 95% confidence interval for the difference of the observed and replicated $\chi 2$ values. A good fitting model is indicated when the values encompass zero (Muthén & Asparouhov, 2012).

Hypothesis-testing strategy. For this section of analyses we used manifest variables. For each BSEM a non-informative or "diffuse" prior distribution was used in estimation. That is, no specifications were made for the prior point estimates or the distribution of the parameters in question, because we had no prior knowledge available from previous research to set specific prior distributions (cf. Kruschke, 2013). To check model convergence a fixed number of 50,000 iterations for two MCMC chains was specified and the PSR values inspected. In addition, visual examination of the trace plots for each parameter was performed.

The data were analyzed using two different analytical procedures. First, the data were analyzed from a nomothetic (between-person) approach. Need importance and satisfaction

scores were standardized, and a cross product term was created by multiplying need satisfaction with importance scores. Three separate BSEM models (i.e., one model for each basic need) for each criterion variable estimated the effects of need importance as a moderator in the relationship between need satisfaction and self-determined motivation and well-being. For each model we report the unstandardized estimates (cf. Jaccard, Turrisi & Wan, 1990; Friedrich, 1982).

Second, the data were analyzed from an intra-individual (within-person) difference approach with the analytical procedure used in the self-esteem literature (Hardy & Moriarty, 2006). Specifically, to test the effects of within-person differential importance of the three basic psychological needs, the basic need satisfaction scores for the most important, the second most important and the least important needs were identified for each participant. Then, separate BSEM models for each criterion variable estimated the satisfaction scores of the most, second most and least important needs as predictors of self-determined motivation, and well-being (measured by self-esteem).

Results

Factorial Validity

The 12-item model with exact zero cross-loadings and exact zero residual correlations, and the 12-item model with informative small variance priors on the cross-loadings achieved adequate convergence. PSR values reached the convergence criterion in the first 1000 and 40,000 iterations respectively, and visual inspection of the trace plots showed additional support for convergence. (i.e., all plots showed a stable convergence across iterations for the two chains). However, the model with non-informative priors indicated unsatisfactory fit to the data with a PP*p* smaller than .05. Next, the model with informative small variance priors on the cross-loadings indicated unsatisfactory fit to the data with a PP*p* smaller than .05. Inspection of the standardized factor loadings revealed that the competence item “people I

know tell me I am good at what I do" had a non-significant factor loading (<.15), this item was subsequently removed from the model. Further examination of this model revealed that the autonomy item "people I interact with on a daily basis tend to take my feelings into consideration" had a factor loading smaller than .30 and wanted to significantly cross-load onto relatedness beyond it's a priori limit. The authors deemed the item content to be ambiguous and subsequently removed that item from the model. This process left a 10-item scale with three subscales: autonomy (n_{items} = 3); competence (n_{items} = 2); and relatedness (n_{items} = 5).

We re-ran the three step BSEM procedure on the new 10-item scale (See Table 1, for the 12 & 10 item model PP*p* and CIs). All major loadings were significant and acceptable (see Table 2). Sensitivity analyses revealed no important discrepancies between parameter estimates when specifying prior variances for cross-loadings at .005, .01 and .015. Composite reliability coefficients (Fornell & Larcker, 1981) for the three subscales were: autonomy, .89; competence, .86; and relatedness, .92.

Table 1

BSEM fit statistics for the basic need importance scale (Study 1).

Model	PP*p*	Lower 2.5%	Upper 2.5%
12-item Non-Informative	.000	85.299	149.570
12-item Non-Informative	.000	40.288	115.345
10-item Non-Informative	.000	22.179	77.632
10-item Informative Priors (cross-loadings)	.059	-6.246	53.777
10-item Informative priors (cross-loadings + residual correlations)	.516	-32.961	31.059

Note. PP*p* = posterior predictive *p* value

Descriptive statistics

The means, standard deviations and bivariate correlations are shown in Table 3. Satisfaction of autonomy, competence and relatedness were significantly and positively

correlated with self-determined motivation and self-esteem. Satisfaction scores of the most important, second most important, and least important basic needs were also significantly and positively related to self-determined motivation and self-esteem. The effects of participants' age and sex on self-determined motivation and self-esteem were examined using two MANOVA's. This revealed no significant multivariate effects of gender; Wilks' Lambda F (2, 297) = .98, p = .06, or age on the criterion variables; Wilks' Lambda F (6, 590) = .98, p = .13. Consequently, the data were collapsed across age and gender for the remaining analyses.

Self-Determined Motivation

Nomothetic need importance analysis. Adequate convergence was achieved for all BSEM models: PSR values reached the convergence criterion in the first 1000 iterations and visual inspection of the trace plots showed a stable convergence across iterations for the two chains. Symmetric 95% posterior predictive confidence intervals and PPp values indicated excellent fit for both self-esteem and self-determined motivation (*autonomy* = 95%[2] CI = [-9.29, 9.33], PPp= .50 *competence* = CI = [-9.09, 9.10], PPp = .50; *relatedness* = CI = [-9.08, 9.33], PPp = .50). Satisfaction of all three basic psychological needs significantly predicted self-determined motivation (RAI; *autonomy;* R^2 =.16, p = <.001; b = 8.54, p = <.001; CI = [6.10, 11.02]; *competence;* R^2 =.11, p = <.001; b = 4.21, p = <.001; CI = [1.79, 6.66]; *relatedness;* R^2 =.24, p = <.001; b = 11.09, p = <.001; CI = [8.86, 13.35]). However, there were no significant interactions between the satisfaction and importance of autonomy, competence or relatedness on self-determined motivation (autonomy; b = -.24, p = .39; CI = [-2.24, 1.81]; *competence*; b = -.35, p = .39; CI = [-2.10, 2.76]; *relatedness*; b = -1.37, p = .11; CI = [-3.63, .87]).

[2] 95% credibility intervals were used throughout this research.

Table 2

Standardized factor loadings and 95% credibility intervals for the need importance scale (Study 1).

Item	Competence	Autonomy	Relatedness
It is important to me…			
to learn interesting new skills	**.75 [.21,.99]**	.01 [-.19,.19]	.01 [-.19,.19]
to feel a sense of accomplishment in what I do	**.79 [.57,1.02]**	.02 [-.18,.20]	-.00 [-.18,.18]
		.00 -[.19,.19]	-.01 [-.19,.16]
			.01 [-.18,.20]
			.01 [-.17,.20]
to feel like I am free to decide for myself how to live my life	-.01 [-.21,.18]	**.68 [.24,.96]**	.01 [-.19,.19]
to feel free to express my ideas and opinions	.02 [-.18,.21]	**.72 [.35,.97]**	-.03 [-.23,.15]
to feel like I can pretty much be myself in my daily situations		**.66 [.20,.93]**	-.02 [-.20,.17]
			.02 [-.18,.20]
			.04 [-.14,.22]
to really like the people I interact with	.00 [-.18,.20]	-.03 [-.23,.15]	**.69 [.23,.88]**
to get along with the people I come into contact with	.00 [-.19,.19]	-.01 [-.20,.17]	**.71 [.41,.92]**
that the people I regularly interact with are my friends		.06 [-.14,.24]	**.68 [.34,.91]**
that people in my life care about me			**.58 [.16,.89]**
that people are generally pretty friendly towards me			**.61 [.27,.87]**

Note. Factor loadings and 95% credibility intervals in bold correspond to the items in each row.

Table 3

Means (M), standard deviations (SD), and bivariate correlations between all study variables (Study 1, n = 300)

	Mean	SD	1	2	3	4	5	6	7	8
Satisfaction										
1. Autonomy	5.50	.67	-							
2. Competence	5.76	.69	0.30**	-						
3. Relatedness	5.35	.79	0.63**	0.34**	-					
Satisfaction scores of the:										
4. Most important need	5.50	.74	0.74**	0.39**	0.74**	-				
5. Second most important need	5.47	.74	0.56**	0.53**	0.69**	0.43**	-			
6. Least important need	5.65	.73	0.57**	0.67**	0.54**	0.41**	0.32**	-		
Well-Being/ Motivation										
7. Self esteem	30.56	5.26	0.29**	0.18**	0.31**	0.28**	0.27**	0.22**	-	
8. Self-determined motivation	51.44	22.32	0.39**	0.20**	0.49**	0.45**	0.41**	0.22**	0.17**	-

Note. **p < 0.01; *p < 0.05.

Idiographic need importance analysis. First, each participant's mean importance score was computed for each basic psychological need; 300 participants from a total of 337 reported within-person differences in the importance of all three basic psychological needs. Participants who failed to record three different need importance scores were removed from the analysis[3]. At first sight, the reader might perceive a bias in terms of the participants whose data were analyzed. We do not dispute that for some people, the need for autonomy, competence and relatedness will be of equal importance. However, we contend that for the purpose of the current research, this is not the question of interest; instead, our interest is in the effects of individual differences in need importance on psychological outcomes in people who do report such differences (89% of the present sample).

Next, we examined model convergence. Both models achieved adequate convergence: PSR values reached the convergence criterion in the first 1000 iterations and visual inspection of the trace plots showed a stable convergence across iterations for the two chains. Symmetric 95% posterior predictive confidence intervals and PP*p* values indicated excellent model fit for self-determined motivation and well-being and the CIs = [-9.22, 9.47], PP*p* = .496). Satisfaction of the most and second most important needs significantly predicted variance in self-determined motivation (R^2 = .26 *p* = <.001; *bs* = 10.05 and 8.18, respectively, *ps* = <.001, CIs = [6.66, 13.52] and [4.85, 11.52]). However, satisfaction of the least important need did not predict self-determined motivation (*b* = -.30, *p* = .44; CI = [-3.64, 3.09]). Furthermore, the beta coefficients decreased in order of importance (i.e., from most important need to least important need). We performed a 'Wald Chi Square' test, to test the equality of beta coefficients for satisfaction of the most and second most important needs. Results showed no significant difference between beta coefficients (*b* = 1.90, *p* = >.05).

[3] We used the same sample for the nomothetic and idiographic analyses for each study.

Well-Being

Nomothetic need importance analysis. Satisfaction of all three basic psychological needs significantly predicted self-esteem: *autonomy*, R^2 =.10, p = <.001; b = 1.36, p = <.001; CI = [.72, 1.96]; *competence*, R^2 =.07, p = <.001; b = .83, p = .003; CI = [.30, 1.49]; *relatedness*, R^2 =.10, p = <.001; b = 1.68, p = <.001; CI = [1.10, 2.26]. There were no significant interactions between the satisfaction and importance of autonomy, competence or relatedness on self-esteem: *autonomy*, b = .01, p = .487; C.I = [-.51, .52]; *competence*, b = -.193, p = .252; CI = [-.78, .39]; *relatedness*, b = -.28, p = .165; C.I = [-.87, .29].

Idiographic need importance analysis. Satisfaction of the most and second most important needs significantly predicted variance in self-esteem (R^2 = .12 p = <.001; bs = 1.23 and 1.14, ps = .003 and .005, CIs = [.34, 2.13] and [.28, 2.01], respectively). Satisfaction of the least important need did not predict self-esteem (b = .70, p = .06; CI = [-.17, 1.57]). The beta coefficients again decreased in order of importance (i.e., from most important need to least important need). Wald Chi Square test revealed no significant difference between beta coefficients for satisfaction of the most and second most important needs (b = .10, p = > .05).

Discussion

Study 1 provided support for the factor structure of the 10-item basic need importance inventory although the small number of items used to indicate the importance of competence factor is clearly a limitation. The main aim of Study 1 was to examine the interactive effects of individual differences in basic psychological need importance and need satisfaction upon self-determined motivation and self-esteem. Consistent with the research by Chen et al. (2015), when the data were considered nomothetically, need importance did not moderate the relationship between need satisfaction and self-determined motivation, or between need satisfaction and self-esteem. Conversely, as hypothesized, when the data were considered and analyzed idiographically, a moderator effect for need importance emerged. Specifically, satisfaction of the most important and second most important needs significantly predicted variance in self-determined motivation and self-esteem, but satisfaction of the least important need did not. Furthermore, the beta coefficient associated with the most important psychological need was higher than the beta coefficient associated with the second most important psychological need, and the beta coefficient associated with the second most important need was higher than the beta coefficient associated with the least important need. These findings support the importance of importance hypothesis from an intra-individual perspective and suggest that the effects of basic need satisfaction on both motivation and well-being are dependent on the importance attached to the fulfilment of a specific need.

Study 2

The aim of Study 2 was threefold. The first aim was to increase the number of competence items in the basic need importance inventory used in Study 1. The second was to re-examine Hypothesis 1 and 2 (nomothetic operationalization of need importance) in a broader population of individuals who participated in a number of different sports. The third

and main interest of this study was to re-examine Hypothesis 3 and 4, that satisfaction (gained via sport) of more important needs would predict a larger proportion of variance in a self-determined motivation and general-well-being than the less important needs.

Method

Participants

Participants were 417 individuals who took part in a wide range of individual and team sports (e.g., football, kayaking, running, basketball, skiing, netball, canoe polo) at a recreational and club level. The opportunity to win £100 was offered as an incentive to complete the online survey. The final sample comprised 323 participants (*n* = 205 men; 118 women; M_{age} = 27.78 years; *SD* = 10.48).

Measures

Need importance. To measure need importance we used the 10-item Basic Need Importance Scale in Study 1, with the addition of three more competence items from the BNSG-S (Gagné, 2003). These items were negatively worded in their original format but for the purpose of the present study, we adapted them into positively worded items (e.g., "In my life I get chances to show how capable I am"). We added these items to address the concern over the small number of competence items in Study 1.

Need satisfaction. We administered the 20-item Basic Needs Satisfaction in Sport Scale (BNSSS: Ng, Lonsdale & Hodge, 2011) to assess the satisfaction of each basic psychological need in the sport context (e.g., "I can overcome challenges in my sport"). Importantly, participants were asked to focus on *one particular sport* when responding to statements about their need satisfaction in sport. This inventory was used because it has been widely used within the sport domain (e.g., Mahoney, Ntoumanis, Gucciardi, Mallett & Stebbings, 2015; Jowett, Hill, Hall & Curran; 2016) and required no further adaptations to fit

the context of the present study. The scale also has good factorial integrity (Ng et al., 2011). Items are measured on Likert Scale ranging from 1 (*not at all true*) to 7 (*very true*).

Self-determined motivation. We used the SMS-II to measure participants' motivation toward sport. As with the need satisfaction scale, participants were asked to focus on *a single sport* when responding to statements about their motivation for sport.

Well-being. We again used Rosenberg's (1965) general self-esteem scale.

Procedure

The procedure for this study was the same as in Study 1, with two alterations: (a) the use of the BNSSS to measure need satisfaction and (b) a demographic section tailored to assess the participants' general sports history and experience. Participants were instructed to select a single sport for consideration when answering questions related to sports participation. Demographic questions asked participants to indicate their level of participation in this sport ranging from 1 (*beginner*) to 5 (*professional athlete*), and the frequency with which they took part ranging from 1 (*less than once per month*) to 11 (*7 days per week).* Participants were instructed to think about their "general life" before responding to questions about need importance and self-esteem, and to think about their *chosen sport* before responding to questions about need satisfaction and self-determined motivation.

Analyses

As in Study 1, the first phase of the analysis examined the factorial validity of the basic psychological need importance scale. The second phase of the analysis examined Hypotheses 1, 2, 3 and 4.

Hypothesis Testing Strategy

Given the two hierarchical levels (the individual and the sport), we analyzed the data using multi-level BSEM. In the current study the individual level (i.e. Level 1) was of primary interest. Consequently, all data were group mean centered (Enders & Tofighi, 2007).

For hypothesis testing, the data were analyzed using the two analytical procedures described in Study 1. That is, the data were first analyzed from a nomothetic (between-person differences) approach. Specifically, three BSEM models (i.e., one model for each basic need) for each criterion variable, tested Hypothesis 1 and 2. Second, the data were analyzed from an intra-individual (within-person differences) approach. Specifically, one BSEM model for each criterion variable tested Hypothesis 3 and 4.

Results

Factorial Validation of the Need Importance Measure

First, factorial validity of the 13-item need importance scale was assessed (i.e., the 10 items used in Study 1 and the 3 additional competence items). The only item that did not compromise model convergence was competence item 1 "in my life, I get chances to show how capable I am". This resulted in an 11-item need importance scale (see Table 4 for PP*p* and CIs): autonomy (n_{items} = 3); competence (n_{items} = 3); and relatedness (n_{items} = 5). All major loadings were significant and acceptable (see Table 5). Composite reliability coefficients were: autonomy, .89; competence, .88; and relatedness, .93.

Table 4

BSEM fit statistics for the basic need importance scale (Study 2).

Model	PP*p*	Lower 2.5%	Upper 2.5%
11-item Non-Informative	.001	20.493	76.347
11-iem Informative Priors (cross-loadings)	.001	20.544	74.272
11-item Informative priors (cross-loadings + residual correlations)	.510	-35.771	34.558

Note. PP*p* = posterior predictive p value

Table 5

Standardized factor loadings and 95% credibility intervals for the basic need importance scale (Study 2).

Item	Competence	Autonomy	Relatedness
It is important to me…			
to be able to learn interesting new skills	**.61[.13,.91]**	-.01 [-.21,.18]	-.02 [-.21,.15]
that most days I feel a sense of accomplishment in what I do	**.74 [.39,1.00]**	.02 [-.19,.21]	.03 [-.15,.21]
that in my life, I get chances to show how capable I am	**.72 [.36,.98]**	.02 [-.18,.21]	-.01 [-.20,.17]
			.04 [-.15,.22]
			.00 [-.19,.18]
that I feel like I am free to decide for myself how to live my life	.02 [-.18,.21]	**.68 [.24,.94]**	-.00 [-.19,.18]
that I generally feel free to express my ideas and opinions	-.01 [-.21,.18]	**.72 [.30,.99]**	-.02 [-.20,.17]
that I feel like I can pretty much be myself in my daily situations	.02 [-.18,.21]	**.72 [.34,1.01]**	.02 [-.17,.21]
			.02 [-.17,.21]
			.00 [-.19,.20]
that I really like the people I interact with	.00 [-.19,.19]	-.01 [-.20,.17]	**.67 [.32,.92]**
that I get along with the people I come into contact with	.02 [-.17,.20]	.01 [-.18,.19]	**.70 [.40,.94]**
that I consider the people I regularly interact are my friends	.00[-.19,.18]	.03 [-.17,.21]	**.64[.32,.88]**
that people in my life care about me			**.60 [.33,.87]**
that people are generally pretty friendly towards me			**.65 [.34,.92]**

Note. Factor loadings and 95% credibility intervals in bold correspond to the items in each row.

Descriptive Statistics

Means, standard deviations and bivariate correlations are in Table 6. Satisfaction of autonomy, competence and relatedness were significantly and positively correlated with self-determined motivation and self-esteem. Furthermore, satisfaction of the most important, second most important and least important basic needs were significantly and positively related to self-determined motivation and self-esteem. The effects of participants' demographic variables (i.e., age and gender) were examined on satisfaction, self-determined motivation and self-esteem. Age was categorized into blocks of 10 years from age 18 to 70 years. Two MANOVA's indicated a multivariate effect of gender, Wilks' Lambda F (2, 320) = 6.54, p = .002, but not for age Wilks' Lambda F (8, 634) = .98, p = .70. Consequently, gender was controlled in all subsequent analyses.

Self-Determined Motivation

Nomothetic need importance analysis. Satisfaction of all three basic psychological needs significantly predicted self-determined motivation: *autonomy;* R^2 = .26, p = <.001; b = 10.29, p = <.001; CI = [7.62, 12.94]; *competence,* R^2 =.25, p = <.001; b = 10.67, p = <.001; CI = [8.02, 13.34]; *relatedness*, R^2 =.10, p = <.001; b = 5.76, p = <.001; CI = [2.91, 8.62]. There were no significant interactions between the satisfaction and importance of autonomy, competence or relatedness on self-determined motivation: *autonomy, b* = -.28, p = .392; CI = [-2.27, 1.73]; *competence, b* = -.34, p = .381; CI = [-2.56, 1.89]; *relatedness, b* = 1.90, p = .062; CI = [-.52, 4.31].

Idiographic need importance analysis. In the idiographic need importance analysis we included 323 participants from a total of 417 who reported within person differences in the importance of all three basic psychological needs. Satisfaction of the most and second most important needs significantly predicted variance in self-determined motivation (R^2 =.25 p = <.001; *bs* = .31 and .20, respectively, both *ps* = <.001; CIs = [.21, .20] and [.09, .30]);

satisfaction of the least important need did not (*b* = .09, *p* = .04; CI = [-.02, .20]). Beta coefficients decreased in order of importance (i.e. most to least).

Well-Being

Nomothetic need importance analysis. Satisfaction of autonomy and competence significantly predicted self-esteem: (*autonomy;* R^2 =.10, *p* = <.001; *b* = .69, *p* = .024; CI = [.00, 1.39]; *competence;* R^2 =.16, *p* = <.001; *b* = 2.25, *p* = <.001; CI = [1.59, 2.91]), but satisfaction of relatedness did not (*relatedness;* R^2 =.04, *p* = <.001; *b* = .43, *p* = .108; CI = [-.25, 1.13]). There were no significant interactions between the satisfaction and importance of autonomy, competence or relatedness on self-esteem; (autonomy; *b* = -.10, *p* = .367; CI = [-.61, .43]; *competence*; *b* = -.45, *p* = .052; CI = [-.10, 1.00]; *relatedness*; *b* = .129, *p* = .333; CI = [-.46, .72]).

