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Understanding the Need for Novelty from the Perspective of Self-Determination Theory

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### Abstract

A fundamental tenet of self-determination theory is that the satisfaction of three basic, innate psychological needs for autonomy, competence, and relatedness is necessary for optimal functioning. The aim of this research was to propose novelty as a basic psychological need in self-determination theory and develop a new measure to assess novelty need satisfaction, the Novelty Need Satisfaction Scale (NNSS). Two studies were performed, one at the global lifestyle level (Study 1: general adults,  $N = 399$ ,  $M_{\text{age}} = 31.30$  years) and the other at a contextual level in physical education (Study 2: first-year post-compulsory secondary school students,  $N = 1035$ ,  $M_{\text{age}} = 16.20$  years). Participants completed the NNSS alongside measures of psychological needs and regulation styles from self-determination theory and psychological well-being. The six-item NNSS showed adequate psychometric properties and discriminant validity with other psychological needs in both studies. Novelty need satisfaction predicted life satisfaction (Study 1) and intrinsic motivation in physical education (Study 2) independent of the other three psychological needs. Results provide preliminary evidence that need for novelty is a unique candidate need alongside existing needs from self-determination theory, but further confirmatory and experimental research is required.

*Keywords:* basic psychological needs, motivation, well-being, curiosity

## Understanding the Need for Novelty from the Perspective of Self-Determination Theory

### **1. Introduction**

Self-determination theory (Deci & Ryan, 1991, 2000) is currently one of the most important motivational theories in social psychology given considerable evidence of its capacity to predict human behavior in multiple behavioral contexts. Although the theory postulates have been widely tested and applied, it is a ‘living’ theory that has been modified and advanced as new applications and processes are discovered (e.g., Vansteenkiste, Niemiec, & Soens, 2010). A key driver of motivation set out in self-determination theory is satisfaction of three basic, psychological needs for autonomy, competence, and relatedness. Since its formulation, these three needs are considered ‘basic’ and fundamental to the development of effective motivational orientations and optimal functioning, despite other proposals (Ryan & Deci, 2000a; Sheldon, Elliot, Kim, & Kasser, 2001). The aim of this article is to suggest the need for novelty, defined as the need to experience something not previously experienced or deviates from everyday routine, as an additional basic need alongside the needs proposed in self-determination theory. The focus is to provide the conceptual basis of the need for novelty and its role in the theory, why its satisfaction is important for optimal functioning, develop a measure of satisfaction of the need, and provide and empirical test of its construct, discriminant, convergent, and predictive validity alongside existing needs in the theory. Consistent with measures based on the conceptualization of the existing candidate needs within self-determination theory, our proposed new measure focuses on the satisfaction of the need for novelty rather than its intensity. While previous studies have developed instruments to measure people’s tendency to seek novelty, our study is the first that conceptualizes novelty as a need within self-determination theory and analyzes the relations of novelty need satisfaction with different positive outcomes.

#### **1.1 Basic Psychological Needs in Self-Determination Theory**

The conceptualization of needs in self-determination theory is based on two classic traditions in the study of motivation, the Hull (1943) and Murray (1938) traditions. On the one hand, Hull specified a set of innate physiological needs (e.g., food, water, sex) whose deficit activates drive states, and that must be met for the organism to remain physically healthy. On the other hand, Murray referred to psychological instead of physiological needs and he considered needs as acquired instead of innate. Murray defined needs as anything that moves an individual to action, and, therefore, most needs established in his list (e.g., abasement, acquisitiveness, dominance) are not necessary to achieve a healthy development and optimal functioning (Deci & Ryan, 2000). Self-determination theory proposes a set of innate needs consistent with the Hullian tradition, but it focuses at the psychological level according to Murray's approach. However, the function of the needs is quite different based on their organismic-dialectical approach.

According to self-determination theory, basic psychological needs are defined as innate psychological nutrients, the satisfaction of which is essential for the process of continuous psychological growth, integrity, well-being, and optimal functioning (Deci & Ryan, 2000). These needs are organismic and present in all individuals, therefore, they do not represent acquired or learned orientations. The needs are qualitatively different from deficits or defensive motives. The needs are conceptualized as essential for optimal functioning—the means to promote human potential— whereas defensive motives are derived from threats and the thwarting of needs (Ryan & Deci, 2000a).