Idiographic need importance analysis. Satisfaction of the second most important need significantly predicted variance in self-esteem (R^2 = .10 *p* = <.001; *b* = .220; *p* = <.001; CI = [.10, .33]), but satisfaction of the most and least important needs did not (*bs* = .04 and .07; *ps* = .24 and .13; CIs = [-.08, .16] and [-.05, .18], respectively).

Table 6

Means (M), standard deviations (SD), and correlations between all study variables (Study 2, n = 323)

	Mean	SD	1	2	3	4	5	6	7	8
Satisfaction										
1. Autonomy	5.45	.79								
2. Competence	5.39	.99	0.55**							
3. Relatedness	5.28	1.12	0.39**	0.34**						
Satisfaction scores of the:										
4. Most important need	5.47	.93	0.56**	0.56**	0.63**					
5. Second most important need	5.38	.99	0.69**	0.65**	0.60**	0.43**				
6. Least important need	5.26	1.08	0.68**	0.67**	0.67**	0.43**	0.42**			
Well-Being/ Motivation										
7. Self Esteem	31.28	5.46	0.41**	0.41**	0.10**	0.19**	0.29*	0.22**		
8. Self-determined motivation	49.93	23.61	0.49**	0.46**	0.30**	0.45**	0.40**	0.36**	0.40*	-

Note. **p < 0.01; *p < 0.05

Discussion

The first aim of the current study was to increase the rather small number of competence items in the basic need importance inventory used in Study 1. Bayesian confirmatory factor analysis, allowing small variance priors on the cross-loadings and residual correlations, produced an excellent model-data fit for an 11-item need importance scale. The second aim of Study 2 was to examine the interactive effects of basic need importance and satisfaction upon self-determined motivation and self-esteem within a wider population of individuals who participate in an array of sports. Results from the nomothetic analysis again showed that basic psychological need importance did not moderate the relationship between need satisfaction and self-determined motivation, or well-being, as hypothesized. Next, the data were analyzed using an intra-individual (within-person differences) analytical approach. Study 2 replicated the findings of Study 1 with regard to domain specific outcomes. As hypothesized, satisfaction of the more important needs significantly predicted variance in self-determined motivation, and satisfaction of the least important need did not. Furthermore, the magnitude of the beta coefficients reflected the importance of the needs that they represented; that is, they were ordered from most important to least important.

Nonetheless, when analyzing the effects of the satisfaction of the most, second most, and least important needs on self-esteem, the results revealed what appear to be rather random effects. One potential explanation for the consistent findings with self-determined motivation, but apparently more random findings with self-esteem, resides in the extent to which the participants in each study identify themselves by their chosen sport. The participants in Study 1 were considered to be individuals who were highly committed to rock-climbing. As such, their participation in this activity was likely to be highly related to their

sense of identity. Consequently, need satisfaction (through their climbing) would be expected to serve as a significant contributor to the overall well-being of these individuals (cf. Hardy & Moriarty, 2006). In contrast, participants in the current study took part in a wide array of sports up to an intermediate level; in other words, these participants were far less committed to their chosen sport and their self-identity was likely less invested in that sport. Furthermore, the multidimensional nature of self-concept (Shavelson, Hubner & Stanton, 1976; Pelham & Swann, 1989; Hardy & Moriarty, 2006) offers many life domains in which one can fulfil one's basic psychological needs. Consequently, if engagement in a particular activity (sport) does not satisfy one's most important psychological needs, then one has every opportunity to compensate for this by engaging in other activities. This issue is addressed and clarified after Study 3.

Study 3

The participants in Study 3 were drawn from a wider population of individuals across two different cultures (Britain and Asia). Consequently, we used the need importance scale that had previously been used in the cross-cultural research by Chen et al. (2015). However, the psychometric properties of this scale had not then been tested. Consequently, a preliminary aim of the current study was to examine the factorial validity of Chen et al's. (2015) basic psychological need importance scale. The main aim Study 3 was to extend Study 1 and 2 by examining how need satisfaction in general life might influence general well-being, rather than how need satisfaction gained through engagement in specific activities might influence general well-being and motivation toward that activity. Participants completed Study 3 under the instruction to respond to questions in relation to their "general life". In other words their responses regarding the satisfaction of their basic psychological needs were based upon many domains of their life and many aspects of their self-identity.

Method

Participants

Participants were 442 individuals recruited from the general population in Britain and Singapore. All participants were fluent English speakers. As in the previous two studies, we used online data collection and we offered the opportunity to win £100 as an incentive to complete the online inventory. The total sample comprised *n* = 394 individuals (194 men; 200 women; M_{age} = 32.7 years; *SD* = 12.53). Participants from Britain were *n* = 223 individuals (123 men; 100 women; M_{age} = 32.01 years; *SD* = 11.54). Participants from Singapore were *n* = 171 individuals (71 men; 100 women; M_{age} = 33.58 years; *SD* = 13.71).

Measures

Need importance. To measure need importance, we used the English version of the need importance scale developed by self-determination theorists to assess basic need importance across different cultures (Sheldon & Gunz, 2009; Chen et al., 2015). This scale was chosen specifically for Study 3 because of its previous use in cross-cultural research (cf. Chen et al., 2015). The scale comprises 12 items across 3 subscales: (a) autonomy (n_{items} = 4); (b) competence (n_{items} = 4); (c); relatedness (n_{items} = 4). Respondents rated how important it is to satisfy each of the basic needs on a Likert scale ranging from 1 (*not important at all*) to 5 (*very important to me*). Example items include: how important is it for you to feel: "…that your choices express who you really are" (autonomy); "…confident that you can do things well" (competence); "…close and connected with other people who are important to you" (relatedness).

Basic need satisfaction. The Basic Need Satisfaction in General Scale (BNSG-S; Gagné, 2003) was used to measure the satisfaction of each basic psychological need. This inventory comprises 12 positively worded items, 9 negatively worded items and 3 subscales:

(a) autonomy (n_{items} = 7); (b) competence (n_{items} = 6); (c); relatedness (n_{items} = 8). Items are measured on a Likert scale ranging from 1 (*not at all true*) to 7 (*very true*).

Well-being. As in the previous studies, we used Rosenberg's (1965) scale.

Depression. Depressive symptoms were measured with the 10-item version of the Centre for Epidemiological Studies-Depression (CES-D) scale (Radloff, 1977). Participants were instructed to consider each item in relation to feelings over the past week. Example items include "my sleep was restless" and "I felt fearful". Items were rated on a scale ranging from 1 (*rarely or none of the time)* to 4 (*most or all of the time*).

Procedure

We invited people to take part in the research via email, advertisements within groups on social media websites and a wide array of online forums. On the first page of the online questionnaire, participants indicated full informed consent and then completed demographic questions. Demographic questions asked participants to indicate their country of residence (i.e., Britain or Singapore), nationality (i.e., British or Asian), age and gender. Before responding to each questionnaire in the survey, participants were instructed to think about their *general life*.

Analyses

The preliminary analysis examined the factorial validity of Chen et al.'s (2015) basic psychological need importance scale. The main analysis examined Hypothesis 1 (nomothetic; well-being) and 2 (idiographic; well-being) using the two analytical procedures described in Studies 1 and 2.

Hypothesis-Testing Strategy

Unlike in the previous studies, we measured depression as an additional indicator of participants' well-being. This was in order to replicate Chen et al.'s (2015) approach in which they created a "well-being" latent variable from the combination of self-esteem and

depression. Further, the data from both cultures were analyzed together using culture as a covariate because the effects of cultural differences were not a question of interest for this particular study. We simply wanted to control for them.

Results

Factorial Validation of the Need Importance Measure

The model with informative small variance priors on cross-loadings and residual correlations indicated excellent fit (see Table 7, for model PP*p* and CIs). All major loadings were significant and acceptable (see Table 8). Composite reliability coefficients were: autonomy, .92; competence, .94; and relatedness, .95.

Table 7

BSEM fit statistics for the 12-item basic need importance scale (Study 3).

Model	PP*p*	Lower 2.5%	Upper 2.5%
Non-Informative	.000	96.364	160.390
Informative Priors (cross-loadings)	.000	40.020	115.129
Informative priors (cross-loadings + residual correlations)	.518	-37.65	37.22

Note. PP*p* = posterior predictive p value

Table 8

Standardized factor loadings and 95% credibility intervals for the 12-item basic need importance scale (Study 3).

Item	Competence	Autonomy	Relatedness
How important is it for you to feel…?			
you are capable at what you do	**.74 [.49,.98]**	-.01 [-.20,.19]	-.02 [-.21,.16]
confident that you can do things well	**.67[.40,.95]**	.01 [-.19,.20]	.01 [-.17,.18]
competent that you can achieve your goals	**.80 [.53,1.03]**	.03 [-.18,.22]	-.00 [-.18,.17]
that you can do well at hard things	**.69 [.39,.96]**	-.00 [-.20,.19]	.03 [-.15,.21]
a sense of choice and freedom in the things you undertake	.02 [-.18,.21]	**.65 [.33,.94]**	.01 [-.18,.17]
that your decisions reflect what you really want	-.01 [-.20,.18]	**.76 [.45,1.00]**	.02 [-.15,.19]
that your choices express who you really are	.01 [-.18,.19]	**.70 [.38,.98]**	-.02[-.20,.14]
that you have been doing what really interests you	.00 [-.19,.19]	**.67 [.34,.96]**	.02 [-.17,.20]
that the person you care also care about you	.04 [-.15,.22]	.01 [-.17,.19]	**.70 [.42,.95]**
a strong sense of connection with people who care for you, and whom you care for	.03 [-.15,.21]	-.03 [-.21,.16]	**.77 [.54,.98]**
close and connected with other people who are important to you	-.02 [-.19,.15]	-03 [-.16,.20]	**.82 [.61,1.02]**
a sense of warm feeling with the people you spend time with	-.03 [-.21,.15]	.01 [-.18,.19]	**.75 [.52,.97]**

Note. Factor loadings and 95% credibility intervals in bold correspond to the items in each row.

Descriptive Statistics

Satisfaction of autonomy, competence and relatedness were significantly and positively correlated with all well-being measures (i.e., self-esteem, life satisfaction and subjective vitality), and significantly and negatively correlated with depression (see Table 9). Satisfaction of the most important and least important basic needs were also significantly and positively correlated with all well-being measures and significantly and negatively correlated with depression. It is important to note that for the current study only the most important and least important needs were examined as predictors of well-being. This was because only 200 participants from a total of 442 reported within-person differences in the importance of all three basic psychological needs. This points to the possibility of some sensitivity issues with the basic need importance scale used in this study, which we discuss later. However, 394 participants from a total of 442 (89%) reported two or more different importance ratings for the basic psychological needs. Therefore, we used only the highest and lowest rated needs – how we did this is explained below.

The effect of participants' background variables (i.e., age, gender and culture) were examined on all variables. Three MANOVA's indicated that there were no significant multivariate effects of age (Wilks' Lambda F (6, 708) = .99, p = .48) or culture (Wilks' Lambda F (2, 391) = .99, p = .31) on well-being/depression variables. However, there was a significant multivariate effect for gender; Wilks' Lambda F (2, 391) = 5.45, p = .005. In light of these findings, gender was controlled for when examining the need satisfaction variables as predictors of self-esteem.

Well-Being

Nomothetic need importance analysis. Satisfaction of autonomy, competence and relatedness significantly predicted well-being: (*autonomy;* R^2 =.52, p = <.001; b = 3.32, p = <.001; CI = [2.86, 3.78]; *competence;* R^2 =.59, p = <.001; b =3.87, p = <.001; CI = [3.46,

4.29]; *relatedness;* R^2 =.33, p = <.001; b = 2.71, p = <.001; CI = [2.13, 3.19]). However, there were no significant interactions between the satisfaction and importance of autonomy, competence and relatedness on well-being (*bs* = -.00, -.15, and -.07; *ps* = .491, .189, .370; CIs = [-.31, .30], [-.50, .19], and [-.46, .32] respectively).

Idiographic need importance analysis. We computed the mean intra-individual importance score for each basic need. For participants who reported one basic need as more important and two basic needs as less important, one of the less important needs was randomly assigned as the least important need, and vice versa. Satisfaction of the most and least important needs both significantly predicted variance in well-being (R^2 =.60 p = <.001; *bs* = 2.20 and 2.90; *ps* = <.001; CIs = [1.44, 2.93] and [2.11, 3.70] respectively). Wald Chi Square test revealed no significant difference between beta coefficients for satisfaction of the most and second most important needs (b = -.73, p = > .05).

Table 9

Means (M), standard deviations (SD), and bivariate correlations between all variables (Study 3, n = 394).

	Mean	SD	1	2	3	4	5	6	7
Satisfaction									
1. Autonomy	4.81	.85							
2. Competence	4.72	.93	.65**						
3. Relatedness	5.14	.86	.58**	.53**					
Satisfaction of the:									
4. Most important need	5.05	.93	.67**	.72**	.77**				
5. Least important need	4.72	.85	.77**	.70**	.62**	.53**			
Well-Being/Depression									
6. Self Esteem	29.17	5.50	.60**	.71**	.47**	.56**	.59**		
7. Depression	10.26	5.95	-.60**	-.58**	-.69**	-.50**	-.54**	-.69**	-

Note. **p < 0.01; *p < 0.05

Discussion

The current study confirmed the factor structure of the 12-item basic need importance scale (Sheldon & Gunz, 2009; Chen et al., 2015), although questions remain about its sensitivity. The main aim of Study 3 was to examine the interactive effects of basic need importance and satisfaction upon well-being and depression in individuals from the general population from two different cultures. First, results confirmed that when viewed nomothetically, the importance of autonomy, competence and relatedness did not moderate the relationship between satisfaction of those needs and well-being (i.e., self-esteem and depression). When the data were treated idiographically, satisfaction of both the most and least important needs significantly predicted similar amounts of variance in general well-being regardless of intra-individual differences in need importance. With regard to general need satisfaction and well-being, these findings appear to offer support for the universality hypothesis that the satisfaction of basic psychological needs has significant consequences for psychological well-being regardless of individual differences in need importance.

Study 4

So far, Studies 1 and 2 support for the importance of importance hypothesis with regard to self-determined motivation. That is, satisfaction of the intra-individually more important needs significantly predicted self-determined motivation (in rock-climbing and sport), but satisfaction of the less important needs did not. In addition, with regards to well-being (measured via self-esteem), the importance of importance effect held for the rock-climbers in Study 1. However, Studies 2 and 3 did not replicate this well-being finding. The results from Studies 2 and 3 are partly consistent with Sheldon and Schüler's (2011) motive disposition theory research, which demonstrated that individual differences in the strength for achievement and affiliation motives moderated the effects of competence and relatedness

satisfaction on domain-specific outcomes within sport (e.g., flow and intrinsic motivation), but not for general well-being outcomes.

The question remains: Why do intra-individual differences in need importance influence the relationship between need satisfaction and general well-being for the rock-climbers in Study 1, but not for the recreational sport participators in Study 2 or the participants from general populations in Study 3? We contend that the influence of intra-individual differences in need importance on general well-being likely depends on the extent to which a person identifies with the activity through which satisfaction is gained. The participants in Study 1 were high-level performers (i.e., highly competent to professional rock climbers), compared with the participants in Study 2 whose participation in sport was mostly recreational. Although it would be unwarranted to claim that the rock-climbers in Study 1 had unidimensional identities, we suspect that given the context of their participation (high achieving) and the addictive nature of extreme sports (Willig, 2008; Woodman et al., 2009), those individuals almost certainly had a unidimensional sense of identity contingent on their participation in rock-climbing.

Furthermore, in line with Hardy and Colleagues' earlier self-esteem research and the findings from Studies 1 and 2, we argue that need satisfaction gained via an activity of extreme importance (i.e., the only significant contributor to general self-esteem) is likely to contribute more to a person's general life well-being than basic need satisfaction gained via other "unimportant" daily life activities. This idea is consistent with recent research that found that super-elite athletes perceived their participation in sport to be the only thing that really mattered in their lives, far more important than their engagement in other normal aspects of life (Hardy, Barlow, Evans, Rees, Woodman & Warr, 2017). Moreover, we suggest that for individuals with such a unidimensional sense of identity, satisfaction of the more important needs will be more keenly felt, and thus be more beneficial to general well-

being, relative to the satisfaction of other less important needs. This is because when people allocate a large proportion of their personal resources to a single life domain, it leaves very little opportunity to compensate for unsatisfied needs through other life domains. Conversely, individuals whose identity is not dependent on a single domain have every opportunity to compensate for unmet needs through their engagement in other life domains, so that satisfaction of the more or the less important needs will not have differential effects on well-being.

A limitation of the previous studies is that we cannot provide evidence for the influence of self-identity on the importance of importance effect regarding general well-being outcomes. Consequently, in Study 4 we sought to measure directly participants' sense of identity with regard to their engagement in specific activities. The main aim of this study was to broaden the findings from Study 1 by demonstrating the importance of intra-individual differences in basic psychological needs across a wider selection of activities, rather than just the single activity of rock-climbing. Finally, we aimed to test this hypothesis regarding the moderating influence of participants' sense of identity by retesting the hypotheses in Study 1 and 3 with individuals from the general population who: (a) felt that their sense of identity was dependent on a single activity/role; or (b) felt they that had a more complex, multidimensional sense of identity.

Method

Participants

We recruited 447 individuals from the general population across the UK (n = 188 men, M_{age} = 40.62 years, SD = 12.22; n = 259 women; M_{age} = 45.08 years, SD = 13.10), again with the opportunity to win £100.

Measures

Sense of identity. We asked participants if they (a) felt they had an identity that was strongly related to a single specific activity or role (i.e., a unidimensional identity) or (b) an identity that was *not* strongly related to one specific activity or role (i.e., a more complex identity). Given the complexity of this question, we applied decomposition techniques similar to that used in The World Health Organization Health and Work Performance Questionnaire (HPQ; Kesler et al., 2003) to improve response accuracy. Specifically, we developed 8 preliminary focus questions that encouraged participants to engage in a self-awareness process by responding to important statements about their identity. We developed these questions using items from the Athlete Identity Measurement Scale (AIMS; Brewer & Cornelius, 2001), and replaced key words related to sport with the general term "activity/role" (e.g., "the essence of who I am is strongly dependent on a single activity/role" and "I define myself by a single activity/role"). The opening paragraph informed participants that each statement described a person whose sense of identity was dependent on a single activity or role. Participants responded to each statement on a scale of 1 (*not like me at all*) to 6 (*very much like me*). Then, we asked "On the whole, do these statements describe how you feel about your sense of identity?" to which participants responded by selecting either *Yes* ("*on the whole, these statements are like me*") or *No* ("*on the whole, these statements are not like me*"). Participants who selected "Yes…" were asked to describe their identity with one or two words (e.g., doctor or triathlete).

Activity/role identity. To confirm the accuracy of the participants' self-selected unidimensional identity, we used a modified form of the Athlete Identity Measurement Scale (AIMS; Brewer & Cornelius, 2001) and replaced key words related to *sport* with the general term *activity/role* in all instances. Example items: "this activity/role is the most important part of my life", "I typically organize my day so that I can take part in this activity/role" and "life

without participating in this activity/role would be extremely difficult". Participants responded on a Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Only participants who reported a unidimensional identity completed this questionnaire.

Need importance. To measure need importance we used the 11-item Basic Need Importance Scale developed in Studies 1 and 2.

Need satisfaction. We used two different need satisfaction questionnaires to measure need satisfaction. Participants who rated themselves as having a unidimensional identity completed an adapted version of the Basic Need Satisfaction in Sport Scale (BNSSS) used in Study 2. In the opening paragraph of this scale we instructed participants to answer the questions whilst thinking of the activity/role they specified at the start of the survey. We replaced words related to *sport* with the general term *activity/role* (e.g., "most days I feel a sense of accomplishment from this activity/role"). Participants who rated themselves as having a more complex identity completed the Basic Need Satisfaction in General Scale (BNS-G) used in Study 3.

Self-determined motivation. We used the SMS-II to measure participants' motivation toward their specific activity or role. This measure was only completed by participants who reported themselves as having a unidimensional identity. For the purpose of the current study we replaced words related to *sport* with the words *activity/role* (e.g., "because this activity/role reflects the essence of whom I am"). We removed item "because I find it enjoyable to discover new performance strategies" because this item is only applicable in particular contexts (i.e., it was difficult to adapt the item to be relevant to all potential activities/roles).

Self-esteem. Self-esteem was measured using Rosenberg's (1965) scale.

Depression. As in Study 3, we measured depressive symptoms with the 10-item version of the Centre for Epidemiological Studies-Depression (CES-D) scale (Radloff, 1977).

Procedure

We invited participants to take part in the online study via advertisements posted in domain-specific groups and fora and through university email lists. On the first page of the questionnaire, participants indicated full informed consent and then completed demographic questions about their age and gender. We then asked participants to think about the different activities that they took part in across their life, which could include the activities associated with work (e.g. academic, business executive, nurse, teacher etc.), sport (e.g. footballer, triathlete, mountaineer etc.), music (singer, pianist, violinist, bassist etc.), at home (e.g. mother, father, grandparent, career etc.), etc. Next, participants completed the preliminary identity decomposition questions, and reported having either a unidimensional or more complex identity. The online inventory then branched off into one of two directions depending on the participant's identity response.

Participants who reported having a unidimensional identity completed the following sequence of questionnaires: the need importance scale (in general life), the activity/role identity scale (i.e., how much they identified with their reported activity/role), the adapted BNSSS (satisfaction of basic needs within their reported activity/role), the SMS-II (self-determined motivation within their activity/identity), the RSE scale (self-esteem in general life) and the CESD scale (depression in general life). Participants who reported having a more complex identity completed the following sequence of questionnaires: the need importance scale (in general life), the BNS-G scale (need satisfaction in general life), the RSE scale (self-esteem in general life), and the CESD scale (depression in general life).

Preliminary Analysis

We used the adapted version of the athlete identity questionnaire to ensure that individuals who rated themselves as having a unidimensional identity truly identified with the activity or role indicated. Any person whose identity data suggested they were less than

highly identified (mean identity score < 4.0) was removed from the study. The final sample comprised 158 unidimensional identity participants (n = 74 men, n = 84 women; M_{age} = 42.90 years; SD = 11.86). In addition, participants with a unidimensional identity were categorized into 3 different activity types (n = 31 occupation, n = 54 sport, n = 25 parental). The final sample also comprised 289 participants with a more complex identity (n = 114 men, n = 175 women; M_{age} = 43.87 years; SD = 13.28).

Main Analyses

The analyses for the current study were split into two parts. In Part 1 we analyzed the unidimensional identity data. Specifically, as in Study 1, we examined Hypotheses 1 (nomothetic; self-determined motivation), Hypothesis 2 (nomothetic; well-being), Hypothesis 3 (idiographic; self-determined motivation) and Hypothesis 4 (idiographic; well-being), using the same analytical procedure described in the all previous studies. In Part 2 we analyzed the complex identity data. Specifically, we examined Hypothesis 5: when relative need importance is operationalized nomothetically, need importance will not moderate the relationship between need satisfaction (gained via all life domains) and well-being; and Hypothesis 6: when need importance is operationalized idiographically, satisfaction (gained via all life domains) of the intra-individually more and less important needs will predict a similar proportion of variance in general well-being. These new hypotheses were examined using the same analytical procedure described in Study 3.

Hypothesis-Testing Strategy

As in Study 3, we created a latent variable ‘well-being’ from the combined self-esteem and depression variables.

Part 1. The unidimensional identity data were first analyzed from a nomothetic (between person differences) approach. Specifically three BSEM models (i.e., one model for each basic need) tested Hypothesis 1 and 2 for each criterion variable. Second, the data were

analyzed from an intra-individual (within-person differences) approach. Specifically, one BSEM model for each criterion variable tested Hypothesis 3 and 4.

Part 2. The complex identity data were first analyzed from a nomothetic (between person differences) approach. Specifically three BSEM models tested Hypothesis 5. Second, the data were analyzed from an intra-individual (within-person differences) approach. Specifically, one BSEM model tested Hypothesis 6.

Results

Unidimensional Identity Descriptive Statistics

Means, standard deviations and bivariate correlations among the main variables are shown in Table 10. Satisfaction of autonomy, competence and relatedness were significantly positively correlated with self-esteem and self-determined motivation and significantly negatively correlated with depression. Furthermore, satisfaction of the most important and second most important basic needs were significantly and positively correlated with self-esteem and self-determined motivation and negatively correlated with depression. Satisfaction of the least important need was significantly negatively correlated with depression and significantly positively correlated with self-determined motivation, but not to self-esteem. The effects of participants' background variables (i.e., age, gender and identity) were examined on self-esteem, depression and self-determined motivation. Identity was categorized into three blocks according to the type of activity/role participants identified with (1 = occupation, 2 = sport, 3 = parental role).

Three separate MANOVA's indicated that there was no significant multivariate effect of age on the criterion variables Wilks' Lambda F (12, 272) = .86, p = .59. Conversely, there was a significant multivariate effect of gender and identity on the criterion variables, Wilks'

Lambda *Fs* (3,106 and 6,210) = 2.69 and 3.23, *ps* = .05 and .001, respectively. Consequently, we controlled for identity and sex.

Table 10

Means (M), standard deviations (SD), and bivariate correlations between all study variables (Study 4: unidimensional identity, n = 110).

	Mean	SD	1	2	3	4	5	6	7	8	9
Satisfaction											
1. Autonomy	6.00	1.00	-								
2. Competence	5.74	1.00	.47**	-							
3. Relatedness	5.70	1.06	.35**	.21*							
Satisfaction of the:											
4. Most important need	5.93	1.01	.65**	.47**	.57**	-					
5. Second most important need	5.80	1.04	.65**	.50**	.57**	.37**	-				
6. Least important need	5.60	0.94	.51**	.67**	.46**	.33**	.34**				
Well-Being/ Motivation											
7. Self esteem	30.35	5.55	.36**	.30**	.10	.30**	.27**	.17	-		
8. Depression	18.47	5.90	-.42**	-.36**	-.20**	-.36**	-.38**	-.24*	-.72**	-	
9. Self-determined motivation[4]	28.04	26.04	.63**	.33**	.35**	.53**	.45**	.33**	.40**	-.51**	-

Note. **p < 0.01; *p < 0.05

[4] There is a lower total score of self-determined motivation in comparison to studies 1 and 2 because we removed one item from the SMS-II in this study (study 4), and this item has a high weighting (item score *3). When this same item was removed in studies 1 and 2, the total scores of self-determined motivation were broadly similar to the total score in the current study.

Unidimensional Identity - Motivated Behavior

Nomothetic need importance analysis. Satisfaction of autonomy, competence and relatedness significantly predicted self-determined motivation: (*autonomy;* R^2 =.46, *p* = <.001; *b* = 17.34, *p* = <.001; CI = [13.24, 21.40]; *competence;* R^2 =.21, *p* = <.001; *b* =7.34, *p* = .003; CI = [2.18, 12.53]; *relatedness;* R^2 =.21, *p* = <.001; *b* = 9.90, *p* = <.001; CI = [4.84, 14.93]). In addition, there was a significant interaction between the satisfaction and importance of autonomy on self-determined motivation (*b* = 3.36; *p* = .009; CI = [.58, 6.17]). There were no significant interactions between the satisfaction and importance of competence or relatedness on self-determined motivation (*bs* = -.40 and .02; *ps* = .435, and .497; CIs = [-5.14, 4.39] and [-4.55, 4.69] respectively). The interaction plot for autonomy showed that when importance of autonomy was high, satisfaction of autonomy predicted more variance in self-determined motivation than when importance of autonomy was low.

Idiographic need importance analysis. We computed the mean intra-individual importance score for each basic need; 110 participants from a total of 157 reported within person differences in the importance of all three basic psychological needs. Participants who failed to record three different need importance scores were removed from further analysis. Satisfaction of the most and second most important needs significantly predicted variance in self-determined motivation (R^2 =.40 *p* = <.001; *bs* = 9.86 and 6.19; *ps* = <.001 and .003; CIs = [5.42, 14.23] and [1.89, 10.41] respectively), but satisfaction of the least important need did not (*b* = 3.10; *p* = .094; CI = [-1.55, 7.73]). Wald Chi Square test revealed no significant difference between beta coefficients for satisfaction of the most and second most important needs (*b* = 3.89, *p* = > .05).

Unidimensional Identity – Well-Being

Nomothetic need importance analysis. Satisfaction of autonomy, competence and relatedness significantly predicted well-being: (*autonomy;* R^2 =.31, *p* = <.001; *b* = 2.17, *p* =

<.001; CI = [1.25, 3.13]; *competence;* R^2 =.17, *p* = <.001; *b* = 1.61, *p* = .002; CI = [.55, 2.68]; *relatedness;* R^2 =.11, *p* = <.001; *b* = 1.08 *p* = .022; CI = [.03, 2.10]). In addition, there was a significant interaction between the satisfaction and importance of autonomy on well-being (autonomy; *b* = .93, p = .002, CI = [.30, 1.59]). However, there were no significant interactions between the satisfaction and importance of competence and relatedness on well-being (*bs* = .07, and .52; *ps* = .491 and .138; CIs = [-.42, 1.54] and [-.80, .91] respectively). The interaction plot for autonomy showed that when importance of autonomy was high, satisfaction of autonomy predicted more variance in well-being than when importance of autonomy was low (see Figure 1).

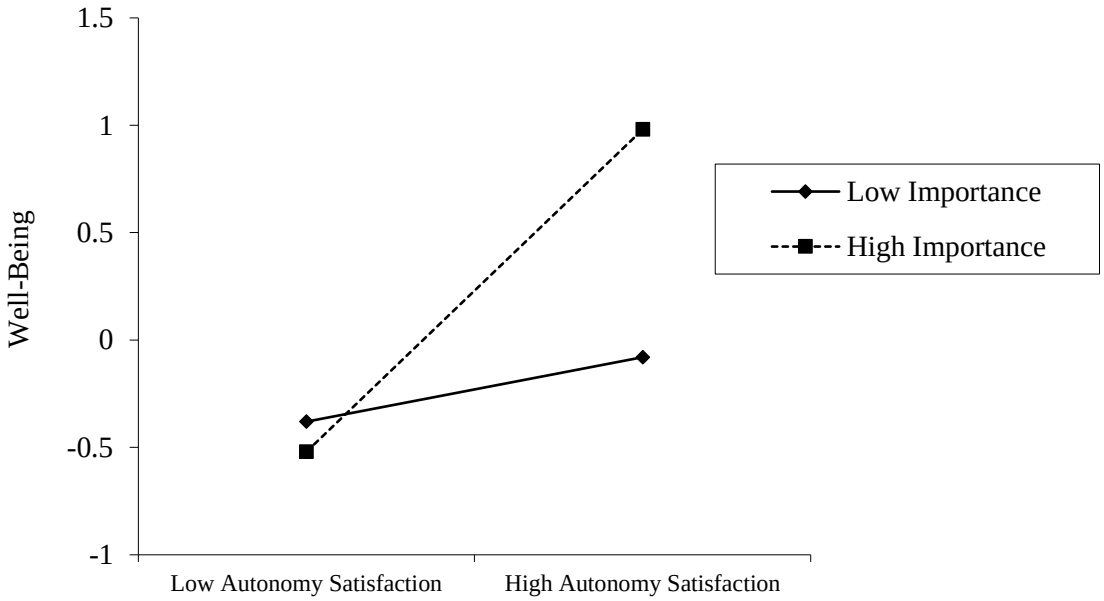

Figure 1. The interaction of autonomy satisfaction and autonomy importance on well-being.

Idiographic need importance analysis. Satisfaction of the most and second most important needs significantly predicted variance in well-being (R^2 =.24 *p* = <.001; *bs* = 1.22 and 1.07; *ps* = .004 and .008; CIs = [.32, 2.18] and [.20, 1.97] respectively), but satisfaction of the least important need did not (*b* = .31; *p* = .258; CI = [-.63, 1.25]). Wald Chi Square test

revealed no significant difference between beta coefficients for satisfaction of the most and second most important needs (b = .07, p = > .05).

Complex Identity Descriptive Statistics

Means, standard deviations and bivariate correlations among the main variables are shown in Table 11. Satisfaction of autonomy, competence and relatedness were significantly and positively correlated with self-esteem and depression. Furthermore, satisfaction of the most, second most and least important basic needs were significantly and positively related to self-esteem and depression. The effects of participant's background variables (i.e., age and sex) were examined on self-esteem and depression. Age was categorized into blocks of 10 years from age 19 to 73 years. Two separate MANOVA's separated by background variable, indicated no significant multivariate effects of age and sex on self-esteem and depression; Wilks' Lambda *Fs* (8,408 and 2,207) = 1.04 and 2.00, *ps* = .409 and .139 respectively.

Complex Identity Well-Being

Nomothetic need importance analysis. Satisfaction of autonomy, competence and relatedness significantly predicted well-being: (*autonomy;* R^2 =.35, p = <.001; b = 3.08, p = <.001; CI = [2.35, 3.81]; *competence;* R^2 =.58, p = <.001; b =4.33, p = <.001; CI = [3.74, 4.92]; *relatedness;* R^2 =.35, p = <.001; b = 3.52, p = <.001; CI = [2.73, 4.31], respectively). However, there were no significant interactions between the satisfaction and importance of autonomy, competence and relatedness on well-being (*bs* = .50, .03, and .08; *ps* = .044, .457, .387; CIs = [-.08, 1.08], [-.53, .60], and [-.49, .65] respectively).

Idiographic need importance analysis. The mean intra-individual importance score for each basic need was computed; 210 participants from a total of 291 reported within person differences in the importance of all three basic psychological needs. Participants who failed to record three different need importance scores were removed from further analysis. Satisfaction of the most, second most, and least important needs all significantly predicted

variance in well-being (R^2 =.58 p = <.001; *bs* = 1.00, 1.64 and 2.32; *ps* = .009, <.001 and <.001; CIs = [.160, 1.81], [.90, 2.40] and [1.65, 3.00] respectively). Wald Chi Square test revealed no significant difference between beta coefficients for satisfaction of the most and second most needs (*bs* = -.66, p = > .05). There was no significant difference between beta coefficients for satisfaction of the most and least important needs (*bs* = -.66, p = > .05), no for the difference between beta coefficients for satisfaction of the second most and least important needs (*bs* = -.66, p = > .05).

Table 11

Means (M), standard deviations (SD), and bivariate correlations between all study variables (Study 4: Complex Identity, n = 210).

	Mean	SD	1	2	3	4	5	6	7	8
Satisfaction										
1. Autonomy	5.04	.83	-							
2. Competence	4.78	1.12	0.59**	-						
3. Relatedness	5.15	.94	0.55**	0.47**						
Satisfaction of the:										
4. Most important need	5.17	.88	0.84**	0.67**	0.63**	-				
5. Second most important need	5.13	.97	0.72**	0.67**	0.70**	0.61**	-			
6. Least important need	4.67	1.02	0.60**	0.68**	0.65**	0.53**	0.51**			
Well-Being/ Motivation										
7. Self esteem	30.35	5.83	0.54**	0.72**	0.44**	0.53**	0.58**	0.62**	-	
8. Depression	19.00	6.38	-.43**	-.55**	-.39**	-.43**	-.45**	-.52**	-.68**	-

Note. **p < 0.01; *p < 0.05

Discussion

In summary, first, we analyzed the unidimensional identity data with the nomothetic analytical procedure, which revealed that importance of autonomy and competence did not moderate the relationship between need satisfaction and self-determined motivation, or general well-being, as hypothesized. However, importance of autonomy did. Specifically, when importance of autonomy was high, satisfaction of autonomy predicted more variance in self-determined motivation and general well-being than when importance of autonomy was low. Although this finding could demonstrate a moderating effect of autonomy importance, it is likely a Type I error due to the large number of analyses conducted. Overall these findings are largely consistent with the previous studies and the research by Chen et al. (2015).

Second, we analyzed the unidimensional identity data with the idiographic analytical procedure. We again demonstrated an effect of need importance. Specifically, satisfaction of the most important and second most important needs significantly predicted variance in self-determined motivation and general well-being, but satisfaction of the least important need did not. Furthermore, the beta coefficient associated with the most important psychological needs were higher than the beta coefficients associated less important needs for both self-determined motivation and general well-being.

Finally, we analyzed the complex identity data with the nomothetic analytical procedure. The results showed that importance of autonomy, competence and relatedness did not moderate the relationship between need satisfaction and well-being (i.e., self-esteem and depression). These findings are largely consistent with study 3 and the research by Chen et al. (2015). Next, the data were analyzed using the intra-individual difference analytical approach. We again demonstrated support for hypothesis 6. That is, for individuals with a complex identity, satisfaction of more and less important needs significantly predicted similar

amounts of variance in general well-being regardless of intra-individual differences in need importance.

With regards to motivated behavior, the findings from *part one* of this study replicate those in studies 1 and 2 and provide further support for the effects of intra-individual differences in need importance on the relationship between need satisfaction and self-determined motivation. Furthermore, the importance of importance hypothesis held for general well-being (measured by self-esteem and depression) for people with unidimensional identities (i.e., *part one* if this study). That is, for those individuals, the most important needs significantly predicted general well-being, but the least important needs did not. However, in *part two* of this study, satisfaction of all three needs had similar effects on well-being, regardless of individual's differences in need importance.

Undoubtedly, the most important finding of this study is that for individuals with a unidimensional identity, the effects of basic need satisfaction on general well-being were dependent on the importance attached to the fulfilment of a specific need and not universally fundamental. Furthermore, these findings indicate the importance of importance hypothesis is robust across multiple activities (e.g., sport, career and parenting).

General Discussion

Self-determination theory considers individual differences in the importance attached to basic psychological needs to have little or no impact on positive and negative outcomes. This is because these needs are hypothesized to be universally fundamental for all human beings (Deci & Ryan, 2000). However, other personality researchers have emphasized the potential significant moderating effect of individual differences in need importance on the relationship between need satisfaction and positive outcomes (e.g., Vallerand, 2000; Hofer & Busch, 2011; Schüler & Kuster, 2011; Schüler et al., 2014a, 2014b).

The purpose of our research was to address the overarching question that was discussed at the start of this work: Do individual differences in the strength of the needs for autonomy, competence and relatedness significantly influence the relationship between need satisfaction and positive outcomes? The findings from the four studies point to the importance of importance in basic psychological needs, in terms of self-determined motivation for a particular activity. Further, in terms of general well-being, the importance of importance in basic psychological needs also applies to individuals who have a unidimensional sense of identity. This is because satisfaction of the more important psychological needs gained via participation in an activity that is central to one's sense of identity is more keenly felt than when gained via other activities is daily life that are not key to sense of identity (where one has the option to satisfy one's needs by engagement in other activities). Furthermore, with regard to need satisfaction in general life (i.e., across all life domains), where one has had every opportunity to compensate for unmet needs, it appears that for individuals with a more complex identity (i.e., more than one source of self-esteem) self-determination theory's universality hypothesis does indeed apply; i.e., satisfaction of basic psychological needs has a similar effect on well-being outcomes regardless of the relative importance attached to different needs.

Broader Implications

The present studies contribute to the body of research examining need importance (or need strength) within the motive disposition literature (e.g., Hofer & Busch, 2011; Schüler & Kuster, 2011; Schüler et al, 2014a; 2014b). Specifically, that research demonstrates that individual differences in the strength of implicit motives influence the domain specific outcomes derived from basic need satisfaction. However, the research has been criticized for using implicit motives as an indicator of need strength. Chen et al. (2015) argued that the implicit motives studied in motive disposition theory are not directly comparable to the needs

described by self-determination theory (Chen et al., 2015). They suggested that to measure need strength it is more appropriate to explicitly assess the importance (or value) of autonomy, competence and relatedness directly (Chen et al., 2015). The current research is the first to show support for the moderating effect of need importance (or strength) in an explicit operationalization congruent with the needs described in self-determination theory.

It is important to note that we used an explicit measure of need importance based on the criticisms mentioned above. However, Ryan and Deci (2000) argue that explicit measures are unable to examine the needs defined in self-determination theory. Clearly, this is a contradiction that self-determination theorists need to address. Furthermore, there appear to be at least two implications of this methodological paradox: 1) although some research suggests that there is a conceptual overlap between implicit motives and basic needs (e.g., Hofer & Busch, 2011; Hofer, Busch & Kiessling, 2008), further research is needed to investigate the congruence of the needs described in both motive disposition and ; 2) for research to move beyond this methodological limitation perhaps of more importance is the development of an implicit measure specifically designed to measure the strength of basic psychological needs within the self-determination theory framework.

Nevertheless, the present research seems point towards to an interesting dichotomy between the importance of importance (e.g., Hardy & Moriarty, 2006; James, 1890; Pelham & Swann, 1995) and the universality hypothesis with regard to the satisfaction of basic psychological needs (e.g., Deci & Ryan 2000; Sheldon & Niemiec, 2006; Sheldon & Schüler, 2011). On the one hand, intra-individual differences in the importance of basic psychological needs play a key role in the attainment of domain specific enhancements (e.g., motivation). Furthermore, when one has a unidimensional sense of identity, individual differences in need importance also play a key role in the attainment of general well-being enhancements. On the other hand, in the totality of one's experiences, where one does not have a unidimensional

sense of identity attached to a single activity, the three basic psychological needs for autonomy, competence and relatedness appear to be universally important for well-being, regardless of individual differences in need importance.

Similar dichotomies exist elsewhere. Hardy and Colleagues' (2017) research shows that super-elite athletes, who have extraordinary levels of motivation, place the importance of sport above all other life domains. Such a narrow focus in life clearly has its advantages for performance and almost certainly leads to unidimensional identities. However, research within the clinical domain has shown that a unidimensional life can have disadvantages with regard to general well-being. Specifically, for corporate executives and high-levels athletes, significant difficulties experienced in work/sport have been shown to negatively impact global self-esteem (Moriarty, 2002). However, the negative effects of difficulties experienced in sport upon global self-esteem were minimal when the athlete in question had other activities besides sport that contributed to their self-esteem. This research emphasized the importance of highly important self-concept domains in the prediction of global self-esteem (Moriarty, 2002). It concluded that it was important to foster a broad self-concept that includes multiple identities across many life domains, thereby allowing individuals the opportunity to compensate for domain-specific difficulties and to reduce their negative impact on global aspects of well-being (cf. Coakley, 1992).

Applied Implications

Our work points to the importance of importance in very high achievers for whom motivation is critical. Thus, our findings could have potentially significant implications in understanding the enhancement of motivation and subsequent work productivity in high achievers. Employers might do well to investigate performance-related enhancement by first understanding individuals' general preferences for need satisfaction. For example, someone who perceives competence to be their most important need, might find it more beneficial to

be provided with opportunities for achievement and feedback on the outcomes of their work. Furthermore, this sort of approach could help managers match individuals for the most productive teams. For example, it would do very little for team productivity to have a collection of individuals all high in the need for personal autonomy (Langfred, 2004).