In addition, the needs are considered universal and present in all cultures and settings (Deci & Ryan, 2000; Sheldon et al., 2001). Need satisfaction is essential for healthy development and well-being and can be achieved by means of a great variety of behaviors that can differ among individuals and cultures. This means that individuals cannot prosper unless they satisfy their needs. Needs persist over the entire lifespan, although their relative

importance, their forms of expression, and the pathways to achieve their satisfaction vary throughout lifetime and across cultures (Ryan & Deci, 2000b).

Deci and Ryan (1991, 2000) and Ryan & Deci (2000b) in their basic postulates of self-determination theory, establish three basic psychological needs that meet the above-mentioned criteria: autonomy, competence, and relatedness. The need for autonomy refers to the desire for choice and volition over one's activities and goals, without externally-referenced pressures and threats, actively engaging in the process of decision-making and attaining a sense of agency in one's environment. The need for competence reflects the desire to experience efficacy, to feel that one is doing things well, and achieving one's goals. The need for relatedness reflects the desire to experience a sense of connectedness with significant others and to maintain good social relations and feel accepted. It is the satisfaction of these three needs that is hypothesized to be related to adaptive motivational orientations toward behaviors, that is, autonomous motivation, and to maintain a sense of optimal functioning. Furthermore, it is the satisfaction of all three needs that is required for optimal functioning and measures of the satisfaction of the needs have indicated a higher-order need satisfaction construct consistent with this complementarity hypothesis (Hagger, Harris, & Chatzisarantis, 2006).

### **1.2 Internalization, Intrinsic Motivation, and Novelty**

The concept of basic psychological needs specifies the content of motivation and provides a basis for energizing and directing action. Needs are considered essential to understand what (content) and why (process) one seeks goals, and they are a key concept to interpret the processes of internalization and intrinsic motivation in self-determination theory (Deci & Ryan, 2000). According to the theory, satisfaction of basic psychological needs is related to more autonomous forms of motivation with respect to activities and behaviors. Autonomous actions are those that are experienced as self-endorsed and reflect of an

individual's genuine sense of self. If psychological needs are satisfied, people value the importance of the activity they are performing, integrate it into their lifestyle, feel that they are the origin of their actions, and experience adaptive outcomes including behavioral persistence, enjoyment, and psychological well-being. However, for the interpretation of this process to be effective, it is necessary to establish a fundamental set of needs that explain a large number of phenomena. As the number of needs increases, the utility of this approach decreases. In fact, one of the reasons why the classic theories of needs were not accepted was that their list of needs was too long and weighty (Ryan & Deci, 2000a). It is extremely important for each candidate need to reflect a basic, fundamental need that extends to the explanation of a large number of behavioral phenomena (Ryan & Deci, 2000a).

Taking this into account, we propose novelty as a candidate basic psychological need within self-determination theory. Drawing from the tenets of the theory, we aim to identify the conceptual basis for the need for novelty, explaining its relation with the process of internalization, intrinsic motivation, and well-being. In fact, in the classic studies of Deci and Ryan, novelty is frequently mentioned as an important element of human motivation. Deci and Ryan (2000) define intrinsic motivation as “active engagement with tasks that people find interesting and that, in turn, promote growth. Such activities are characterized by novelty, or what Berlyne (1971) called ‘collative stimulus properties’, and by optimal challenge” (p. 233). Ryan and Deci (2000b) consider that intrinsic motivation is “the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn” (p. 70), and Deci and Ryan (1991) state that intrinsic motivation “leads people to encounter new challenges that are optimal for their self-development and that can be integrated as development proceeds naturally” (p. 244). Novelty and perceived competence, therefore, represent two essential aspects of intrinsic motivation derived from original conceptualizations of the construct in self-determination theory. It is therefore

surprising that competence has been conceived as a basic psychological need, the object of study of many studies, while novelty has not received comparable attention.

The conceptual case for novelty seeking as an innate and universal need is based on the original operationalization of self-determination theory. Deci and Ryan (1985) contend that children are active, inquisitive, and curious from birth and are constantly in need of stimulation. The key motivational state of intrinsic motivation characterizes the natural inclination toward spontaneous interest and exploration, assimilation, and mastery as an essential experience necessary for cognitive and social development and optimal functioning (Ryan, 1995; Ryan & Deci, 2000b). Moreover, self-determination theory suggests that humans have innate propensities to commit to interesting activities (novelty), practice capacities (competence), pursue relations with others in social groups (relatedness), and integrate personal and intrapsychic experiences in relative unity (autonomy) (Deci & Ryan, 2000). Individuals are therefore compelled to seek out new experiences, a need that complements the desire to experience effectance and choice, mastery, and connectedness with others (Deci & Ryan, 1991).