As alluded to above, previous research points to a performance versus well-being dilemma for high achievers. Although our data suggest that for individuals with a unidimensional identity satisfaction of only the more important needs influence global well-being, it would be unwise to suggest that an individual should ignore opportunities that satisfy their less important needs. This is important because research suggests that individuals may suffer disproportionately from need frustration when global well-being is contingent upon a single need (Sheldon & Niemiec, 2006) or few life domains (Coakley, 1992; Milyavskaya et al; 2009). In other words, individuals may be more vulnerable to the negative effects of domain specific need frustration because when there are few personal sources of need satisfaction, there is little opportunity to compensate for unmet needs. Furthermore, Coakley (1992) suggested that negative outcomes can occur when the development of multiple identities is constrained. Therefore, it may be beneficial for clinical psychologists to consider cognitive reappraisal concerning the importance of basic psychological needs and target life domains on the relationship between need satisfaction and well-being (Lazarus & Folkman, 1984; Craven, Marsh & Debus, 1991; Moriarty, 2002), particularly for people who often neglect aspects of life because of a particularly strong dependency on their participation in a single activity (Hardy et al, 2017; Laland et al, 2017; Moriarty, 2002; Sheldon & Niemiec, 2006).

Limitations and Future Research

The findings regarding general well-being in Study 2 are difficult to fully explain. Specifically, we found that satisfaction of the second most important need was the only

predictor of general well-being. Furthermore, this model resulted in a particularly low r-squared value. We deemed the effects of need satisfaction on global self-esteem to be a Type I error and suggested that these findings were likely unprincipled. Moreover, in this work (namely Studies 1, 2 and 4), participants completed a need satisfaction questionnaire about their satisfaction in a particular domain (i.e., climbing, sport, occupation, and parenting). With regard to general well-being, future research would do well to test whether the importance of importance effect is robust to general need satisfaction (measured across all domains of life) for those individuals whose sense of identity is dependent on a single domain. We suspect that given the unidimensional nature of these individuals' lives, the effects of need satisfaction from daily life (outside of their identity) on general well-being would be rather minimal and thus replicate the findings from studies 1 and 4.

Conclusion

The findings of the present studies offer support for the importance of examining intra-individual differences in the importance of basic psychological needs, but also offers support for self-determination theories universality hypothesis. Specifically, this research demonstrates that the motivation benefits associated with need satisfaction gained via a specific activity, depend on the importance weighting attached to a specific need. Furthermore, this research also demonstrates that for the general population, when need satisfaction is measured across all domains of life, all three basic needs appear to have equal benefits to general well-being regardless of individual differences in importance. However, when an individual's sense of identity is highly related to their investment in a specific activity, the general well-being benefits experienced from need satisfaction within an important activity also depend on the intra-individual level of importance. Collectively, these studies demonstrate that although all three needs are required to a similar extent for general

well-being in some contexts, there are other contexts where only the satisfaction of the more important needs is important.

Chapter 3: A Three-Wave Longitudinal Analysis of Sense of Coherence and Basic Need Satisfaction on Psychological Functioning[5]

Abstract

Because of the difference in traditional foci, researchers working within the framework of sense of coherence (Antonovsky, 1979; 1987) and within the framework of self-determination theory (Deci & Ryan 1985) have worked independently from each other. As such, empirical studies have not addressed the relationship between the two theories and any associated well-being. That relationship is the focus of this study. First, results provided support for the credibility of a four-factor sense of coherence scale, with an additional dimension termed *relationality.* Second, results demonstrated a considerable conceptual overlap (60%) among the dimensions of sense of coherence and basic needs perspectives. Third, a series of three-wave longitudinal analyses demonstrated that satisfaction of basic psychological needs mediates the relationship between sense of coherence and optimal/positive well-being (measured via life satisfaction, vitality, and informant rated coping effectiveness health/performance). However, basic need satisfaction failed to mediate the relationship between sense of coherence and the absence of psychiatric symptoms. There was, nonetheless, a significant direct effect of sense of coherence on the absence of psychiatric symptoms. Collectively, these findings are in line with the origin of both theories and also suggest that the dimensional structure of sense of coherence more adequately explains the absence of psychiatric illness than the satisfaction of basic needs, whereas basic need satisfaction only explains the presence of positive psychological wellbeing.

[5] Based upon Glendinning, F., Hardy, L., Woodman, T., & Markland, D. (2018). *A Three-Wave Longitudinal Analysis of Sense of Coherence and Basic Need Satisfaction on Well-Being.* Manuscript in preparation.

Introduction

Self-determination theory (Deci and Ryan, 1985) proposes the existence of three psychological needs (autonomy, competence, and relatedness) that are necessary for psychological health. Another important perspective on health, but one that has received considerably less attention than self-determination theory, is Antonvsky's (1979, 1987) sense of coherence theory. Specifically, Antonovsky (1979) proposed the existence of three core dimensions (comprehensibility, manageability, and meaningfulness) which shape a person's global orientation that 'there is a high probability that things will work out as well as can reasonably be expected' (pg. 124).

Historically, empirical research within self-determination theory has focussed on associations between need satisfaction and positive referents of psychological health such as life satisfaction, vitality, and others that capture optimal forms of functioning and growth orientated behaviour. In contrast, sense of coherence literature has traditionally focussed on understanding how people "*survive"* in spite of the chaos and stress of life rather than how they "*thrive"* from satisfying events. Because of the difference in traditional foci, research within the framework of sense of coherence and basic needs satisfaction has taken place independently, and any similarities/differences between the two perspectives are yet to be addressed. The authors propose some convergence/divergence amongst the dimensions described by both theories that may have important implications for understanding people's movement toward positive health and away from ill health.

Sense of Coherence

The original development of the sense of coherence theory was concerned with the *salutogenic* question of why some people, regardless of major stressful situations and severe hardships, stay healthy and others do not (Eriksson & Lindstrom, 2005). Through the study of individuals with experience of extreme trauma (e.g., Holocaust concentration camp

survivors), Antonovsky (1979) suggested that the salutogenic question could be understood in terms of the extent to which a person had a strong sense of coherence (i.e., seeing the world as comprehensible, manageable and meaningful). Specifically, *meaningfulness* refers to the feeling that the stimuli in one's internal and external environment are challenges worthy of emotional investment and commitment; and *manageability* to the perception that resources are available to one to meet the demands posed by those stimuli (Antonovsky, 1979; 1987). Finally, *comprehensibility* refers to the perception that those stimuli make cognitive sense and that one's perception of the world is somewhat clear and predictable (Antonovsky, 1979; 1987).

Sense of Coherence and Psychological Well-Being

The World Health Organisation (WHO; 1948) define health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Antonovsky (1979) strongly opposed this definition, and instead agreed with Dubo's (1968) view of health as "a modus vivendi enabling imperfect men to achieve a rewarding and not too painful existence while they cope with an imperfect world" (p. 67).

Through his scepticism of the WHO definition, Antonovsky (1979) explained the relationship between sense of coherence and psychological health by separating the idea of health into two concepts. On the one hand, he suggested that because many of the resources that promote a strong sense of coherence directly relate to the more positive referents of well-being (i.e., life satisfaction, morale, and positive/negative affect), it is reasonable to suspect that sense of coherence also relates to this dimension, though indirectly (Antonovsky, 1987). On the other hand, he hypothesised sense of coherence should have more of a direct relationship with how a person feels about their level of *functioning* (i.e., the absence of ill-health; Antonovsky, 1987). That is, when life is repeatedly painful a person with a strong sense of coherence will be no happier or more satisfied than a person with a weaker sense of

coherence, but they will feel that they are handling it as well as possible, making life bearable (Antonovsky, 1987).

In line with this principle, research has shown support for sense of coherence as a moderator in the relationship between negative life events and psychiatric symptoms (Jorgenson, Frankowski & Carey, 1999), and between traumatic Holocaust experiences (child survivors) and posttraumatic stress (van der Hal-van Raalte, van IJzendoorn & Bakermans–Kranenburg, 2008; Verenese, Pepe, 2017). Further, research demonstrates that individuals with a reported weak sense of coherence (i.e., the perspective that life is chaotic, unmanageable, and meaningless) are more vulnerable to feelings of anxiety, anger, and hostility (Amirkhan & Greaves, 2003; Eriksson & Linström, 2005; Ristkari, Sourander, Ronning, & Helenius, 2006; Von Bothmer & Fridlund, 2003), because they are more likely to interpret stressors as threatening (Anson et al. 1993, Antonovsky & Sagy, 1986). Indeed a substantial body of research suggests that sense of coherence contributes to the prevention of dysregulation; however, other research shows that sense of coherence is also associated with positive affect and life satisfaction (Dezutter, Wiesmann, Apers, Luyckx, 2013; Moksnes, Løhre, Espnes, 2013).

Basic Psychological Needs Theory

Unlike sense of coherence, self-determination theory traditionally deals with the exploratory and growth-oriented aspects of human behaviour, such as how satisfaction of the needs for autonomy, competence and relatedness promote individuals to reach their fullest potential (Deci & Ryan, 2000; Sheldon & Niemiec, 2006). Specifically, satisfaction of *autonomy* refers to feeling free to behave in ways that express ones true interests (Deci & Ryan, 1985, 2000), *competence* to feeling effective in bringing about desired outcomes and the experience of opportunities where one can express capabilities (Deci & Ryan, 2000), and *relatedness* to feeling securely connected to and understood by others (Deci & Ryan, 2000).

Self-determination theorists hypothesise that satisfaction of these needs supports organismic integration processes (Deci & Ryan, 1985) that allow individuals to grow, thrive and achieve self-actualisation.

Basic Psychological Needs Theory and Psychological Well-Being

A broad literature has repeatedly shown support for the direct relationship between need satisfaction and optimal forms of psychological well-being (e.g., life satisfaction; Deci et al., 2001, self-esteem; Chen et al., 2015, general well-being; Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010) and subjective vitality; Bartholomew, Ntoumanis, Ryan &, Thøgersen-Ntoumani, 2011). In addition, some research has shown that need satisfaction is negatively associated with burnout (Hodge, Lonsdale, & Ng, 2008), bulimic symptoms (Pelletier, Dion & Levesque, 2004) and emotional exhaustion (Reinboth & Duda, 2004), and positively associated with reduction in anxiety and depression cognitions (Dwyer, Hornsey, Smith, Oei and Dingle, 2011). However, other research suggests that need satisfaction has little or no association with ill-being (Adie et al., 2008; Bartholomew Gagne, Ryan & Bargmann, 2003). Thus, questions remain about the strength and robustness of the relationship between need satisfaction and psychopathology.

Do the Two Theories Share Conceptual Overlap?

Despite the obvious differences in traditional empirical focus, we argue that sense of coherence and basic psychological needs theory share some conceptual overlap. For example, both perspectives contain efficacy-inspiring elements reflected in the dimensions of manageability and competence satisfaction. Both dimensions are shaped through opportunities to demonstrate skilfulness in environments that are challenging and engaging (Deci & Ryan, 2000; Slootjes, Keuzenkamp & Saharso, 2017; Volanen, Lahelma, Silventoinen & Suominen, 2004). A person high in manageability should cope well when confronted with adverse events, and have the belief that they have the necessary resources to

meet life's demands (Antonovsky, 1979). Similarly, the affective consequences of a sense of competence allow individuals to better adapt to new challenges in changing environments (Deci & Ryan, 2000). Further, meaningfulness, the motivational dimension of sense of coherence, is very compatible with autonomy satisfaction. Integral for both is that people play a significant part in shaping their own outcomes within socially valued context, without the control or whims of others (Antonovsky, 1987; Deci & Ryan, 2000; Idan, Eriksson &Yagon, 2017). Ryan and Deci (2000) assume that meaningfulness happens structurally through the movement toward greater integrity and autonomy. Other researchers stress its independent importance and suggest that a sense of meaning is an additional fundamental need to comprehend and make sense of the many difficulties and tragedies of life (Anderson, Chen & Carter, 2000).

Perhaps the most intuitive dimension to sense of coherence is the *comprehensibility* dimension. Key to comprehensibility is experience of *consistency,* which refers to the extent to which one, during the course of early living, experienced information that was clear and structured rather than chaotic, disordered, random, and inexplicable (Idan et al., 2017). Aspects of comprehensibility measure the extent to which people understand the behaviour of those around them. Self-determination theorists captured this in the original definition of relatedness satisfaction. However, we argue that need satisfaction measures do not capture the cognitive element of relatedness, instead they appear to be more concerned with the extent to which a person feels "liked" and treated kindly (e.g., Gagné, 2003). Thus, comprehensibility may be incomparable to the basic needs described by self-determination theory.

We suggest that there is some overlap (but not a perfect one–to-one relationship) between sense of coherence and basic need dimensions. However, we also suggest that the conceptualisation of sense of coherence has more cognitive emphasis (i.e., comprehensibility)

that may strengthen its association with negative health outcomes (e.g., lower levels of depression; Hittner & Swickert, 2010; Kövi et al., 2017). This is because, "without a clear picture of the demands in a life that is chaotic and unpredictable; people are extremely unlikely to manage well" (Antonovsky, 1987).

Overview of the Present Studies

The first aim of this research was to examine the conceptual overlap between the dimensions described by sense of coherence and basic needs theory. The second aim was to investigate the longitudinal associations between satisfaction of basic needs, sense of coherence and psychological health outcomes (positive well-being and psychiatric disorder), across three time points.

This is the first study to investigate causal associations between basic need satisfaction and sense of coherence, therefore regardless of one's theoretical stance on the direction of structural paths; we thought it necessary to explore the causal order of those variables in both directions. However, Antonovsky (1979) maintained that during early adulthood, sense of coherence becomes more or less fixed and since then, research has supported its stability (Schneider, Büchi, Sensky & Klinghoffer, 2000). Therefore, for the purpose of the current research, we hypothesise that basic need satisfaction will mediate the relationship between sense of coherence and well-being (i.e., life satisfaction, vitality and informant-rated coping effectiveness (hypothesis 1). Further, in line with Antonvsky's position that sense of coherence has more of a direct effect on the absence of ill health, we also hypothesise that need satisfaction will *not* mediate the relationship between sense of coherence and psychiatric symptoms (hypothesis 2).

Dimensionality of sense of coherence. Earlier work using principle components analysis suggested that sense of coherence might best be conceptualised as a unidimensional measure (e.g., Coe, Romeis, Tang & Wolinsky, 1990; Flannery & Flannery, 1990; Frenz,

Carey, Jorgeson, 1993; Sammallahti, Holi & Komulainen, 1996). However, research using confirmatory factor analysis has shown support for a three-factor multi-dimensional scale (e.g., Feldt, Leskinen, Kinnunen & Mauno, 2000; Feldt, Lintula, Suominen, Koskenvou, Vahtera & Kivimäki, 2007; Gana & Garnier, 2001). These findings are inconsistent and there has been little research since 2007 to help clarify the inconsistencies. Consequently, before embarking on the main purpose of this research, phase 1 of the analyses examined the dimensionality of sense of coherence via the orientation to life questionnaire.

Method

Participants

Participants were individuals from the general population across the UK. We asked all participants to nominate one informant to complete a questionnaire about them during the study. Data screening procedures included a cut off completion time of 5 minutes based on results from a small pilot study (N = 10) which aimed to establish an approximate study completion period. Consequently, we removed participants who completed the study in less than 5 minutes and participants who did not have data for all three self-report and informant report time points (0-12-24 weeks). The final sample comprised 67 self-report participants (N = 36 Males and 31 Females, M_{age} = 35.03, SD = 14.05) and their corresponding informants. We offered all participants the opportunity to enter into a prize draw as monetary incentive.

Measures

Sense of coherence. We used the 29-item orientation to life scale (Antonovsky, 1988) to examine individual's sense of coherence. This inventory comprises 16 positively worded items, 13 negatively worded items and three subscales: comprehensibility (n_{items} = 11); manageability (n_{items} = 10); and meaningfulness (n_{items} = 8). We measured items along a 7-point semantic differential scale with two anchoring statements. Example anchoring statements are 1 (full of interest) to 7 (completely routine) and 1 (never happened) to 7

(always happened). Higher scores indicated greater sense of coherence. Previous research demonstrates good internal consistency with Cronbach's alphas ranging from .70 to .92 (Eriksson & Lindstrom, 2005).

Need satisfaction. We used the Basic Need Satisfaction in General Scale (BNSG-S; Gagné, 2003) to measure the satisfaction of each basic psychological need across time. This inventory comprises 12 positively worded items, 9 negatively worded items and 3 subscales: autonomy ($n_{\text{items}} = 7$); competence ($n_{\text{items}} = 6$); relatedness ($n_{\text{items}} = 8$). Items were measured on a 7-point Likert scale, ranging from 1 (*not at all true*) to 7 (*very true*). Higher scores indicated greater need satisfaction.

Optimal/positive well-being. We used a number of indicators of positive well-being. These indicators included; life satisfaction, subjective vitality, informant rated coping effectiveness-performance and informant coping effectiveness-health. We measured life satisfaction with the Satisfaction with Life Scale (Diener et al., 1985). This inventory comprises five items rated on a Likert scale ranging from 1 (*strongly disagree*) to (*strongly agree*) 7. This measure has been widely used within the self-determination literature and has demonstrated good internal consistency with Cronbach's alpha ranging from .79 to .89 (Pavot & Diener, 1993). Composite reliabilities from the current study ranged from .84 to .92. We measured vitality across time using Ryan and Fredericks' (1997) Subjective Vitality Scale. Subjective vitality refers to the state of having energy available to the self. This inventory consists of six positively worded items and one negatively worded item. We measured items on a scale ranging from 1 (*not at all true*) to (*very true*) 7. This measure has also been widely used within the self-determination literature and demonstrates good internal consistency with Cronbach's alpha ranging from .80 to .89 (Bostic, Rubio & Hood, 2000; Ryan and Frederick, 1997). Composite reliabilities from the current study ranged from .92 to .94.

We used the informant-rated coping effectiveness – performance scale (MacGregor, 2015), to assess the behavioural outcome of coping (e.g., "Person X is able to maintain a high level of performance effectiveness in everyday life, when he/she has had a setback"). Items scored on a Likert scale ranging from 1 (*never)* to 7 (*always)*. Higher scores are indicative of a higher level of coping effectiveness Composite reliabilities from the current study ranged from .93 to .96. We used the informant-rated coping health scale, to assess the health costs of coping (e.g., "Person X is able to maintain a high level of personal health in everyday life, when he/she has had important upcoming deadlines") across time. Items scored on a Likert scale ranging from 1 (*never)* to 7 (*always)*. Higher scores are indicative of a higher level of coping effectiveness. Composite reliabilities from the current study ranged from .96 to .98.

Psychiatric symptoms. We used the General Health Questionnaire (GHQ; Goldberg & Hillier, 1979) to measure short-term psychiatric disorder in the general population. We used the 28-item version of the GHQ, which contains four subscales: Depression ($n_{\text{items}} = 7$); social dysfunction ($n_{\text{items}} = 7$); anxiety/insomnia ($n_{\text{items}} = 7$); and somatic symptoms ($n_{\text{items}} = 7$). We used the recommended 4-point Likert method ranging from 0 (*not at all*) to 3 (*much more than usual*) to indicate symptom severity (Goldberg & Williams, 1988; Swallow, Lindow, Masson & Hay, 2010). Previous research demonstrates good internal consistency with Cronbach's alpha ranging from .65 to .90 (Failde & Ramos, 2000). Composite reliabilities from the current study ranged from .74 to .99.

Procedure

We combined the self-report and informant-report inventories into two separate omnibus surveys and administered them using Qualtrics (2014-2016) online survey software. We recruited participants via local advertisement and social media websites. We sent the study information sheet and a '*start the study'* web link to people who showed an interest in taking part. On the first page of the self-report inventory, participants indicated full informed

consent and then completed demographic questions that asked them to indicate their age and gender. Next, we asked participants to nominate one person that knew them well to complete an informant questionnaire. Participants then completed the following sequence of questionnaires; the basic need satisfaction in general scale, the orientation to life scale, the life satisfaction scale, the subjective vitality scale and then the general health questionnaire. We emailed self-report participants four months and eight months after completion of the first questionnaire with their Time 2 and Time 3 study web links. The order and content of the measures remained the same for each time point. We emailed informant-report participants their first '*start the study'* web link within 7 days of their corresponding self-report completion. On the first page of the questionnaire, participants indicated full informed consent and then completed the coping effectiveness – performance and coping effectiveness – health measures. We emailed informant-report participants with the inventory web link to the following time points on the same dates as the corresponding self-report participant.

Measurement Issues

Dimensionality of Sense of Coherence

In the first phase of this section we aimed to address the sense of coherence dimensionality issue outlined in the introduction.

Bayesian structural equation modelling. We implemented Bayesian Structural Equation Modelling (BSEM) to assess the factorial validity of the three-factor sense of coherence scale. Bayesian approaches are becoming increasingly popular for confirmatory factor analysis and structural equation modelling (cf. van de Schoot, Winter, Ryan, Zondervan-Zwijnenburg & Depaoli, 2017). One the many advantages of BSEM is that it allows researchers to specify a small degree of uncertainty by replacing exact zero parameters (commonly used in frequentist approaches) with approximate zeros (i.e., approximate zero

means, small variances), thus producing more realistic and parsimonious solutions (cf. Muthén & Asparouhov, 2012).

We performed all analyses using Mplus version 8 (Muthén & Muthén, 2017). We specified small prior variances for cross loadings with a mean of zero and a variance of 0.01, corresponding to 95% small cross-loading bounds of ± .02 (Muthén & Asparouhov, 2012). For the correlated residuals we specified an inverse-Wishart prior distribution *IW* (0, degrees-of-freedom parameter $d = p + 6$). We estimated all BSEM with Markov Chain Monte Carlo (MCMC) simulation procedure with a Gibbs sampler and a fixed number of 100,000 iterations for two MCMC chains (Gelman et al., 2013). We assessed model convergence with the potential scale reduction factor (PSR). PSR values that lie between 1.0 and 1.1 for all parameters show support for model converge (Gelman, Carlin, Stern & Rubin, 2004). In addition, visual inspection of the trace plots was performed for each parameter to check that the parameter values in each MCMC converged to a similar target distribution (van de Schoot & Depaoli, 2014). We performed sensitivity analyses on cross-loadings and residual covariance to check for stability of the estimates. Specifically, we compared estimates with priors on the cross-loadings specified at .015, .01, and .005, and priors on the residual correlations specified at IW 0, $d = p + 6$, $p + 20$, and $p + 2$.