The integration of new experiences is related to a tendency toward negentropy, a term that represents a more elaborated organization of the system which is central to the development of a sense of self (Deci & Ryan, 1991). Systems that are not renewed tend to deplete, disappear and become extinct, and, therefore, for humans to survive they need continuous innovation and evolution in their developmental process. Since prehistory, humans have developed new objects, inventions, activities, ideas, and projects as a part of their natural evolution. Life without the pursuit of novelty would mean individuals would not engage in exploratory pursuits to understand the self and their environment, to search for meaning, and for personal growth (Kashdan & Silvia, 2009). Although this need to innovate is related to the needs for competence and autonomy, it seems a source of motivation in its



own. In this line, novelty would have an adaptive function being important for the development of phylogenetic and ontogenetic adaptive strategies. Children seek new experiences to stimulate their developing brains; adolescents seek novelty to extend their horizons and to develop their social identities; and in adults novelty is related to the development of the self-actualized individual, cognitive flexibility and better social relationships, fundamental aspects for this longest stage of psychosocial growth (see Reio & Choi, 2004).

Novelty is needed in all the life contexts, such as education, work, leisure, physical activity or interpersonal relationships. For example, students and exercisers need to alternate familiar and new activities in an optimal challenge (balance between competence and novelty) to improve their motivation, satisfaction, well-being and performance (Csikszentmihalyi, 1990; Sylvester et al., 2016). Furthermore, if people do not seek novel activities within the tasks they do in the workplace or in leisure time, they will likely experience boredom and maladaptive outcomes like low self-worth, negative affect, low life satisfaction and psychological well-being. Research has shown that even individuals engaged in the most mundane and routine of tasks in the workplace seek novel strategies to maintain interest (Sansone, Weir, Harpster, & Morgan, 1992). The need for novelty is also related to experience more adaptive social outcomes. When individuals experience novel activities, people seek to share it with others and this process increases their intrinsic motivation and relatedness (Kashdan & Silvia, 2009). This suggests that novelty may co-exist and complement the existing needs within self-determination theory and that satisfaction of the need for novelty in parallel with satisfaction of other needs will lead to adaptive outcomes and optimal functioning.

### **1.3 Contemporary Approaches to the Study of Novelty**

Other approaches to the study of novelty and intrinsic motivation exist in the literature that share certain aspects with the conceptualization of novelty within self-determination theory, although from different viewpoints and foci.

**Interest.** Silvia (2005, 2006, 2008) suggests that intrinsic motivation proceeds from two assessments: (a) an individual's assessment of the novelty-complexity of an event, referring to assessing it as new, unexpected, complex, difficult to process, surprising, mysterious, or obscure; and (b) his or her assessment of the comprehensibility of the event, implying that people value it if they have the skills, knowledge, and resources to deal with it. If people rate an event as new and comprehensible, they will consider it motivating, regardless of their age and culture. This approach seems to conceive novelty and competence as the drivers of intrinsic motivation, drawing from classic approaches to novelty and curiosity like that of Berlyne (1960, 1971) and, more recently, self-determination theory itself. In fact, Silvia (2006) explicitly equates his view of novelty with self-determination theory, considering it an important aspect of intrinsic motivation. In this sense, Silvia (2006), drawing from the classic experiments of Reeve (1989) with anagrams and puzzles, suggests that interest and enjoyment, two defining features of intrinsic motivation, have different origins. Novelty and complexity would activate feelings of interest, whereas perceived competence would increase feelings of enjoyment, which is consistent with self-determination theory principles.

**Curiosity.** Curiosity is defined as the predisposition to recognize and seek new knowledge and experiences (Kashdan, Sherman, Yarbro, & Funder, 2013). Kashdan (2004) assumes that curiosity emerges from a person's self-development, and is therefore related to the nature of the organismic needs established in self-determination theory (Silvia, 2006). This approach to curiosity also has its origins in the studies of Berlyne. In fact, Berlyne (1954) differentiated between two types of curiosity, perceptual and epistemic. The former

refers to the impulse that is activated by new stimuli and reduced by continuous exposure to them, whereas the latter refers to the desire for knowledge. Berlyne also distinguished between specific curiosity (desire for particular information) and diversive curiosity (a more general search for stimulation). With the introduction of the concepts of perceptual and diversive curiosity, Berlyne classified the desire for change and novelty as curiosity.

In development of self-determination theory, Deci (1975) also mentioned curiosity, including it in “the more general realm of all intrinsically motivated behaviors” (p. 53). From this perspective, competence and curiosity are related, establishing that people are curious about their own skills, and curiosity is considered as a mild motivational state that is easily overcome by any weak physiological drive (Loewenstein, 1994). This perspective has been criticized by Loewenstein (1994), supported by two arguments. On the one hand, competence and curiosity are not synonymous. For example, the effort to learn a certain motor skill is probably motivated by the need for competence rather than curiosity. However, the desire to explore a new site while hiking would reflect curiosity but not the need to achieve competence. Furthermore, curiosity cannot be considered to be overcome by other physiological drives because many people can remember moments in their lives when curiosity was very intense, even interfering with basic needs such as hunger and thirst (Loewenstein, 1994).

**Sensation seeking.** Sensation seeking was developed by Zuckerman (1979, 1984) and it was initially described as “the need for varied, novel, and complex sensations and experiences, and the willingness to take physical and social risks for the sake of such experiences” (Zuckerman 1979, p. 10). Arnett (1994), in a new conceptualization, defines sensation seeking as the need for novelty and intensity of stimulation, giving a greater emphasis to the role of socialization, and not viewing sensation seeking as a potential for taking risks but as a more general experience present in multiple areas of people’s life.

Sensation seeking is akin to a need, because an exclusively behavioral definition for the construct without a motivational component would only lead to a descriptive conceptualization without explanatory function (Hammelstein, 2004). Similarly, studies indicate that it is reasonable to conceive of sensation seeking as a basic need for stimulation (Roth & Hammelstein, 2012; Roth, Hammelstein, & Brähler, 2007). In fact, these authors directly link the concept of novelty as a need to that established by other comprehensive psychological theories like self-determination theory. Sensation seeking has also been shown to be related to interest, so that people with a high need of sensation seeking are more interested in new, unfamiliar and complex things (Zuckerman, 1994).

**Perceived variety.** The hedonic adaptation prevention model (Sheldon & Lyubomirsky, 2012) establishes that experiencing varied, unexpected, or surprising behaviors serve to continually stimulate and promote well-being. Sylvester et al. (2014) define perceived variety as a psychological experience that includes novel experiences (stimulating interest) and alternating familiar experiences (reinforcing learning and development). Although Sylvester et al. do not propose perceived variety as a basic psychological need, the results of their study show that it directly predicts well-being and is empirically distinct from competence, autonomy, and relatedness. It is a complementary experience with the satisfaction of the three basic psychological needs that explains an important amount of the variance of positive affect and subjective vitality.

#### **1.4 The Present Research**

The purpose of this research is to introduce novelty as basic psychological need parallel with the three existing needs for autonomy, competence, and relatedness proposed in self-determination theory. Based on our review of the literature, novelty seems to be an innate need which is present in all cultures and stages of development, the satisfaction of which contributes to increased intrinsic motivation and well-being, and is related to adaptive

behavioral outcomes and optimal functioning. Although the exploratory behavior may vary in intensity throughout the life span, it is omnipresent in daily human experience (Kashdan, Rose, & Finchman, 2004). It seems, therefore, to meet the criteria established by Deci and Ryan (2000) of a basic psychological need. In fact, original studies on intrinsic motivation on which self-determination theory is based make reference to novelty as an essential element of intrinsic motivation (Deci, 1975; Deci & Ryan, 1985, 1991, 2000; Ryan & Deci, 2000b). Deci and Ryan (1985) seem to consider that novelty is implicit in existing need sets. For example, novelty considered subsumed by autonomy in that autonomous activities tend also to have a sensational or unique component and by competence in that experiencing challenge requires one to extend one's skills by trying something new. From this perspective, people seek to practice newly acquired skills, but when the skills cease to be novel, their satisfaction decreases. This view would limit novelty to being a construct intimately linked to autonomy and competence. It is important, therefore, to identify whether novelty can function in its own right largely independent of autonomy and competence.