We assessed model-data fit according to the PP*p* value where a well-fitting model is indicated when values are around .50, whereas values of $p < 0.05$ indicate an unacceptable model-data fit (Muthén & Asparouhov, 2012). Additionally, a good-fitting model is indicated when the symmetric 95% confidence interval for the difference of the observed and replicated $\chi 2$ values encompass zero (Muthén & Asparouhov, 2012). We used the deviance information criteria (DIC) to compare BSEM; differences >5 are substantial (Spiegelhalter et al., 2002) and lower scores indicate better fitting models.

Approximate Measurement Invariance

In the second phase of this section we examined Bayesian approximate measurement invariance for the sense of coherence and basic need satisfaction scales, to assess whether the same factor structure underpins the items at all times of measurement, and that the factor loadings and item intercepts are approximately equivalent (Eslworth, Beauchamp & Osborne, 2016; Millsap & Olivera, 2012). We report the full analytical strategy for the approximate measurement invariance analyses in Appendix A.

Results

Factorial Validation

We ran a preliminary BSEM on the sense of coherence scale at the first time point. The three factor (29-item) model with informative priors on the cross-loadings and residual covariance revealed unusually good-fit to the data with a PP*p* of >.9. Researchers have suggested that PP*p*'s close to 0 or 1 could indicate model misspecification (Wang & Kim, 2017). This 'unusually good fit' may be explained by the sample size of the current research (n = 67). More specifically, in small sample sizes, parameter estimates are highly sensitive to the specification of the prior distribution (e.g., McNeish, 2016). In an attempt to resolve this issue, we used the inverse Wishart a priori specification procedure identified by Asparouhov, Muthén and Morin (2015). The first step of this approach is to specify a large degrees-of-freedom parameter d (e.g., d = 100) and gradually decrease d in an ad hoc manner, with the primary goal of determining the largest d that yields a well-fitting model. A large degrees-of-freedom parameter d is considered a stricter prior and the prior that should be used for analysis. This process revealed that the largest d to yield a well-fitting model was d = p + 20 (where p = number of items). Thus, d = p + 20 was retained for the final analyses. BSEMs

with $d < p + 20$, yielded unusually good fit to the data (i.e., potential model misspecification) and BSEMs with $d > p + 20$, yielded large reductions in model fit[6].

Sense of coherence. Support for convergence was achieved for all BSEM; Table 2 displays the number of iterations at which PSR values reached the convergence criteria. The BSEM fit statistics are also displayed in Table 2. Inspection of the standardised factor loadings for the three factor (29-item) model, revealed that a number of items failed to load significantly onto their intended factor (See Table 1 for the content, standardised factor loadings and their corresponding CIs for these *problem* items). The item content revealed that of those items, several appeared to represent a theme characterised by the extent to which one feels that they can *rely* on and *understand* the behaviour of the people around them. These were, comprehensibility (CR) items 1, 2 and 3 and manageability (MA) items 2, 3, and 7. In addition, for those items there were a number of residual correlations that significantly escaped their specified small variance prior. Consequently, we decided to test a four-factor sense of coherence scale, with the fourth factor (referred to as *relationality* herein) representing those items discussed above, and an additional item that the authors deemed to better represent relationality, as opposed to its original intended factor (manageability item 1). We discuss the additional factor below.

We reran the BSEM on the new four-factor (29-item) sense of coherence scale. BSEM with informative priors on the cross-loadings and residual correlations revealed good fit to the data, with a PP*p* >0.5. Inspection of the standardised factor loadings revealed that the new model specification improved all but one of the problem items reported above. All other

[6] For BSEMs with $d = p + 6$, PP*p*s ≈ .850. For BSEMs with $d = p + 30$, PP*p*s ≈ .150. For BSEMs with $d = p + 40$, PP*p*s ≈ .000.

problem items identified were subsequently removed by the authors[7]. This process resulted in a 24-item scale with four subscales: comprehensibility (n_{items} = 7); manageability (n_{items} = 5); meaningfulness (n_{items} = 7) and relationality (n_{items} = 5). The reduced 24-item four-factor model resulted in excellent fit to the data at time points 1, 2 and 3 (see Table 2 for fit statistics). All major loadings were significant and acceptable across all three time points (see Table 3), and all inter-factor correlations were significant and positive (see Table 4). Furthermore, the DIC model comparison statistic demonstrated support for the 24-item four-factor models as the preferred models, when compared to the 24-item three-factor models (see Table 2 for DIC statistics). Sensitivity analyses revealed no important discrepancies between parameter estimates when varying the a priori distribution for cross-loadings and residual covariance (100% of the discrepancies fell between ±.05).

Approximate measurement invariance. BSEM demonstrated support for time invariance of factor loadings and item intercepts for the sense of coherence and basic need satisfaction scales. See Appendix A for the full analytical report.

[7] ***Relationality item 4*** (Time 1: CI = [-.15, .59]; Time 2: CI = [-.31, .59]; Time 3: CI = [-.17, .91]), had non-significant factor loadings (<.25) across all three time points. ***Meaningfulness item 3*** (Time 1: CI = [-.28, .50]; Time 3: CI = [-.32, .61]) had non-significant factor loadings at Time 1 and 3. ***Manageability item 5***, (Time 2: CI = [-.18, .74]; Time 3: CI = [-.32, .61]) and ***comprehensibility item 9*** (Time 2: CI = [-.10, .59]; Time 3: CI = [-.13, .37]), had non-significant factor loadings (<.30) at Time 2 and 3. Given that those factor loadings were substantially lower than Hu and Bentler's cut off (>.40), they were subsequently removed from further analysis. Additionally, ***relationality item 2*** (Time 3: CI = [-.13, .37]), had a non-significant and negative factor loading. The authors deemed the item content to be ambiguous and subsequently removed that item from the model.

Table 1

Item content, standardised factor loadings and corresponding CIs for problem items.

Item		Factor Loading	Upper/Lower 2.5% CI
CR item-1	When you talk to people, do you have the feeling that they don't understand you?	.22	[-.13, .58]
CR item-2	Think of the people with whom you come into contact daily, aside from the ones to whom you feel closest. How well do you know most of them?	.25	[-.15, .64]
CR item-3	Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?	.21	[-.11, .54]
MA item-2	Has it happened in the past that people whom you counted on disappointed you?	.30	[-.04, .61]
MA item-3	Do you have the feeling that you are being treated unfairly?	.21	[-.41, .71]
MA item-7	Do you think that there will always be people whom you'll be able to count on in the future?	.23	[-.22, .61]

Note. CR = comprehensibility, MA = manageability.

Table 2

BSEM fit statistics for the sense of coherence scale.

Model	PP*p*	Lower 2.5% CI	Upper 2.5% CI	DIC	PSR	Iterations
Time 1						
24-item three-factor scale	.375	-68.61	95.65	4440.19	1.00	4400
24-item four-factor scale	.504	-82.26	81.20	4409.99	1.01	3900
Time 2						
24-item three-factor scale	.354	-64.87	98.80	4356.09	1.00	4100
24-item four-factor scale	.475	-80.05	83.93	4326.83	1.01	4200
Time 3						
24-item three-factor scale	.388	-69.32	93.92	4264.68	1.00	2000
24-item four-factor scale	.505	-81.93	81.24	4235.07	1.01	8900

Note. PP*p* = posterior predictive p value; PSR = potential scale reduction; Iterations = point at which PSR reached the <1.1 convergence criterion, DIC = deviance information criteria.

Table 3

Standardised factor loadings for the 24-item 4-factor sense of coherence scale.

	Comprehensibility			Manageability			Meaningfulness			Relationality		
Item	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
CR-4	**.79****	**.53****	**.83****	-.03	.06	-.07	-.03	.00	-.03	-.04	.02	-.09
CR-5	**.76****	**.70****	**.53****	.03	.01	.01	.03	-.00	.07	.03	-.01	.09
CR-6	**.72****	**.84****	**.66****	-.04	-.07	.03	.01	.05	.03	.02	-07	.01
CR-7	**.87****	**.82****	**.76****	.03	-.10	-.06	-.05	-.09	-.13	-.10	-.05	-.01
CR-8	**.74****	**.50****	**.61****	.02	.12	.06	.11	.02	.08	.05	.12	.08
CR-10	**.53****	**.51****	**.80****	-.04	.12	.02	-.03	.04	-.01	.03	.03	-.03
CR-11	**.35***	**.54****	**.58****	-.06	.03	.06	-.04	.02	.05	.03	.06	.02
MA-4	-.01	-.01	-.03	**.58****	**.76****	**.60****	-.03	.01	.08	-.04	-.01	-.09
MA-6	-.02	-.03	-.05	**.60****	**.50****	**.81****	.03	.04	-.02	-.02	.01	.05
MA-8	-.01	.06	.07	**.60****	**.58****	**.79****	.05	.10	-.05	.02	.03	.02
MA-9	-.04	-.03	-.04	**.78****	**.95****	**.77****	-.01	-.01	.05	-.03	-.07	.00
MA-10	.08	.10	.04	**.80****	**.74****	**.80****	.01	-.05	-.02	.07	.00	.01
ME-1	-.05	-.02	-.04	-.06	-.03	-.04	**.53****	**.56****	**.65****	-.07	.04	-.04
ME-2	-.11	.00	-.13	-.10	-.01	-.07	**.91****	**.71****	**.91****	.00	-.03	-.03
ME-4	-.03	-.08	-.05	-.03	-.02	.02	**.83****	**.83****	**.74****	-.16	-.02	.02
ME-5	.06	-.04	.03	.05	.11	.06	**.61****	**.63****	**.79****	.13	.14	.02
ME-6	-.00	.05	.02	-.01	-.10	.00	**.77****	**.79****	**.82****	.02	-.07	-.02
ME-7	.14	.09	-11	.13	.11	.01	**.65****	**.55****	**.65****	.06	.03	.06
ME-8	.03	.01	.14	.04	-03	.07	**.67****	**.84****	**.64****	.06	-.03	-.00
CR-1	.00	.05	.05	.03	-.02	.03	.07	.11	.03	**.71****	**.42****	**.62****
CR-3	.03	-.05	.02	-.06	-.05	.02	-.02	-.05	.10	**.81****	**.93****	**.78****
MA-2	.02	.00	-.03	.04	-.01	-.02	-.04	.03	-.07	**.81****	**.75****	**1.01****
MA-3	-.04	.07	-.01	-.04	.03	-.03	-.03	-.04	-.03	**.69****	**.58****	**.63****
MA-7	-.06	-.07	.00	.01	.01	.02	.06	.02	.01	**.59****	**.72****	**.61****

Note. CR = Comprehensibility, MA = Manageability and ME = Meaningfulness.

Table 4

Latent inter factor correlations, and their 95% credibility intervals for the 24-item four-factor sense of coherence scale for each time point.

Time 1	1	2	3	4
Comprehensibility	-			
Manageability	.57 [.26, .76]	-		
Meaningfulness	.35 [.03, .50]	.51 [.21, .72]	-	
Relationality	.41 [.09, .65]	.60 [.31, .78]	.50 [.19, .71]	-
Time 2	**1**	**2**	**3**	**4**
Comprehensibility	-			
Manageability	.65 [.37, .82]	-		
Meaningfulness	.50 [.17, .72]	.64 [.37, .81]	-	
Relationality	.39 [.05, .64]	.62 [.35, .80]	.59 [.31, .77]	-
Time 3	**1**	**2**	**3**	**4**
Comprehensibility	-			
Manageability	.57 [.27, .77]	-		
Meaningfulness	.41 [.07, .66]	.76 [.56, .87]	-	
Relationality	.53 [.23, .74]	.69 [.46, .84]	.63 [.37, .79]	-

Brief Discussion

The first phase of the research provided support for a four-factor sense of coherence scale. Further, the four-factor solution was superior to the three-factor solutions. The additional fourth factor termed “relationality” included all items that characterised the extent to which the behaviour of others is consistent and understandable as well as those that focussed on people as social resources. Example items are; “has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well “and “has it happened in the past that people whom you counted on disappointed you”. Consequently, we deemed relationality to measure the extent to which a person understands their social environment and the perception that there are people whom they count on. Interestingly, the emergence of the relationality factor is not unique to this study. Other research has reported

error covariance between those comprehensibility and manageability items (Feldt et al. 2007). We suggest that for the proceeding analyses; the most appropriate way to conceptualise sense of coherence is with the four factors identified here (i.e., comprehensibility, manageability, meaningfulness and relationality).

Longitudinal Analytical Section

Main Analyses

First, we examined the linear relationship between the sense of coherence and basic need satisfaction dimensions using canonical correlation analysis in SPSS. Then, we utilized a three-wave, cross-lagged mediation model to test *hypothesis one* and *hypothesis two*, using BSEM. We used the BSEM to obtain small sample performance (Rouder, Sun, Speckman, Lu & Zhou, 2013; Stenling, Ivarsson, Johnson, & Lindwall, 2015). However, despite Bayesian estimation's usefulness in analysing small sample sizes, the full cross-lagged model with all possible structural paths was too complex for the current sample size. Consequently, we modelled the hypothesised structural paths only (e.g., time 1 sense of coherence; time 2 need satisfaction; time 3 psychological well-being/ill-being). Further, we implemented non-informative priors on the structural paths, and used informative priors for item factor loadings guided by recommendations for the quality of factor loadings (Comrey & Lee, 1992; Gucciardi & Zyphur, 2016). For the cross-loadings between psychological well-being and ill-being correlates, we specified zero mean small variance priors because we expected the latent indicators to have small associations with non-intended latent factors (Asparouhov & Muthén, 2009; Gucciardi & Zyphur, 2016). As in previous research (e.g., Gucciardi & Zyphur, 2016), for the correlated residuals we specified an inverse-Wishart prior distribution *IW* (0, degrees-of-freedom parameter $d = p + 6$).

We used the subscale scores for each of the sense of coherence and need satisfaction dimensions to create two latent factors, “sense of coherence” (time 1: independent variable) and “need satisfaction” (time 2: mediator variable). We created a “positive well-being” latent factor from the combination of the total scores the dependant variables: life satisfaction, subjective vitality, coping effectiveness-performance and coping effectiveness-health (time 3: dependent variable 1). Then, we created an “absence of ill-being” latent factor from the combination of the total subscale scores from the general health questionnaire: social dysfunction, depression, anxiety/insomnia and somatic symptoms (time 3: dependent variable 2). Finally, we ran supplementary analyses with a latent factor “need satisfaction” (time 1: independent variable) and a latent factor “sense of coherence” (time 2: mediator variable).

Results

Descriptive Statistics

We ran a series of multivariate and univariate analyses to assess the influence of age and gender on sense of coherence and basic need satisfaction across time and the dependant variables at Time 3. The results revealed no significant multivariate or univariate effects of age and sex on all variables (*p*s = > .05). We ran repeated measures ANOVA on all variables to investigate differences across time. The results showed that there were no significant differences across time for sense of coherence, basic need satisfaction, life satisfaction, and vitality (*p*s = > .05). Follow up analyses revealed a significant difference across time for psychiatric symptoms (F = 69.46, *p* = <.001), coping effectiveness – performance (F = 6.38, *p* = .002) and coping effectiveness – health (F = 3.5, *p* = .034). Follow up analyses revealed that psychiatric symptoms at Time 1 (M = 23.00, *SD* =11.12) and Time 2 (M = 21.72, SD = 12.14) were significantly higher than at Time 3 (M = 10.02, *SD* = 7.46), *p*s = <.001. Coping effectiveness (performance) at Time 1 (M = 47.18, SD = 7.87) was significantly higher than at Time 3 (M = 44.05, SD = 9.91), *p* = .003. Further, coping effectiveness (health) at Time 1

(M = 47.18 and 57.67, *SD* = 7.87) was significantly higher than at Time 3 (M = 54.75, SD = 12.29), $p = .027$.

Bivariate correlations. Means, standard deviations and bivariate correlations are displayed in Table 5. Sense of coherence was significantly correlated across time and basic need satisfaction was also significantly correlated across time. Sense of coherence was significantly and positively correlated with basic need satisfaction, life satisfaction, subjective vitality and coping effectiveness - performance across time. Basic need satisfaction was significantly and positively correlated with life satisfaction and vitality across time. In addition, basic need satisfaction was significantly and positively related to coping effectiveness – performance across time, except for basic need satisfaction Time 1 which was not significant. Both sense of coherence and basic need satisfaction across time were significantly and negatively associated with psychiatric symptoms across time. See Table 1 in Appendix B for the bivariate correlations across all study variables, including the Time 1 and Time 2 well-being/psychiatric symptom variables.

Canonical Correlations

Canonical correlations demonstrated a significant and considerable conceptual overlap between the sense of coherence and basic need satisfaction dimensions. The magnitude of the canonical correlations and the standardised canonical coefficients for sense of coherence (set 1) and for basic need satisfaction (set 2) are displayed in Table 6.

Table 5

Means (M), standard deviations (SD) and bivariate correlations between observed variables across all three times points.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
Time 1													
Sense of coherence	4.80	.78	-										
Basic need satisfaction	5.29	.63	.75**	-									
Time 2													
Sense of coherence	4.73	.84	.84**	.71**	-								
Basic need satisfaction	5.16	.72	.62**	.74**	.74**	-							
Time 3													
Sense of Coherence	4.79	.84	.73**	.62**	.87**	.63**	-						
Basic need satisfaction	5.19	.73	.51**	.68**	.65**	.76**	.72**	-					
Life satisfaction	25.46	6.37	.32**	.36**	.52**	.45**	.67**	.66**	-				
Subjective Vitality	33.45	8.09	.43**	.56**	.57**	.55**	.68**	.74**	.62**	-			
Psychiatric illness	10.01	7.46	-.48**	-.40**	-.57**	-.45**	-.67**	-.58**	-.44**	-.56**	-		
Coping effectiveness -performance	44.04	9.91	.35**	.43**	.37**	.42**	.31**	.33*	.19	.35**	-.18	-	
Coping effectiveness - health	54.75	12.29	.18	.21	.16	.28*	.13	.19	.17	.24	-.05	.73**	-

Note. **p < 0.01; *p < 0.05. SOC = sense of coherence, BNS = basic need satisfaction, LSAT = life satisfaction, VIT = vitality, PS = Psychiatric Symptoms, CEFF = coping effectiveness – performance, CHEL = coping effectiveness – health.

Table 6

Canonical correlations and standardised canonical coefficients for all three time points.

	Time 1		Time 2		Time 3	
	Canonical Correlation	Canonical Coefficient	Canonical Correlation	Canonical Coefficient	Canonical Correlation	Canonical Coefficient
	.77** (60%)	-	.79** (62%)	-	.78** (61%)	-
	.33 (11%)	-	.43* (18%)	-	.27 (7.2%)	-
	.13 (2%)	-	.14 (1.9%)	-	.06 (0.3%)	-
Set-1						
Comprehensibility	-	-.15	-	-.04	-	-.18
Manageability	-	-.22	-	-.30	-	-.13
Meaningfulness	-	-.45	-	-.66	-	-.52
Relationality	-	-.43	-	-.13	-	-.34
Set-2						
Autonomy	-	-.43	-	-.47	-	-.65
Competence	-	-.51	-	-.50	-	-.48
Relatedness	-	-.33	-	-.21	-	-.03

Note. **p < 0.01; *p < 0.05, % score represents the percentage overlap between set-1 and set-2.

Longitudinal Mediation Models

Need satisfaction and positive well-being. Sense of coherence at Time 1 was significantly associated with basic need satisfaction at Time 2 (*a* = .72, CI = [.44, 1.03]) which in turn was significantly associated with positive well-being (*b* = .44, CI = [.15, .75]). Sense of coherence Time 1 did not directly predict positive well-being at Time 3 (*c'* = .15, CI = [-.20, .49]), but did indirectly predict positive well-being (*a*×*b* = .31, 95% C.I = [.10, .59]) via basic need satisfaction at Time 2 (see Figure 2).

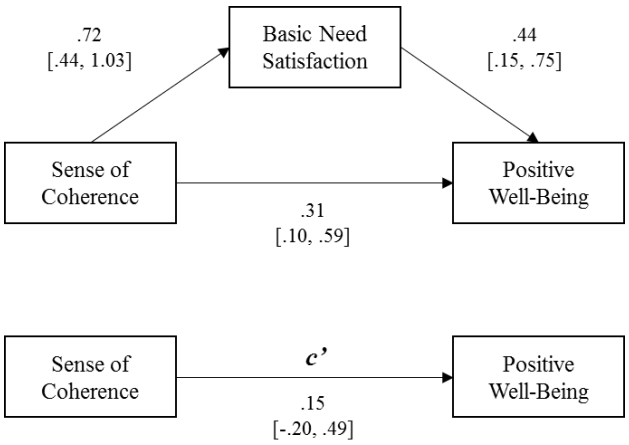

Figure 2. Path coefficients for time 2 basic need satisfaction as a mediator in the relationship between time 1 sense of coherence and time 3 positive well-being.

Need satisfaction and absence of psychiatric symptoms. Basic need satisfaction at Time 2 did not significantly predict the absence of psychiatric symptoms at Time 3 (*b* = -.26, CI = [-.59, .05]). However, there was a significant direct effect of sense of coherence at Time 1 on absence of psychiatric symptoms at Time 3 (*c'* = -.55, CI = [-.93, -.19], see Figure 3).

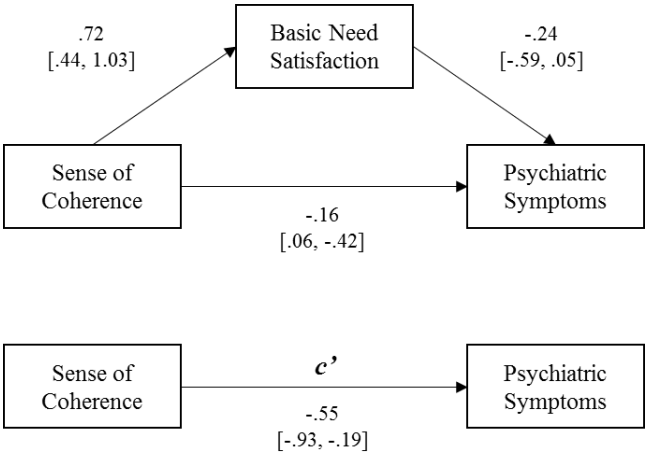

Figure 3. Path coefficients for time 2 basic need satisfaction as a mediator in the relationship between time 1 sense of coherence and time 3 psychiatric symptoms.

Supplementary Longitudinal Mediation Models

Sense of coherence and positive well-being. Basic need satisfaction at Time 1 was significantly associated with sense of coherence at Time 2 (a = .94, CI = [.63, 1.30]), which in turn was significantly associated with positive well-being (b = .35, CI = [.01, .72]). Basic need satisfaction at Time 1 did not directly predict positive well-being at Time 3 (c' = .27, CI = [-.14, .69]), but did indirectly predict positive well-being at Time 3 ($a \times b$ = .33, CI = [.01, .71]) via sense of coherence at Time 2 (see Figure 4).

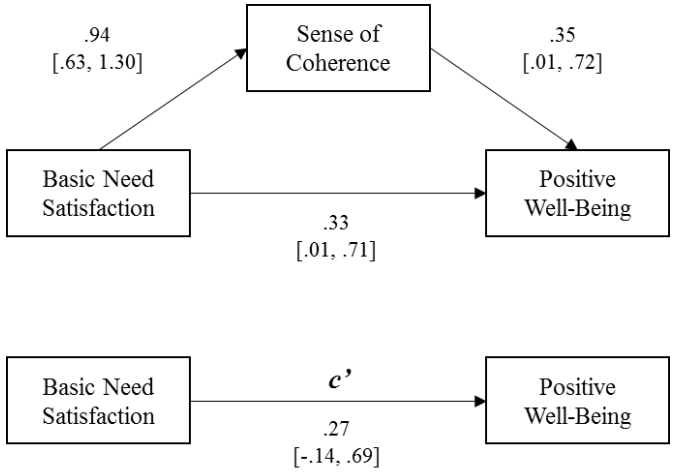

Figure 4. Path coefficients for time 2 sense of coherence as a mediator in the relationship between time 1 basic need satisfaction and time 3 positive well-being.

Sense of coherence and absence of psychiatric symptoms. Sense of coherence at Time 2 significantly predicted the absence of psychiatric symptoms at Time 3 (b = -.55, CI = [-.92, -.21]). In addition, there was a significant indirect effect of basic need satisfaction at Time 1 on absence of psychiatric symptoms at Time 3 ($a \times b$ = -.51, CI = [-.92, -.19]) via sense of coherence at Time 2. There was no significant direct effect of basic need satisfaction at Time 1 on absence of psychiatric symptoms at Time 3 (b = .065, CI = [-.35, .48], see Figure 5).

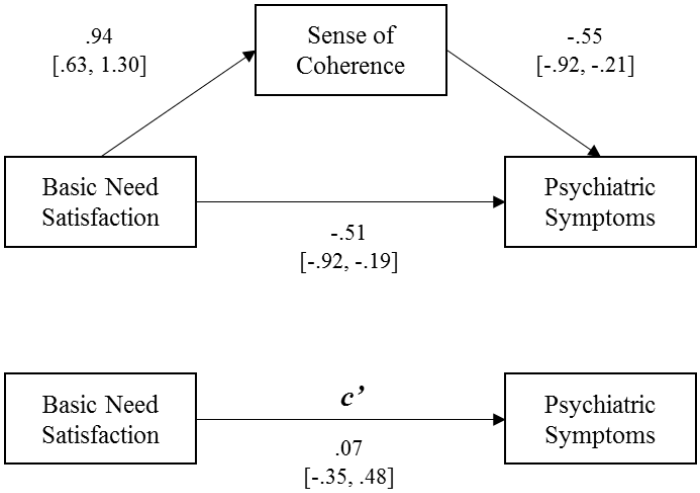

Figure 5. Path coefficients for time 2 sense of coherence as a mediator in the relationship between time 1 basic need satisfaction and time 3 psychiatric symptoms.

General Discussion

Sense of coherence theory (Antonovsky, 1979; 1987) and self-determination theory (Deci & Ryan, 1985) are two different perspectives on health and well-being whose core dimensions appear to share some similarities. However, the theories disagree on their traditional focus. In his original conceptualisation, Antonovsky (1979; 1987) was concerned with how sense of coherence ultimately leads to *survival* in the sense that one has no functional limitation. Conversely, empirical research in self-determination theory has historically focussed on how basic need satisfaction facilitates optimal/positive psychological health and growth orientated behaviour.

The purpose of the present research was first to address the aforementioned dimensionality issue of the sense of coherence scale. Second, to examine whether the dimensions of both theories shared significant conceptual overlap and third, to investigate the longitudinal associations between sense of coherence, basic need satisfaction, and a range of psychological health outcomes. More specifically, we aimed to test whether satisfaction of basic psychological needs mediated the relationship between sense of coherence and (a) positive well-being, (b) psychiatric illness. In line with Antonovsky (1979), we hypothesised that sense of coherence would have an indirect association with optimal/positive well-being (measured via life satisfaction, vitality and coping effectiveness health/performance) via satisfaction of basic psychological needs (hypothesis one). We also hypothesised that satisfaction of basic needs would *not* mediate the relationship between sense of coherence and the absence of psychiatric illness (measured via the general health questionnaire; hypothesis two). This is because Antonovsky assumed sense of coherence to have more of a direct relationship with this referent of mental health.

The current research provided support for the credibility of a four-factor sense of coherence scale, with an additional dimension – *relationality* – representing the extent to

which one has the general orientation that they understand the behaviour of the people within their social environment and that there are people whom they can count on. Results showed considerable conceptual overlap (60%) among the dimensions of sense of coherence and basic needs perspectives. In addition, this research found support for hypothesis one and two. That is, satisfaction of basic needs significantly mediated the relationship between sense of coherence and optimal well-being, but failed to mediate the relationship between sense of coherence and psychiatric symptoms. In line with Antonovsky's (1979) assumption, the mediation analyses also indicated that sense of coherence was significantly and directly associated with lower levels of psychiatric symptoms. Further, supplementary mediation analyses revealed that sense of coherence was a significant mediator in the relationship between basic need satisfaction and optimal well-being as well as basic needs and psychiatric symptoms.

Broader Implications

These results raise a number of interesting theoretical implications. First, our findings suggest that sense of coherence is more significantly associated with lower levels of psychiatric illness than basic psychological needs satisfaction. We also found that optimal well-being is only partially determined by feeling autonomous, competent and related, but to an important extent by sense of coherence. These findings appear to challenge the view that both optimal and sub-optimal forms psychological functioning can be explained by a single underlying principle (i.e., basic psychological need satisfaction and frustration; Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013).

We offer possible theoretical explanations for our findings. First, in the current research the comprehensibility dimension was least related to the canonical correlation between sense of coherence and basic needs. This finding is not surprising given that the measurement of the basic psychological needs satisfaction appears to have less cognitive

emphasis that sense of coherence theory. We suggest however that the cognitive capacity of sense of coherence plays a crucial role in predicting lower levels of psychiatric illness. In line with this principle, other major theoretical concepts emphasise *clarity* and *certainty* as important dimensions in the interpretation of adverse life situations (Lazarus & Folkman, 1984). That is, to manage (or cope) effectively, one needs to have an adequate understanding of life's demands (Cederblad, Dahlin, Hagnell & Hansson, 1994). Individuals who have a strong sense that "the stimuli deriving from one's internal and external environments are structured, predictable and explicable" (Antonovsky, 1987, p. 19), will be less likely to perceive uncertainty in encounters of negative events. Inadequate understanding limits the possibilities of finding suitable solutions to stressors, even when appropriate resources are available. Second, with regard optimal well-being, we suggest that those who have a global orientation that "life is coherent and makes emotional sense" will (a) be more able to identify and attend to need satisfying experiences and (b) have a natural bias in viewing their needs as more or less satisfied.

This research suggests that sense of coherence has capacity to explain both absence of psychiatric illness as well as optimal/positive well-being. In contrast, satisfaction of basic needs seemed to exert its influence only on the latter. These findings reflect the traditional position of sense of coherence and self-determination theory. That is, to *thrive* (i.e., to be integrated, satisfied and vital), it is important for us to feel autonomous, competent and related, but to *survive* the countless stressors with which we as human beings are constantly confronted, it is important for us to feel that life is somewhat comprehensible, manageable and meaningful (Antonovsky, 1987). Therefore, we propose that for individuals who are experiencing significant negative life events, focus on sense of coherence paradigms may be more useful for intervention than need satisfying experiences. This is important because research has shown that for those who have suffered childhood adversity and violence

exposure, sense of coherence can act as a protective factor from psychopathology in later life (Cederblad, Dahlin, Hagnell, & Hansson, 1995; Honkinen et al. 2009; Koposov, Ruchkin & Eisemann, 2003). Future clinical based research would do well to examine the effectiveness of integrating sense of coherence paradigms into trauma-informed interventions, such as cognitive behavioural therapy. This may be especially important for populations at risk (i.e., children from deprived backgrounds), for those who have traits that characterise their inability to interpret aspects of their internal and external environments (e.g., individuals with alexithymia and autism spectrum disorder), and for those with neurobehavioral disorders that often lead to poor peer-relations, aggression and learning problems (e.g., attention deficit hyperactivity disorder (Edbom, Malmberg, Lichenstein, Granlund & Larsson, 2010).

Researchers have questioned self-determination theory's ability to adequately explain the "dark side" of human activity, further stating that this was not the original intended application of basic psychological needs (Pyszczynki, Greenburg & Solomon, 2000). Our findings partially support this idea, however, the current research did not investigate the effects of need thwarting (i.e., need frustration) on well-being and psychiatric symptoms. Vansteenkiste and Colleagues (2013) argued that "unfulfilled needs may not relate as robustly to malfunctioning as frustrated needs may" (pg. 265). According to self-determination theory, there is an important distinction between need satisfaction and need thwarting. Specifically, need thwarting is the experience that something is actively obstructing (i.e., thwarting) need satisfaction, whereas low need satisfaction is the feeling of being "dissatisfied" (e.g., "I feel non-related"; Bartholomew et al., 2011). Indeed, some research has demonstrated significant associations between need thwarting and negative affect (Bartholomew, Ntoumanis, Ryan, Bosch & Thøgersen-Ntoumani, 2011; Gunnel, Crocker, Wilson, Mack & Zumbo, 2013). As such, it would be interesting for future research to investigate the relationship between need thwarting, sense of coherence and subsequent psychopathology. Given the findings from

previous research, which demonstrates the stress buffering capabilities of sense of coherence (e.g., van der Hal-van Raalte et al., 2008), we suggest that sense of coherence would have a moderating effect on this relationship.

There is an impressive body of research demonstrating the significance of basic psychological need satisfaction in the prediction of a number of positive outcomes. In education, research has repeatedly demonstrated the effectiveness of autonomy supportive classroom environments (e.g., Reeve & Jang, 2006; Reeve, Jang, Carrell, Jeon & Barch, 2004). We suggest that this domain is a good example of where need supportive and sense of coherence reinforcing frameworks can complement each other to achieve desirable (high-level) outcomes. For example, it may be beneficial for teachers to nurture inner motivational resources (i.e., autonomy support) using clear messages, ensuring that expectations are understood (i.e., comprehensibility support) and that students are aware of resources available to help meet educational demands (i.e., manageability support).

As in previous work (cf. Eriksson & Linström, 2006) our findings demonstrate the significance of sense of coherence in the prediction of both lower levels of psychiatric symptoms and optimal forms of well-being. As such, we suggest that future research might evaluate the rationale for sense of coherence as an additional fundamental need. As discussed in the introduction, Ryan and Deci (2000) have previously dismissed this idea, because in line with the process of organismic integration (Deci & Ryan, 1985), they assume that sense of coherence happens structurally through greater experiences of autonomy or integration. However, Antonovsky (1984) highlights that life experiences need not be intrinsically satisfying to reinforce a sense of coherence. After all, he was not concerned with the most desirable dimensions of health or “utopian” goals. For example, he suggested that “people may find little joy in their work, but if they feel that the work has a meaning because it is how they support their family and keep it functioning smoothly and happily, they can still have a

strong sense of coherence" (Antonovsky, 1984, p. 120). Nevertheless, how one structurally achieves sense of coherence should not be central to the argument against its position as a basic need. Especially given that the structural equivalency of autonomy, competence and relatedness has also been challenged (e.g., competence is not valuable unless it reflects self-determination; Carver & Scheier, 2000). In our view, sense of coherence has potential to do well against Baumeister and Leary's (1995) meta-theoretical perspective of what constitutes a fundamental need.

Limitations

There are, of course, several limitations to our research. The final sample in Study 2 was particularly small (n = 67). Therefore, questions remain about the generalisability of our findings. Future research is required to test the factor structure of the sense of coherence scale and the main longitudinal hypotheses reported in this study, with a larger sample size, and in a number of different samples that are relevant to the theoretical underpinning of sense of coherence theory (e.g., people who have experienced significant psychological trauma). Nevertheless, we aimed to overcome the sample size concern by using Bayesian structural equation modelling (BSEM). Specifically, research has shown that in BSEM, the posterior predictive p value performs better with small sample sizes than the maximum likelihood chi square statistic (De Bondt & Van Petegem, 2015; Lee & Song, 2004; Muthén & Asparouhov, 2012). However, despite using BSEM, we were still unable to perform the full cross-lagged mediation model (i.e., all measurements at all time points) recommended by Cole and Maxwell (2003). This may be because the number of parameters in our analyses exceeded the number of latent indicators. Consequently, an additional limitation of this study includes the failure to control for prior assessments of the mediator and outcome variables, and the potential bias that can occur as a result. Another limitation includes the possible problem of capitalisation on chance. Specifically, we used the same data in several analyses to explore

the factor structure of the sense of coherence scale. However, these analyses were conducted in an exploratory fashion, and thus further research is warranted to confirm the factor structure proposed in the present research. Further, although BSEM has demonstrated its capabilities of analysing small sample sizes without compromising power, to the best of our knowledge no research has investigated optimal combinations of sample size to degrees of freedom. Therefore, little is known about the susceptibility of the PP*p* value to the number of observations, and the performance of BSEM estimation with varying sample sizes (De Bondt & Van Petegem, 2015). Finally, it is important to note that there are additional models that were not tested in the current research, for example, we did not test an alternative reciprocal model of how well-being might influence the independent and mediating variables. This should be considered for future research.

Conclusion

This research was the first to examine the relationship between basic need satisfaction, sense of coherence and psychological health. First, we found that the sense of coherence and basic need dimensions share significant overlap. Second, in a series of longitudinal mediation analyses we found that sense of coherence exerts its influence on optimal/ positive well-being (i.e., life satisfaction, vitality, coping effectiveness performance/health) indirectly via basic need satisfaction. However, basic need satisfaction failed to mediate the relationship between sense of coherence and (absence of) psychiatric disorder. Third, in support of Antonvsky's (1979) hypothesis, sense of coherence had a significant direct effect with this well-being referent.

Chapter 4 - General Discussion

Summary of Results

The present chapter aims to briefly remind the reader about the main objectives of the current thesis before discussing the results obtained from the two experimental chapters (Chapters 2 and 3) in a broader theoretical context. The theoretical and applied implications of the thesis are discussed as well as the overall strengths and limitations. Then, possible directions for future research are presented, followed by a conclusion.

Chapter 1 briefly overviewed self-determination theory (Deci & Ryan, 1985; 2000) and highlighted theoretical limitations which required further research attention. The research in the present thesis focussed on the requirement for empirical study regarding self-determination theory's universality of basic needs hypothesis, the conceptual overlap between the social-cognitive dimensions defined within self-determination and sense of coherence theory and the relationship between the two theories regarding psychological functioning (Antonovsky, 1979; 1987).

Chapter 2 had three main objectives (i) to examine whether individual differences in the importance of the basic psychological needs significantly influenced the relationship between need satisfaction and self-determined motivation, (ii) to examine whether individual differences in the importance of the basic psychological needs significantly influenced the relationship between need satisfaction and general well-being (measured via self-esteem and depression) and (iii) to compare two statistical approaches (i.e., idiographic vs nomothetic). On the one hand Studies 1, 2 and *part one* of Study 4 of Chapter 2 demonstrate the significance of intra-individual differences (i.e., ideographic) in basic need importance (i.e., importance of importance) in the relationship between need satisfaction and self-determined motivation for a particular activity. These findings contradict the universal benefits position and instead offer strong support for the importance of intra-individual importance with

regards to basic psychological needs. On the other hand in Studies 3 and 4 we showed that for the general population, the effects of need satisfaction on general well-being were equal for all people regardless of the importance attached to each need. However, in Studies 1 and *part one* 4 we show that for individuals with a unidimensional sense of identity, the association between need satisfaction (via an important activity) and general well-being depends on the intra-individual level of need importance. We conclude that these findings collectively support the position that the basic psychological needs are not always universally required for motivation and well-being.

Chapter 3 of the present thesis aimed to (i) address the dimensionality issue of the sense of coherence scale, using a BSEM approach to confirmatory factor analysis (ii) test whether the dimensions described by sense of coherence and basic need satisfaction shared significant conceptual overlap and (iii) to investigate the longitudinal associations between sense of coherence, basic need satisfaction, and a range of psychological health outcomes (i.e., positive well-being and psychiatric illness). First, results from Study 5 provided support for the credibility of a four-factor sense of coherence scale, with an additional dimension representing the extent to which one has the general orientation that they understand the behaviour of the people within their social environment (social comprehension) and that there are people whom they can count on (social manageability). This additional fourth factor was termed – *relationality.* Second, results demonstrated considerable conceptual overlap (60%) amongst the dimensions of sense of coherence and basic need satisfaction. Third, satisfaction of basic needs significantly mediated the relationship between sense of coherence and optimal well-being (measured via life satisfaction, vitality and informant rated coping effectiveness health/performance), but failed to mediate the relationship between sense of coherence and the absence of psychiatric symptoms. However, analyses revealed that sense of coherence was directly associated with lower levels of psychiatric symptoms.

Theoretical and Methodological Implications

Basic needs are not always universally required

The most significant theoretical implication of this thesis concerns self-determination theory's universality of basic needs hypothesis. Self-determination theorists assume that individual differences in need importance have little or no influence on how much one benefits from need satisfaction (Deci & Ryan, 2000). However, in line with Vallerand's (2000) position, the findings from this research suggest that it is a rather important issue to examine individual differences in basic need strength, because these differences can have important implications for motivation and general well-being.

Specifically, the findings from the present thesis highlight an interesting dichotomy between the importance of importance hypothesis (e.g., Hardy & Moriarty, 2006; James, 1890; Pelham & Swann, 1995) and the universality hypothesis with regard to the satisfaction of basic psychological needs (e.g., Deci & Ryan, 1985; 2000). On the one hand, in the totality of one's experiences, where one does not have a unidimensional sense of identity attached to a single activity, the three basic psychological needs appear to be universally important for well-being, regardless of individual differences in need importance. On the other hand, intra-individual differences in the importance of basic psychological needs play a key role in the attainment of domain-specific enhancements (e.g., motivation). Furthermore, when one has a unidimensional sense of identity, individual differences in need importance also play a key role in the attainment of general well-being enhancements. These findings thus appear to contradict the universal benefits position (Deci & Ryan, 1985; 2000; Chen et al., 2015), and instead contribute to the series of empirical work from other theoretical traditions that demonstrate that the effects of need satisfaction on motivation and domain specific well-being are influenced by individual differences in personality (i.e., behavioural dispositions;

Hofer & Busch 2011, Schüler & Kuster, 2011; Schüler, Sheldon & Frölich, 2010; Schüler, Wegner & Knechtle, 2014b).

Basic need satisfaction does not explain absence of psychiatric illness

Self-determination theory has primarily focused on need-supportive environments that contribute to psychological growth through need satisfaction. However, more recently, researchers hypothesise that need supportive contexts can also play a buffering role against the emergence of malfunctioning, through building inner resources that contribute to subsequent coping (Vansteenkiste & Ryan, 2013). However, results from Study 5 suggest that satisfaction of basic needs has no relationship with the absence of psychiatric symptoms, but that sense of coherence is capable of explaining both absence of psychopathy and optimal well-being. The present thesis appears to widen the view that all psychological functioning can be explained by a single underlying principle (i.e., basic psychological need satisfaction and frustration; Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013), and instead suggests that sense of coherence plays an important role in one's overall levels of psychological functioning.