Recent approaches to the study of novelty from other perspectives, using different terminology (interest, curiosity, sensation seeking, perceived variety), also allude to the importance of novelty for human motivation. These approaches clearly consider novelty as different to competence. Novelty would be more linked to interest, reflecting a perceptual and diversive level (general search for new stimuli), whereas competence would be more linked to enjoyment and a more epistemic and specific view (attempting to acquire some particular knowledge) (Loewenstein, 1994; Silvia, 2006). Although these constructs and their underpinning approaches are different to that proposed by self-determination theory, their conceptualization of novelty is entirely consistent with the basic principles of self-determination theory. In this sense, the study of novelty is topical and timely; however, the different approaches have quantified the intensity with which people seek novelty instead of

the people's level of satisfaction of this need. Only the study of Sylvester et al. (2014) on perceived variety has measured level of satisfaction, but it should also be taken into account that their construct includes alternating familiar experiences, in addition to novel experiences. Despite of the widespread acknowledgment of the importance of novelty in numerous life domains including education, work, and interpersonal relations, there has been a relative dearth in research examining the contribution of novelty in these domains and the role of the need for novelty in predicting motivation and behavior in these domains is in need of further investigation (Loewenstein, 1994).

Theoretical and empirical accounts of self-determination theory focused exclusively on three needs for competence, autonomy, and relatedness as the basic and fundamental needs driving human motivation and have not tended to consider alternatives (Sheldon, 2011). Sheldon et al. (2001) carried out three studies to test the construct and cross-cultural validity of 10 candidate psychological needs. The results showed that the three basic psychological needs proposed in self-determination theory with self-esteem were associated to event-related affect and, therefore, sat at the apex of a 'basic' needs hierarchy. However, this research did not consider novelty as a candidate need. We plan to continue advancement in the identification of basic psychological needs within self-determination theory by proposing novelty as a candidate basic psychological need. In order to provide empirical support for this proposal, we plan to develop a measure of the satisfaction of the need for novelty from first principles. In addition, we aim to explore relations of our measure of novelty need satisfaction with the existing needs from self-determination theory and like constructs in tests of construct, discriminant, convergent, and predictive validity.

We also planned to test the validity of the satisfaction of the need for novelty with constructs operating at the global and contextual levels of generality, consistent with Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation. According to

Vallerand's model, global level represents a general state of motivation toward life while the contextual level refers to the motivation developed in specific spheres of the human activity (contexts). Research has shown that education, work, leisure (of which physical activity is a significant part), and interpersonal relationships are the most important contexts for humans (Biddle, Hagger, Chatzisarantis, & Lippke, 2007; Vallerand, 1997). The Study 1 was conducted at a global level of generality while the Study 2 was carried out at a physical education (PE) context. We decided to analyze this context because it represents an education context with high transference to the leisure context of physical activity (Hagger & Chatzisarantis, 2016) and, therefore, was highly representative of this level of the hierarchy.

In Study 1 we explored the psychometric properties of the measure of satisfaction of the need for novelty and its discriminant and convergent validity with measures of satisfaction of the other three basic psychological needs from self-determination theory. In addition, we tested the predictive validity of the satisfaction of need for novelty in predicting life satisfaction as an indicator of well-being independent of satisfaction of the other three needs. Study 2 provided a replication of the construct validity of the novelty need satisfaction measure at the contextual level with adolescents in PE classes. Relations between satisfaction of the need for novelty and the other three needs and the different forms of motivation from self-determination theory were tested.

We expected that satisfaction of the need for novelty would be positively related to the satisfaction of other needs from self-determination theory with medium effect sizes. We also predicted positive, medium-sized effects of the novelty measure on life satisfaction and autonomous forms of motivation. We expected our findings to provide preliminary evidence for the validity of the satisfaction of the need for novelty importance as a predictor of well-being and adaptive forms of motivation from self-determination theory.

## **2. Study 1**

## 2.1 Method

### 2.1.1 Participants

Participants were 399 adults (202 males, 197 females) aged 18 to 65 years ( $M_{\text{age}} = 31.30$ ,  $SD = 11.31$ ) from two provinces in southeast Spain. Participants were recruited from university, sports centers, social and leisure centers, with the majority Caucasian and of a middle-income socio-economic status.

### 2.1.2 Measures

**Basic psychological needs.** We used the validated Spanish version (González-Cutre et al., 2015) of the Basic Needs Satisfaction in General Scale (BNSG-S, Gagné, 2003). The Spanish version was comprised 16 items, in contrast to the 21 items of the original version, and a negative-worded method effect following the model proposed by Johnston and Finney (2010). The scale measures satisfaction of the needs for competence (6 items, e.g., “People I know tell me I am good at what I do”), autonomy (3 items, e.g., “I generally feel free to express my ideas and opinions”), and relatedness (7 items, e.g., “People in my life care about me”). Participants were requested to consider their own life when responding and to indicate the extent to which an item was true for them on 7-point Likert-type scale ranging from 1 (*not at all true*) to 7 (*very true*). We removed the competence item “I have been able to learn interesting new skills recently” due to overlap with the need for novelty.

**Need for novelty.** We developed a set of nineteen candidate items for our initial version of the satisfaction of the need for novelty measure. First, three university researchers each with a doctoral degree in psychology from a psychology of motivation research group developed a definition of the construct novelty, supported by an extensive review of the scientific literature. The need for novelty was defined as the need to experience something not previously experienced or deviates from everyday routine. Next, based on contemporary definitions in studies of novelty and existing questionnaires measuring the intensity of the



experience of novelty (e.g., Curiosity and Exploration Inventory II; Kashdan et al., 2009), a broad battery of items was developed to assess the satisfaction of the need for novelty, in order to finally select the items with the best psychometric properties. The items were written to be used referring to the people's perception about the presence of novelty both in their lives in general (global level, Study 1) and in a specific context (e.g., PE, Study 2). The items were drafted to avoid redundancy and to include different facets of novelty: activities, skills, situations, emotions and knowledge. We tried to develop the same number of items for each facet. The candidate items are provided in the Supplementary materials numbered 1 to 19.

To assess their content and face validity and ensure that they matched the semantic definition, the items were reviewed by three experts who were not members of the research group; they assessed the representativeness, uniqueness (not overlapping with the other three basic psychological needs), and clarity of the items, giving their qualitative opinion and suggested modifications. Next, taking into account the experts' opinions, and after a theoretical debate within the research group, we eliminated items 3 ("I develop new skills"), 17 ("I frequently acquire new knowledge"), 18 ("I think I frequently know new things"), and 19 ("I think I learn something new every day") because we considered that, as they referred to acquiring new knowledge and learning, they might be overlapping with the concept of the need for competence. Lastly, we observed that, on the one hand, items 2 ("I perform activities that seem novel to me") and 4 ("I feel I do novel things"), and, on the other hand, items 11 ("I have the opportunity to discover new things") and 16 ("I think I discover new things frequently") were redundant, so we decided to retain only items 4 and 16, which had better clarity and brevity, following the recommendations of the expert group. The remaining 13 items were inserted in the BNSG-S to be administered concurrently in order to prevent an acquiescence effect in the responses and all items were, therefore, rated on 7-point Likert-type scales, ranging from 1 (*not at all true*) to 7 (*very true*).

**Life satisfaction.** We used the validated Spanish version (Atienza, Pons, Balaguer, & García-Merita, 2000) of the Satisfaction with Life Scale (SWLS) of Diener, Emmons, Larsen, and Griffin (1985). The scale comprises 5 items (e.g., “In most ways, my life is close to my ideal”) measuring general life satisfaction on 5-point Likert-type scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

### **2.1.3 Procedure**

The ethical board of the first author’s university approved this study. Three researchers with expertise in administering psychological tests and wearing official accreditation passes, approached center attendees as they were entering or leaving the facility asking them to complete the questionnaires. Participants were informed that they would be participating in a survey on life motivation and were asked to provide verbal and written consent to participate. They then completed the questionnaires in a quiet waiting area of the center without disruption under the supervision of the researcher.