As in other research, results from Chapter 3 show that need satisfaction has little or no association with the low levels of ill-being (e.g., Adie et al., 2008; Bartholomew Gagne, Ryan & Bargmann, 2003). That said, researchers have more recently suggested that "unfulfilled needs may not relate as robustly to malfunctioning as frustrated needs may" (Vansteenkiste & Ryan, 2013, p. 265). Therefore, future research could investigate the relationship between need thwarting (i.e., the active obstruction of basic need satisfaction), sense of coherence and subsequent psychopathology. Nevertheless, the present findings suggest that the dimensional structure of sense of coherence more adequately taps into the absence of psychiatric illness than self-determination theory. This is because sense of coherence speaks to the importance of how one comprehends and makes sense of their life experiences, including the difficult

and traumatic. As such, sense of coherence may play a crucial role in bridging the gap between pathological functioning and human thriving.

Furthermore, Chapter 3 suggests that sense of coherence is a significant predictor of pathological functioning and subjective well-being (e.g., coping effectiveness, life satisfaction and vitality). Thus, from alternative perspective of the present findings, sense of coherence could also be considered as candidate for an additional fundamental need. According to Baumeister and Leary (1995), a fundamental need should: "(a) produce effects readily under all but adverse conditions, (b) have affective consequences, (c) direct cognitive processing, (d) lead to ill effects (such as on health or adjustment) when thwarted, (e) elicit goal-oriented behaviour designed to satisfy it (subject to motivational patterns such as object substitutability and satiation), (f) be universal in the sense of applying to all people, (g) not be derivative of other motives, (h) affect a broad variety of behaviours, and (i) have implications that go beyond immediate psychological functioning" (pg. 498). Although it is beyond the data of the current thesis to provide evidence to support those criteria. It may be a worthwhile for future research to examine sense of coherence against those meta-theoretical requirements. In line with this perspective, other researches have argued that there is a fundamental need to comprehend (comprehensibility) and make sense of life experiences (meaningfulness), to feel secure, safe and to believe one will be able to survive and thrive, physically and psychologically (Carver & Scheier, 2000).

Does self-determination theory apply to everybody?

Basic psychological needs theory (Deci & Ryan, 1985; 2000) emerged from many other motivational theories that focus on aspects of human development and growth. Therefore, the study of basic need satisfaction lends itself well as a framework for the field of positive psychology. On the other hand, the origin of sense of coherence emerged from the study of malfunctioning following the extreme trauma of the World War II concentration

camps, and is thus different to the humanistic, positive psychology, origin of basic psychological needs theory. More specifically, the foundational rationale underpinning sense of coherence is that the human environment causes strain, and that stress and chaos are universally experienced. As such, Antonovsky (1979; 1995) was not concerned with happiness, or well-being beyond the concept of survival (i.e., the absence of ill health). He was instead more concerned with people's capacity to stay well despite life's difficulties. The essence of our findings reflect the traditional position of sense of coherence and self-determination theory. That is, to *survive* the countless stressors with which we as human beings are constantly confronted, it is important for us to feel that life is somewhat comprehensible, manageable and meaningful (Antonovsky, 1987). But to *thrive* (i.e., to be integrated, satisfied and vital), it is also important for us to feel autonomous, competent and related.

These findings have broader implications for an overwhelmingly large number of people who live in particularly stressful conditions. For example, in 2015 the United Kingdom alone had an estimated 7.3% of individuals living in conditions characterised by severe deprivation of basic human needs; including food, water, sanitation facilities, health, shelter, and education (ONS, 2017). In such circumstances, it is perhaps especially important for *survival* to have a strong sense of coherence and relatively fruitless for individuals to take part in the pursuit of basic psychological need satisfaction. In line with this idea, Deci and Ryan (2000) tentatively suggest that self-determination theory hypotheses only hold once one is above poverty level.

Studies 1 to 4 of Chapter 2 consistently demonstrated support for the importance of importance in domain specific enhancements (i.e., motivation). Furthermore, when one has a unidimensional sense of identity, intra-individual differences in need importance also play a key role in the attainment of general well-being enhancements. Thus for exceptionally high

achievers, who often place a particular competence domain above all other life domains (Hardy et al., 2017, Moriarty, 2000), self-determination theory's universal benefits position may not apply. In line with this theorising, other research shows self-determined motivation may not always apply to extraordinarily high level performers (e.g., super elite athletes), instead, more obsessive of forms of motivation appear to be stronger predictors of deliberate practice and performance (Hardy et al., 2017). Future research is needed to test whether the effectiveness of interventions that aim to enhance motivation and performance through basic need satisfaction, benefit more from interventions that target the individual performer's most important needs.

The importance of intra-individual importance

Over 100 years ago James (1890) proposed that self-views in areas that are perceived to be most important should have greater effect on self-esteem compared to less important life areas. Despite its "common sense" supposition, original empirical work failed to demonstrate support for James's individual-importance hypothesis (e.g., Marsh, 1986; Marsh & Sonstroem, 1995). Several researchers have argued that these findings were largely explained by methodological weaknesses. That is, previous research utilized 'inappropriate' nomothetically-derived statistical approaches instead of a more relevant ideographic (i.e., intra-individual) patterning of people's importance ratings (Hardy & Moriarty, 2006; Hardy & Leone, 2008; Lindwall, Aşçi, Palmeira, Fox & Hagger, 2011; Pelham & Swann, 1989). Research utilising idiographic analyses show that self-views in domains scored as intra-individually more important, are stronger predictors of global self-esteem compared to the less important self-concept domains.

This methodological problem is not limited to research in self-esteem. Specifically, recent work by Chen and Colleagues (2015) examined the universal basic needs hypothesis by testing the moderating effect of individual differences in basic need importance with a

nomothetically-derived approach and found no importance effect. The aim of the current thesis was to examine individual differences in need importance with nomothetic and idiographic importance scores. In line with previous research, Chapter 2 consistently showed no importance effects when using nomothetically derived analyses, but showed support for the importance of importance with regards to basic needs when using an idiographic approach. Interestingly, research by Hardy and Moriarty (2006) also found that for particular domains (i.e., physical appearance) importance of importance may not always apply. For example, despite showing that body attractiveness was a strong predictor of global self-esteem, individuals generally rated body attractiveness as low in importance. Hardy and Moriarty (2006) suggested that group norms and societal pressures might influence the accuracy of self-reported importance scores because of the influence of denial. Research should thus consider such influences when assessing self-ascribed importance. Nevertheless, the findings from this thesis have significant implication for the usefulness of ideographic intra-individual statistical approaches.

Applied implications

The findings from Chapter 2 suggest that it is more beneficial for motivation, to satisfy the basic needs of high relative importance. Thus, our findings could have potentially significant implications in understanding the enhancement of motivation in a high performance setting. Coaches and managers should focus on providing opportunities that satisfy athletes and employees most important needs, in order to enhance motivation and subsequent performance. This may be especially important in the moments before competition, because pre-competition need satisfaction is associated with increased levels of performance during competition (Sheldon et al., 2013).

Evidence from Chapter 2 also suggests that when an individual's sense of identity is contingent upon their investment in a single domain, it is more beneficial for general well-

being to satisfy the basic needs of high relative importance. Such a narrow focus in life has its advantages for performance, for example, Hardy and Colleagues' (2017) research shows that super-elite athletes, who have extraordinary levels of motivation, place the importance of sport above all other life domains. However, a unidimensional life can certainly have disadvantages with regard to general well-being. Specifically, research suggests that individuals who "put all their eggs in one basket" will suffer disproportionately from failure and/or need frustration, when global well-being is contingent upon a single need or domain (Coakley, 1992; Milyavskaya et al, 2009; Sheldon & Niemiec, 2006). This is because, when a person allocates a large proportion of resources to a highly important life domain or need, it leaves very little opportunity to compensate for unsatisfied needs in other life domains. Therefore, from a psychological well-being perspective, it is important to experience need satisfaction across many areas of life, to allow for multi-dimensional identities and more opportunities to compensate for domain specific difficulties (Moriarty, 2002).

In line with the above suggestion, research shows that athletes who have a wide range of personally valued life domains, have the capacity to minimise the impact of the psychological stress associated with serious injury (Moriarty, 2002). However, cooperate executives whose competence valuation relies on a limited range of activities, cope poorly as a result of bad performance within those domains (Moriarty, 2002). From a mental health perspective, high level athletes and employees who are at risk of developing unidimensional identities should be encouraged to develop interests outside of the high performance context (Coakley, 1992, Moriarty, 2002). The same appears to apply to education, for example, Milyavskaya et al (2009) show that, for adolescents, need satisfaction within a life domain suspected to be of relatively high importance (i.e., friendship groups) predicted lower adjustment to education and increased intentions to drop out of school.

Furthermore, the psychological makeup of individuals with unidimensional identities could elicit maladaptation and poor psychological adjustment. For example, researchers suggest that when the basic needs are persistently frustrated, people can develop compensatory responses including the development of rigid behaviour patterns such as adopting perfectionistic standards in an attempt to prove one's worth (Vansteenkiste & Ryan, 2013). For these individuals, engagement in a highly important activity can become rigid, obsessive and subsequently overwhelm ones sense of identity (Bélanger, Marc-André, Lafrenière, Vallerand & Kruglanski, 2012). Whilst, perfectionistic standards and obsessiveness are characteristics of extraordinarily high achievers (e.g., super elite athletes; Hardy et al, 2017) and almost certainly lead to higher levels of performance in that activity (Bélanger et al., 2012), this type of functioning can temporarily distract the deeper problems of need thwarting and/or early life trauma.

From a general well-being perspective, clinicians and therapists should emphasise cognitive reconstruction strategies that encourage individuals to positively reappraise the importance of multiple life areas as well as their least important basic needs. This approach could help strengthen a person's self-concept and coping skills for when failure threatens self-worth (Bélanger et al., 2012), or when the individual is forced to withdraw participation from an activity contingent to one's self-identity (Craven, Marsh & Debus, 1991; Lazarus & Folkman, 1984; Moriarty, 2002). This is particularly important for people who often neglect aspects of life because of a particularly strong dependency on their participation in a single activity (Hardy et al, 2017; Lalande et al, 2017; Moriarty, 2002; Sheldon & Niemiec, 2006).

Research shows that experiences of childhood adversity (Basto-Pereira, Miranda, Ribeiro & Maia, 2016) and poor sense of coherence (Ristkari, Sourander, Ronning, Elonheimo, Henrik, Helenius & Salokangas, 2009) are associated with psychosocial problems in young adulthood, high levels of anti-social and rule breaking behaviour, and

criminal offence. Need satisfying experiences are said to lead to a sense of wellness and the building of inner resources that underlie resilient behaviour (Vansteenkiste & Ryan, 2013). However, the findings from Chapter 3 suggest that, for populations at risk (i.e., children from deprived backgrounds), it may be more beneficial for clinical based interventions to integrate sense of coherence paradigms into trauma-informed interventions, such as those that promote cognitive skills training through perspective thinking and cognitive restructuring (Ristkari, et al, 2009). This is important because sense of coherence can act as a protective factor from psychopathology in later life for those who have suffered childhood adversity (Cederblad, Dahlin, Hagnell, & Hansson, 1995; Honkinen et al. 2009; Koposov, Ruchkin & Eisemann, 2003).

Directions for Future Research

Buunk and Nauta (2000) suggest that, in line with the dual-concern model (Rubin, Pruitt, & Kim, 1994) which discriminates between "concern for own goals" and "concern for goals of others", the needs for autonomy and relatedness are incompatible. Although self-determination theory does not consider these two needs as incompatible, there are certainly conditions under which these need can become so (Buunk & Nauto, 2000). Dual concerns model describes environments where this incompatibility can occur, namely in social situations where the "need for autonomy of Person A can lead to the "thwarting" of the need for autonomy of Person B when A wants something that conflicts with what B wants" (Buunk & Nauto, 2000, pg. 280). Thus, when a person's most important needs are, in theory, incompatible, what effect does this have on psychological well-being? Does an individual's most important need offer any insight into the prediction of ones least important need? For example, is one high in the need for autonomy or competence, pre-disposed to have less of a concern for being accepted by others? To what extent does a person's cultural background and/or personality have any predictive significance over self-ascribed importance in basic

needs? For instance, one might expect that a person who has a tendency to be compassionate, cooperative, and often willing to compromise self-interests for others (agreeableness: Rothmann & Coetzer, 2003), may also have a strong need for relatedness.

Future research should examine the importance of intra-individual importance in need thwarting. Specifically, using the recently developed need satisfaction/frustration scale (Bartholomew et al., 2011; Chen et al., 2015), researchers could examine the effect of intra-individual differences in need importance on the relationship between need frustration and maladaptation/general psychological health. Other research could investigate the relationship between need thwarting, sense of coherence and subsequent psychopathology. Given the findings from previous research, which demonstrates the stress buffering capabilities of sense of coherence (e.g., van der Hal-van Raalte, van IJzendoorn & Bakermans–Kranenburg, 2008), sense of coherence should have a moderating effect on this relationship.

Research suggests that adversity-related experiences (e.g., family dysfunction) and associated trauma are an important ingredient for superior levels of performance (e.g., Olympic/gold medallist performance; Sarkar, Fletcher & Brown, 2015; Hardy et al., 2017). More specifically, intense negative emotions associated with trauma (e.g., anger), motivate the individual's subsequent effort to perform at the highest level (Sarkar, Fletcher & Brown, 2015; Woodman et al., 2009). Other research shows that an experience of loss (e.g., the death of a family member), can actively damage need satisfaction (e.g., the need to belong; Felton & Jowett, 2014) and manifest itself a need to succeed to a high level, in order to prove ones worth of love that one was once deprived (Bowlby, 1977; Hardy et al., 2017). Future research might do well to examine the extent to which early life experiences of need thwarting and/or need dissatisfaction characterise high level performance

Researchers suggest that individuals who are imprisoned at a young age, are less likely to develop independent self-identities (Travis & Waul, 2003) and more likely to

experience need obstruction (Mandracchia & Smith, 2015), and over time, lose the ability to initiate their own behaviour (Haney, 2002, Travis & Waul, 2003). Therefore, when institutional controls are removed, and autonomy and freedom are relinquished, these individuals often experience painful post-prison adjustment, that can lead to post-traumatic stress reactions, harmful behaviour and re-offence (Haney, 2002, Travis & Waul, 2003). In such circumstances (i.e., severe psychological need deprivation and isolation), it is perhaps extremely important to build a sense of coherence, ensuring that these individuals understand themselves in a life post-imprisonment (i.e., comprehensibility support) and that they are aware of resources available to help with personal and social re-adjustment (i.e., manageability support). In line with this idea, it may be interesting for future research to examine the effectiveness of sense of coherence paradigms incorporated into re-integration programs that aim to reduce harmful behaviour post incarceration.

Strengths and Limitations of the Thesis

One limitation of this thesis includes the exclusive reliance on ‘e-questionnaires’ for data collection. That said, the use of online data collection for behavioural sciences has increased over the last several years and ‘e-questionnaire’ data collection methods have proved to be more effective in obtaining large sample sizes (Wright, 2005). From a global research training perspective, I was grateful to have the opportunity to be involved in a number of additional research projects, some of which involved more personal (face to face) approaches to data collection:

1. ‘The Development and Validation of a Measure of Mental Robustness for Military Operations’*:* Simpson, Roberts, Hardy, **Glendinning**, Holt and Downing (manuscript under review).

2. ‘Coaches Coaching Psychological Skills – Why not? A Framework and Questionnaire Development’: Poyner, Roberts, **Glendinning** and Callow (manuscript under review).
3. ‘Back to Basics: Distinguishing Anxiety and Depression’: **Glendinning**, Woodman and Ng (manuscript under review).
4. Psychosocial indicators of recovery from anterior cruciate ligament reconstructive surgery (manuscript in preparation). This project is in collaboration with Prof. Lew Hardy, Dr Lyne Evans and Tom Williams (Ph.D. researcher).

Another important limitation of the thesis is that it did not employ any true experimental design or incorporate the use of qualitative analyses, both of which would have been beneficial for developing a broad research experience. Nevertheless, the methodological approaches applied in this thesis have helped develop my proficiency for the use of complex and advanced statistical analyses.

The current research relied on the use of explicit self-report measures. Theoretical assumptions of the explicit measure approach are that the motivations of behaviour are consciously known (Levesque & Brown, 2007). However, it is well established within theories of social cognition that psychological processes have an implicit aspect that represent non-conscious motivations that can be activated automatically (Levesque & Brown, 2007). I regret not having enough time to incorporate an implicit measurement into this thesis, however, because of the methodological problem discussed in Chapter 2, this would have required the development of a new implicit need importance measurement; a Ph.D. in itself.

There are several strengths to this thesis; overall the two empirical chapters incorporate rigorous design and analysis, including the use of Bayesian structural equation modelling for confirmatory factor analysis; intra-individual, longitudinal and cross-lagged designs; and the use of informant reports. Studies 1 to 4 are the first studies to demonstrate

the importance of individual differences in basic need strength in an explicit operationalisation congruent with the needs described by self-determination theory. Data from those studies have significant implications for self-determination theory's universal benefits position. To the best of the current researcher's knowledge, Study 5 is the first study to form hypotheses regarding the longitudinal relationship between sense of coherence and self-determination theory. Furthermore, studies 1 to 4 were written as a single multi-study paper and submitted for publication, which allowed the researcher to assess the research question in significant depth. Additionally, from a research training perspective, this thesis has provided the current researcher with a magnitude of learning experiences, the opportunity to submit work to a high-impact journal, and developed the researcher's knowledge about the culture of high-quality research (3*, 4* standard for research excellence framework).

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Appendices

Appendix A - Measurement Invariance

Analytical Strategy

We examined longitudinal approximate measurement invariance (cf. Muthén and Asparouhov, 2013; Chiorri, Day & Malmberg, 2014) of the four-factor sense of coherence scale validated in the current research and the basic need satisfaction – in general scale in three separate models testing: (i) the factor structure (configural invariance); (ii) factor loadings (metric invariance); and (iii) item intercepts (scalar invariance).

We estimated all BSEM with Markov Chain Monte Carlo (MCMC) simulation procedure with a Gibbs sampler and a fixed number of 100,000 iterations for two MCMC chains (Gelman et al., 2013). For the correlated residuals we specified an inverse-Wishart prior distribution *IW* (0, degrees-of-freedom parameter *d*) with $d = p + 20$. We varied three different levels of approximation by specifying zero mean small variance priors of .05, .01 and .005 on the factor loadings (metric invariance), item intercepts (scalar invariance) and then the combination of factor loadings and item intercepts (metric + scalar invariance). We used the fit indices outlined in the current research and used the deviance information criteria (DIC) to compare BSEM. Any parameters that differ significantly from the priors between Time 1, 2 and 3 are highlighted in the Mplus output.

Results

Time Invariance of the Sense of Coherence Scale

Fit statistics are displayed in Table 1. The test for configural invariance indicated excellent fit. The test for approximate metric invariance (factor loadings) resulted in excellent fit at all prior distributions (.05, .01 and .005) and the DIC values showed no meaningful difference in model comparisons. The test for approximate scalar invariance (item intercepts) also resulted in excellent fit at all prior distributions and the DIC value showed support for a the model with a prior distribution of .005, as the preferred model. The test for approximate metric and scalar invariance resulted in excellent model fit and the DIC value showed support

for a more parsimonious model with a prior distribution of .005 (see Table 2 for standardised factor loadings and item intercept scores). Further, the Mplus output indicated that no parameters were invariant (see Tables 3 and 4 for difference scores).

Time Invariance of the Basic Need Satisfaction – in General Scale

Fit statistics are displayed in Table 1. The test for configural invariance indicated good fit. The test for approximate metric invariance (factor loadings) resulted in good fit at all prior distributions (.01, .005 and .005) and the DIC statistic showed no meaningful difference in model comparisons. The test for approximate scalar invariance (item intercepts) also resulted in excellent fit at all prior distributions and the DIC value showed support for the prior distribution of .005 as the preferred model. The test for approximate metric and scalar invariance combined resulted in excellent model fit and the DIC value showed support for a more parsimonious model with a prior distribution of .005 (see Table 5 for standardised factor loadings and item intercept scores). Further, the Mplus output indicated that no parameters were invariant (see Tables 6 and 7 for difference scores).

Table 1

Model-data fit indices for Bayesian approximate measurement invariance models

			Observed and replicated χ^2 *95% CI*					
	λ prior	ν prior	2.5% PP*p*	97.5% PP*p*	PP*p*	DIC	PSR	Iterations
Sense of Coherence Scale:								
Configural	-	-	-135.94	140.68	.481	12921.22	1.00	3600
Metric (approx. MI)	.005	-	-146.38	131.35	.543	12956.89	1.00	6500
Metric (approx. MI)	.01	-	-146.85	130.74	.547	12957.55	1.00	6300
Metric (approx. MI)	.05	-	-144.84	130.38	.542	12956.46	1.00	3600
Scalar (approx. MI)	-	.005	-145.29	130.97	.540	12935.58	1.00	3600
Scalar (approx. MI)	-	.01	-148.12	127.22	.559	12939.58	1.00	3600
Scalar (approx. MI)	-	.05	-144.84	130.38	.542	12956.46	1.00	3500
Metric and scalar (approx. MI)	.005	.005	-154.99	121.59	.604	12914.00	1.00	1700
Metric and scalar (approx. MI)	.01	.01	-158.14	117.53	.616	12917.56	1.00	1800
Metric and scalar (approx. MI)	.05	.05	-154.02	120.49	.597	12941.04	1.00	2800
Basic Need Satisfaction Scale:								
Configural	-	-	-71.67	175.01	.205	11342.81	1.00	3200
Metric (approx. MI)	.005	-	-77.67	170.28	.229	11334.29	1.00	2400
Metric (approx. MI)	.01	-	-79.59	167.66	.237	11333.97	1.00	3000
Metric (approx. MI)	.05	-	-.80.53	164.90	.248	11336.62	1.00	2800
Scalar (approx. MI)	-	.005	-.88.31	158.17	.286	11335.21	1.00	3900
Scalar (approx. MI)	-	.01	-92.16	154.90	.307	11336.63	1.00	3800
Scalar (approx. MI)	-	.05	-92.99	154.76	.309	11349.31	1.00	3900
Metric and scalar (approx. MI)	.005	.005	-.90.53	155.53	.301	11332.87	1.00	2400
Metric and scalar (approx. MI)	.01	.01	-.95.99	149.30	.335	11335.97	1.00	2300
Metric and scalar (approx. MI)	.05	.05	-.92.99	154.76	.309	11349.31	1.00	3900

Note. λ = factor loading prior variance of difference between time points; ν = item intercept prior variance of difference between time points; DIC = deviance information criterion.