### **2.1.4 Data Analysis**

First, we performed a one-factor CFA of the novelty items. Second, to analyze the convergent and discriminant validity of novelty items with items measuring satisfaction of the three basic psychological needs from self-determination theory, a model with four correlated latent factors (novelty, competence, autonomy and relatedness) was tested. Composite reliability ( $\rho$ ) and Average Variance Extracted (AVE) of novelty were calculated. Composite reliability should be higher than .60 (Bagozzi & Yi, 1988) and AVE should be higher than .50 (Hair, Black, Babin, & Anderson, 2009). AVE measures the amount of variance captured by a construct in relation to variance due to random measurement error. Pending acceptable fit of the four-correlated-factor model, we analyzed invariance of this model across gender and age to observe possible group differences.

For the CFAs, we used the covariance matrix and the maximum likelihood estimation method with bootstrapped parameter estimates and standard errors. This procedure is effective in generating stable estimates robust to any departures in multivariate normality (Byrne, 2001). To analyze the goodness of fit of the model, we used the following indices: the comparative fit index (CFI), the incremental fit index (IFI), the root mean square error of approximation (RMSEA), and its 90% confidence interval (CI), and the standardized root mean square residual (SRMR). According to the main guidelines of structural equation modeling (Hu & Bentler, 1999), the following cut-points were established as indicative of good fit: CFI and IFI values equal to or higher than .95, and RMSEA values equal to or lower than .06, and SRMR values equal to or lower than .08. There is a general consensus to consider values over .90 as acceptable for CFI and IFI, in view of the difficulty of obtaining a good fit when analyzing models with multiple variables and using real data instead of simulated data (Marsh, Hau, & Wen, 2004)

Convergent and discriminant validity of the satisfaction of the need for novelty measure as a basic psychological need alongside the needs established in self-determination theory was tested using the latent factor correlations ( $\phi$ ) between the novelty measure and the satisfaction of the needs for autonomy, competence, and relatedness. Convergent validity was assumed if statistically significant and positive relations were found among the need satisfaction measures. Discriminant validity was supported if correlations of the novelty measure with the other needs measures were different from unity (1.00) by a value 1.96 times the standard error of the correlation (Bagozzi & Kimmel, 1995). Predictive validity was established using regression testing whether the novelty measure predicted life satisfaction independent of the other need satisfaction variables. All the analyses were carried out with the SPSS 22 and AMOS 22 statistical packages.

## **2.2 Results and Discussion**

### 2.2.1 Confirmatory Factor Analysis

First, we eliminated item 13 (“I feel that I frequently do different activities”) because the bootstrapping analysis indicated a large fluctuation in the value of the factor loading, showing a CI value of  $p > .05$ . The single factor CFA of the 12 novelty items obtained the following fit indices:  $\chi^2(54, N = 399) = 148.69, p < .001$ ; CFI = .96; IFI = .96; RMSEA = .066 (90% CI = .054-.079); SRMR = .036. Although the fit indices could be considered acceptable, in a final analysis, in order to improve the quality of the measure and obtain excellent values, we decided to eliminate the items with the largest standardized covariance residuals (ranging from 2.02 to -1.48) and the factor loadings lower than .70 (Comrey & Lee, 1992): items 1, 5, 6, 7, 10, and 12. We examined the content of the items that were identified in the examination of the analysis of the residuals. Items 1 (“I frequently feel I do different things”) and 5 (“What I do is usually different for me”) appeared to have redundant content with both reflecting perceptions of doing different things in life. Item 6 (“I feel new emotions”) also shared some redundancy with item 9 (“I feel new sensations”) regarding experiencing new sensations or emotions. Item 7 (“I think that the activities I carry out are varied”) and 12 (“I think I manage to develop my originality”) likely reflected constructs rather than novelty. For example, item 7 relates more to the construct of perceived variety that includes novel and alternating familiar experiences than novelty per se (Sylvester et al, 2014), and item 12 refers to the concept of originality that covers creativity and even autonomy (Sheldon, 1995). Finally, item 10 (“I do not usually slip into routines”) was negatively worded that may have presented some difficulties in understanding. Removing these items resulted in the final six-item version of the scale which captures the novelty need satisfaction construct (see Appendix). A CFA of the six-item version exhibited good fit with the data ( $\chi^2(9, N = 399) = 24.86, p = .003$ ; CFI = .99; IFI = .99; RMSEA = .067 (90% CI =

.036-.098); SRMR = .024). The descriptive statistics and the factor loadings of the items are provided in Table 1.