Table 2

Standardised factor loadings (λ) and item intercepts (ν) of the four-factor sense of coherence scale across all time points for metric & scalar invariance with Bayesian estimator.

	Time 1 (n=67)		Time 2 (n=67)		Time 3 (n=67)	
	λ	ν	λ	ν	λ	ν
Comprehensibility - Item 1	.74	-.01	.72	.03	.77	.01
Comprehensibility - Item 2	.64	-.03	.64	.00	.63	-.03
Comprehensibility - Item 3	.66	.01	.69	.04	.65	-.03
Comprehensibility - Item 4	.83	.02	.84	-.05	.79	-.00
Comprehensibility - Item 5	.64	.03	.60	-.02	.61	.04
Comprehensibility - Item 6	.62	.03	.60	-.01	.65	-.00
Comprehensibility - Item 7	.49	.02	.49	.02	.51	.04
Manageability - Item 1	.61	.04	.62	.05	.61	.05
Manageability - Item 2	.62	.05	.61	.07	.63	.04
Manageability - Item 3	.69	.02	.69	.05	.70	.05
Manageability - Item 4	.82	.06	.86	.00	.82	.02
Manageability - Item 5	.82	-.04	.80	.05	.81	-.02
Meaningfulness - Item 1	.57	.07	.57	.04	.58	.08
Meaningfulness - Item 2	.85	.06	.83	.07	.87	.05
Meaningfulness - Item 3	.79	.04	.78	.02	.77	.03
Meaningfulness - Item 4	.66	.03	.67	.03	.69	-.01
Meaningfulness - Item 5	.79	.00	.77	.07	.78	.04
Meaningfulness - Item 6	.61	.04	.58	.00	.58	.06
Meaningfulness - Item 7	.67	.03	.71	.01	.67	.07
Relationality - Item 1	.60	.05	.58	.03	.59	.03
Relationality - Item 2	.83	.04	.83	.05	.80	-.04
Relationality - Item 3	.87	.01	.86	.04	.90	.08
Relationality - Item 4	.64	.06	.64	.01	.63	.05
Relationality - Item 5	.60	.03	.61	.00	.59	.04

Table 3

Sense of coherence: Difference output for standardised factor loadings from metric and scalar invariance analysis with a Bayesian estimator and a prior distribution of .005 for standardised factor loadings

Factor Loading	**Parameter Value**		**Deviations From Mean**		
	M	***SD***	**Time 1**	**Time 2**	**Time 3**
Comprehensibility Item-1	0.74	0.08	-0.002	-0.024	0.026
Comprehensibility Item-2	0.64	0.08	0.005	0.000	-0.005
Comprehensibility Item-3	0.67	0.08	-0.007	0.021	-0.014
Comprehensibility Item-4	0.82	0.08	0.006	0.020	-0.026
Comprehensibility Item-5	0.61	0.08	0.021	-0.016	-0.006
Comprehensibility Item-6	0.62	0.09	0.000	-0.025	0.025
Comprehensibility Item-7	0.50	0.10	-0.011	-0.003	0.013
Manageability Item-1	0.61	0.12	-0.004	0.007	-0.003
Manageability Item-2	0.62	0.10	0.001	-0.013	0.012
Manageability Item-3	0.69	0.10	-0.007	0.002	0.006
Manageability Item-4	0.84	0.09	-0.012	0.023	-0.012
Manageability Item-5	0.81	0.09	0.011	-0.009	-0.002
Meaningfulness Item-1	0.57	0.10	-0.004	0.002	0.002
Meaningfulness Item-2	0.85	0.08	-0.002	-0.016	0.017
Meaningfulness Item-3	0.78	0.08	0.005	0.002	-0.007
Meaningfulness Item-4	0.67	0.08	-0.012	0.000	0.013
Meaningfulness Item-5	0.78	0.08	0.006	-0.009	0.003
Meaningfulness Item-6	0.59	0.07	0.018	-0.008	-0.01
Meaningfulness Item-7	0.68	0.09	-0.014	0.027	-0.013
Relationality Item-1	0.59	0.09	0.007	-0.006	-0.001
Relationality Item-2	0.82	0.08	0.008	0.009	-0.017
Relationality Item-3	0.88	0.08	-0.009	-0.019	0.028
Relationality Item-4	0.64	0.10	0.000	0.004	-0.004
Relationality Item-5	0.60	0.10	0.003	0.007	-0.01

Table 4

Sense of coherence: Difference output for standardised item intercepts from metric and scalar invariance analysis with a Bayesian estimator and a prior distribution of .005 for standardised factor loadings.

Item Intercept	**Parameter Value**		**Deviations From Mean**		
	M	***SD***	**Time 1**	**Time 2**	**Time 3**
Comprehensibility Item-1	0.01	0.06	-0.02	0.022	-0.003
Comprehensibility Item-2	-0.02	0.06	-0.013	0.021	-0.008
Comprehensibility Item-3	0.01	0.06	0.006	0.028	-0.034
Comprehensibility Item-4	-0.01	0.07	0.031	-0.038	0.006
Comprehensibility Item-5	0.02	0.07	0.011	-0.035	0.024
Comprehensibility Item-6	0.00	0.06	0.02	-0.016	-0.005
Comprehensibility Item-7	0.03	0.06	-0.004	-0.004	0.008
Manageability Item-1	0.04	0.06	-0.007	0.006	0.001
Manageability Item-2	0.05	0.06	-0.005	0.018	-0.013
Manageability Item-3	0.04	0.07	-0.017	0.007	0.010
Manageability Item-4	0.03	0.07	0.033	-0.026	-0.007
Manageability Item-5	-0.00	0.07	-0.038	0.050	-0.012
Meaningfulness Item-1	0.07	0.06	0.005	-0.024	0.019
Meaningfulness Item-2	0.06	0.07	0.003	0.011	-0.013
Meaningfulness Item-3	0.03	0.06	0.013	-0.010	-0.002
Meaningfulness Item-4	0.02	0.07	0.014	0.015	-0.030
Meaningfulness Item-5	0.04	0.07	-0.036	0.031	0.006
Meaningfulness Item-6	0.03	0.06	0.005	-0.031	0.026
Meaningfulness Item-7	0.04	0.07	-0.004	-0.031	0.034
Relationality Item-1	0.04	0.06	0.014	-0.004	-0.011
Relationality Item-2	0.02	0.07	0.02	0.033	-0.054
Relationality Item-3	0.04	0.07	-0.033	-0.004	0.037
Relationality Item-4	0.04	0.06	0.017	-0.033	0.015
Relationality Item-5	0.02	0.06	0.006	-0.020	0.014

Table 5

Standardised factor loadings (λ) and item intercepts (ν) of the three-factor the basic need satisfaction in general scale across all time points for metric & scalar invariance with Bayesian estimator.

	Time 1 (n=67)		Time 2 (n=67)		Time 3 (n=67)	
	λ	ν	λ	ν	λ	ν
Autonomy item-1	0.76	-0.01	0.77	0.05	0.82	-0.01
Autonomy item-2	0.54	-0.01	0.55	-0.01	0.53	-0.01
Autonomy item-3	0.65	0.09	0.64	0.05	0.61	0.09
Autonomy item-4	0.71	-0.02	0.70	0.01	0.73	-0.02
Autonomy item-5	0.34	0.09	0.34	0.02	0.33	0.09
Autonomy item-6	0.60	0.07	0.62	0.02	0.61	0.07
Autonomy item-7	0.73	0.02	0.75	0.02	0.69	0.02
Competence item-1	0.71	0.00	0.71	-0.03	0.72	0.00
Competence item-2	0.57	0.05	0.55	0.05	0.60	0.05
Competence item-3	0.41	0.00	0.44	0.01	0.43	0.00
Competence item-4	0.82	0.04	0.83	0.07	0.84	0.04
Competence item-5	0.78	0.03	0.75	0.02	0.76	0.03
Competence item-6	0.76	0.04	0.76	0.00	0.71	0.04
Relatedness item-1	0.64	0.02	0.68	-0.01	0.67	0.02
Relatedness item-2	0.62	0.03	0.63	0.00	0.63	0.03
Relatedness item-3	0.60	-0.04	0.59	0.01	0.61	-0.04
Relatedness item-4	0.51	0.00	0.49	0.04	0.51	0.00
Relatedness item-5	0.35	0.03	0.35	0.03	0.34	0.03
Relatedness item-6	0.66	0.01	0.66	0.02	0.62	0.01
Relatedness item-7	0.60	-0.03	0.64	0.01	0.62	-0.03
Relatedness item-8	0.62	-0.02	0.61	0.01	0.62	-0.02

Table 6

Basic need satisfaction: Difference output for standardised factor loadings from metric and scalar invariance analysis with a Bayesian estimator and a prior distribution of .005 for standardised factor loadings.

Factor Loading	**Parameter Value**		**Deviations From Mean**		
	M	***SD***	**Time 1**	**Time 2**	**Time 3**
Autonomy item-1	0.78	0.08	-0.021	-0.013	0.034
Autonomy item-2	0.54	0.10	-0.002	0.010	-0.008
Autonomy item-3	0.63	0.08	0.019	0.004	-0.023
Autonomy item-4	0.71	0.10	-0.003	-0.012	0.016
Autonomy item-5	0.34	0.09	0.000	0.003	-0.003
Autonomy item-6	0.61	0.09	-0.011	0.012	-0.001
Autonomy item-7	0.72	0.07	0.009	0.029	-0.038
Competence item-1	0.71	0.08	-0.009	0.000	0.009
Competence item-2	0.57	0.08	-0.002	-0.021	0.023
Competence item-3	0.43	0.10	-0.015	0.009	0.006
Competence item-4	0.83	0.07	-0.011	0.003	0.008
Competence item-5	0.76	0.08	0.016	-0.010	-0.006
Competence item-6	0.74	0.08	0.015	0.014	-0.029
Relatedness item-1	0.66	0.07	-0.026	0.016	0.010
Relatedness item-2	0.63	0.09	-0.011	0.003	0.008
Relatedness item-3	0.60	0.10	0.003	-0.009	0.007
Relatedness item-4	0.50	0.09	0.005	-0.016	0.011
Relatedness item-5	0.35	0.09	0.004	0.002	-0.006
Relatedness item-6	0.65	0.09	0.015	0.015	-0.030
Relatedness item-7	0.62	0.09	-0.024	0.022	0.002
Relatedness item-8	0.62	0.08	0.000	-0.007	0.007

Table 7

Basic need satisfaction: Difference output for standardised factor loadings from metric and scalar invariance analysis with a Bayesian estimator and a prior distribution of .005 for standardised factor loadings

Item Intercept	**Parameter Value**		**Deviations From Mean**		
	M	***SD***	**Time 1**	**Time 2**	**Time 3**
Autonomy item-1	0.04	0.07	0.025	0.017	-0.042
Autonomy item-2	0.00	0.06	0.018	-0.007	-0.011
Autonomy item-3	0.04	0.06	-0.052	0.006	0.046
Autonomy item-4	0.00	0.07	0.009	0.008	-0.017
Autonomy item-5	0.04	0.06	-0.035	-0.016	0.051
Autonomy item-6	0.05	0.06	0.009	-0.026	0.017
Autonomy item-7	0.02	0.07	0.002	-0.003	0.001
Competence item-1	-0.01	0.07	0.013	-0.023	0.01
Competence item-2	0.06	0.06	0.016	-0.007	-0.009
Competence item-3	0.04	0.06	0.058	-0.025	-0.032
Competence item-4	0.05	0.07	-0.018	0.024	-0.006
Competence item-5	0.02	0.07	-0.004	0.002	0.002
Competence item-6	0.01	0.07	-0.017	-0.015	0.032
Relatedness item-1	0.01	0.06	-0.005	-0.013	0.018
Relatedness item-2	0.02	0.06	0.012	-0.023	0.011
Relatedness item-3	-0.01	0.06	0.015	0.019	-0.034
Relatedness item-4	0.03	0.06	0.011	0.018	-0.029
Relatedness item-5	0.03	0.06	0.003	-0.004	0.001
Relatedness item-6	0.00	0.06	-0.024	0.017	0.006
Relatedness item-7	-0.01	0.06	-0.002	0.017	-0.015
Relatedness item-8	0.01	0.06	0.039	-0.006	-0.033

Appendix B – Bivariate Correlations

Table 1

Means (M), standard deviations (SD) and bivariate correlations between observed variables across all three times points.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Time 1																						
1. SOC	4.80	.78	-																			
2. BNS	5.29	.63	.75**	-																		
3. LSAT	25.10	5.53	.58**	.58**	-																	
4. VIT	33.70	7.95	.62**	.62**	.67**	-																
5. PS	22.97	11.12	-.70**	-.44**	-.54**	-.61**	-															
6. CEFF	47.18	7.87	.26*	.17	.29*	.06	-.12	-														
7. CHEL	57.67	10.88	.41**	.36**	.28*	.17	-.15	.58**	-													
Time 2																						
8. SOC	4.73	.84	.84**	.71**	.61**	.60**	-.62**	.20	.29*	-												
9. BNS	5.16	.72	.62**	.74**	.49**	.48**	-.29*	.22	.36**	.74**	-											
10. LSAT	24.61	5.98	.59**	.57**	.77**	.43**	-.46**	.13	.21	.75**	.60**	-										
11. VIT	33.04	.785	.54**	.63**	.50**	.75**	-.48**	.02	.11	.67**	.64**	.53**	-									
12. PS	21.72	12.14	-.62**	-.49**	-.50**	-.31*	.61**	-.22	-.23	-.80**	-.56**	-.69**	-.44**	-								
13. CEFF	45.64	8.94	.25*	.27*	.42**	.23	-.16	.68**	.47**	.28*	.33**	.28*	.28*	-.26*	-							
14. CHEL	57.64	10.74	.13	.22	.37**	.14	.06	.56**	.50**	.19	.32**	.28*	.19	-.16	.81**	-						
Time 3																						
15. SOC	4.79	.84	.73**	.62**	.66**	.57**	-.61**	.06	.25*	.87**	.63**	.75**	.61**	-.71**	.25*	.18	-					
16. BNS	5.19	.73	.51**	.68**	.53**	.52**	-.30*	.11	.21	.65**	.76**	.61**	.59**	-.50**	.22	.18	.72**	-				
17. LSAT	25.46	6.37	.32**	.36**	.69**	.50**	-.35**	-.04	.06	.52**	.45**	.73**	.49**	-.40**	.18	.21	.67**	.66**	-			
18. VIT	33.45	8.09	.43**	.56**	.56**	.69**	-.44**	.04	.09	.57**	.55**	.53**	.72**	-.42**	.33**	.26*	.68**	.74**	.62**	-		
19. PS	10.01	7.46	-.48**	-.40**	-.43**	-.35**	.50**	-.06	-.15	-.57**	-.45**	-.52**	-.31**	.60**	-.21	-.11	-.67**	-.58**	-.44**	-.56**	-	
20. CEFF	44.04	9.91	.35**	.43**	.45**	.25*	-.19	.66**	.55**	.37**	.42**	.34**	.25**	-.30*	.71**	.64**	.31**	.33*	.19	.35**	-.18	-
21. CHEL	54.75	12.29	.18	.21	.30*	.19	-.05	.55**	.59**	.16	.28*	.15	.14	-.08	.62**	.63**	.13	.19	.17	.24	-.05	.73**

Note. $^{**}p < 0.01$; $^{*}p < 0.05$. SOC = sense of coherence, BNS = basic need satisfaction, LSAT = life satisfaction, VIT = vitality, PS = Psychiatric Symptoms, CEFF = coping effectiveness – performance, CHEL = coping effectiveness – health.

Appendix C – Basic Need Importance – In General Scale

Basic Need Importance in General Scale

Please read each of the following items carefully, thinking about how it relates to your LIFE, and then indicate how IMPORTANT it is for you. Use the following scale to respond

It is important for me…

1	2	3	4	5	6	7
Not at all important			Somewhat important			Very important

1. (S1A1, S2A1) to feel like I am free to decide for myself how to live my life.
2. (S1R1, S2R1) to really like the people I interact with.
3. (S1C1, S2C2) that people I know tell me I am good at what I do (**did not retain in S1&S2**)
4. (S1R2, S2R2) that I get along with people I come into contact with.
5. (S1A2, S2A3) that I generally feel free to express my ideas and opinions.
6. (S1R3 S2R4) that I consider the people I regularly interact with to be my friends.
7. (S1C2, S2C3) that I am able to learn interesting new skills.
8. (S1R4, S2R5) that people in my life care about me.
9. (S1C3, S2C4) that most days I feel a sense of accomplishment from what I do.
10. (S1A3, S2A5) that the people I interact with on a daily basis take my feelings into consideration **(did not retain)**
11. (S2 C5) that In my life I ~~do not~~ get ~~much of~~ ~~a~~ chance<u>s</u> to show how capable I am (**Added and retained in Study 2**)
12. (S1A4, S2A6) that I feel like I can pretty much be myself in my daily situations.
13. (S1R5, S2R8) that people are generally pretty friendly towards me.

Note. (S1) = Study 1, (S2) = Study 2. A = Autonomy, C = Competence, and R = Relatedness.

Appendix D – Sense of Coherence (Orientation to Life) Scale

Sense of Coherence (Orientation to Life) Scale

Below is the 24-item four-factor version of the orientation to life questionnaire validated in Study 5.

CR-1: In the past ten years your life has been:

1	**2**	**3**	**4**	**5**	**6**	**7**
full of changes without your knowing what will happen next						completely consistent and clear

CR-2: Do you have the feeling that you are in an unfamiliar situation and do not know what to do?

1	**2**	**3**	**4**	**5**	**6**	**7**
very often						very seldom or never

CR-3: When you face a difficult problem, the choice of a solution is:

1	**2**	**3**	**4**	**5**	**6**	**7**
always confusing and hard to find						always completely clear

CR-4: Your life in the future will probably be:

1	**2**	**3**	**4**	**5**	**6**	**7**
full of changes without knowing what will happen next						completely consistent and clear

CR-5: Do you have very mixed-up feelings and ideas?

1	2	3	4	5	6	7
very often						very seldom or never

CR-6: Does it happen that you have the feeling that you do not know exactly what is about to happen?

1	2	3	4	5	6	7
very often						very seldom or never

CR-7: When something happened, have you generally found that:

1	2	3	4	5	6	7
you overestimated or underestimated its importance						you saw things in the right proportion

MA-1: What best describes how you see life?

1	2	3	4	5	6	7
one can always find a solution to painful things in life						there is no solution to painful things in life

MA-2: When you do something that gives you a good feeling:

1	2	3	4	5	6	7
it's certain that you will go on feeling good						it's certain that something will happen to spoil the feeling

MA-3: Many people – even those with a strong character – sometimes feel like losers in certain situations. How often have you felt this way in the past?

1	2	3	4	5	6	7
never						very often

MA-4: When you think of the difficulties you are likely to face in important aspects of your life, do you have the feeling that:

1	**2**	**3**	**4**	**5**	**6**	**7**
you will always succeed in overcoming difficulties						you won't succeed in overcoming difficulties

MA-5: How often do you have feelings that you are not sure you can keep under control?

1	**2**	**3**	**4**	**5**	**6**	**7**
very often						very seldom or never

ME-1: Life is:

1	**2**	**3**	**4**	**5**	**6**	**7**
full of interest						completely routine

ME-2: Do you have the feeling that you do not really care what goes on around you?

1	**2**	**3**	**4**	**5**	**6**	**7**
very seldom or never						very often

ME-3: Most of the things you do in the future will probably be

1	**2**	**3**	**4**	**5**	**6**	**7**
completely fascinating						deadly boring

ME-4: When you think about your life, you very often:

1	**2**	**3**	**4**	**5**	**6**	**7**
feel how good it is to be alive						ask yourself why you exist at all

ME-5: Doing the thing you do every day is:

1	2	3	4	5	6	7
a source of deep pleasure and satisfaction						a source of pain and boredom

ME-6: You anticipate that your personal life in the future will be:

1	2	3	4	5	6	7
totally without meaning or purpose						full of meaning and purpose

ME-7: How often do you have the feeling that there is little meaning in the things you do in your daily life?

1	2	3	4	5	6	7
very often						very seldom or never

RE-1: When you talk to people, do you have the feeling that they do not understand you?

1	2	3	4	5	6	7
Never have this feeling						always have this feeling

RE-2: Has it happened to you in the past that you were surprised by the behaviour of people whom you thought you knew well?

1	2	3	4	5	6	7
never happened						always happened

RE-3: Has it happened that people whom you counted on disappointed you?

1	2	3	4	5	6	7
never happened						always happened

RE-4: Do you have the feeling you are being treated unfairly?

1	**2**	**3**	**4**	**5**	**6**	**7**
very often						very seldom or never

RE-5: Do you think there will always be people whom you will be able to count on in the future?

1	**2**	**3**	**4**	**5**	**6**	**7**
you're certain there will be						you doubt there will be