[Insert Table 1 here]

Second, the CFA with four correlated latent variable comprising the novelty need satisfaction scale and the need satisfaction scales for autonomy, competence, and relatedness exhibited acceptable fit indices ( $\chi^2(178, N = 399) = 376.38, p < .001$ ; CFI = .92; IFI = .92; RMSEA = .053 (90% CI = .045-.060); SRMR = .054). Latent factor correlations between novelty need satisfaction and the competence ( $\phi = .64$ ; 90% CI = .52-.79) and autonomy ( $\phi = .55$ ; 90% CI = .45-.67) need satisfaction scales were medium in effect size, and the correlation between novelty and relatedness ( $\phi = .30$ ; 90% CI = .16-.40) was smaller by comparison and differed significantly from the other two correlations. These correlations support the convergent validity of the novelty factor because they form a theoretically-predictable pattern of relations with conceptually-related constructs. Discriminant validity was also supported because the factor correlations were less than unity by 1.96 times the standard error of the correlation. Factor loadings and error variances of the four-correlated-factor model are shown in Figure 1. Composite reliability ( $\rho = .89$ ) and AVE (.57) values were acceptable for the novelty factor.

[Insert Figure 1 here]

### 2.2.2 Invariance Analysis across Gender and Age

We used multi-group analysis to examine invariance of the four-correlated-factor model across gender and age given the broad age range of the participants: 18-65 years (Table 2). We compared the unconstrained model with models in which sets of key model parameters were progressively constrained to be invariant across groups consistent with Byrne, Shavelson, and Muthén's (1989) recommendations. With regard to the analysis across gender, no significant differences were found in the model  $\chi^2$  between the unconstrained

model and the model in which the factor loadings were set as invariant, which is a minimum criterion for invariance (Byrne et al., 1989; Milfont, & Fischer, 2010). In addition, the difference in CFI between the unconstrained model and the models in the invariance routine was lower than .01, thus meeting the criterion established by Cheung and Rensvold (2002) to support model invariance.

[Insert Table 2 here]

In the analysis across age, we divided the sample into three age groups: 18 and 24 years ( $n = 155$ ;  $M = 21.86$ ,  $SD = 1.69$ ); 25 and 32 years ( $n = 111$ ;  $M = 28.04$ ,  $SD = 2.45$ ); older than 32 years ( $n = 133$ ;  $M = 45.03$ ,  $SD = 8.60$ ). This decision was made taking into account that there were not enough people between ages 45 and 65 to enable us to adequately compare the different life stages. The multi-group analysis revealed no significant differences in the model  $\chi^2$  between the unconstrained model and the model in which the factor loadings were set as invariant, thus supporting factorial invariance. Moreover, the CFI differences between these models were less than .01.

### **2.2.3 Predictive Validity Analysis**

Factor correlations (Table 3) indicated that satisfaction of the need for novelty was positively correlated with life satisfaction with medium effect size as predicted. Predictive validity was tested using linear multiple regression analysis using manifest variables rather than a latent variable analysis due to restrictions in parameter: sample size ratio which should be at least 10:1; our model had 399 participants and over 100 parameters. This had the limitation of not controlling for measurement error. However, as factors were well specified with good composite reliabilities, it is unlikely that the findings in analyses using manifest variables were substantially affected.

[Insert Table 3 here]

The regression analysis was performed in two steps. In the first step, the three basic psychological needs were entered as independent variables, and in the second step, the need for novelty was entered. This provides a stringent test of predictive validity as it removes all common variance shared by the four needs and isolates the unique variance in life satisfaction predicted by each (Sheldon et al., 2001). The results of the first step showed that life satisfaction was predicted by satisfaction of the needs for competence ( $\beta = .36, p < .001$ ) and autonomy ( $\beta = .25, p < .001$ ), explaining 29.4% of the variance. In the second step, life satisfaction was predicted by satisfaction of the needs for competence ( $\beta = .31, p < .001$ ) and autonomy ( $\beta = .20, p < .001$ ), and, in addition, by satisfaction of the need for novelty ( $\beta = .17, p = .001$ ), with 31.2% of the variance in life satisfaction explained. Satisfaction of the need for relatedness did not significantly predict life satisfaction ( $\beta = .05, p = .355$  for the first step;  $\beta = .06, p = .264$  for the second step).

Results indicate adequate psychometric properties of the final six-item version of the satisfaction of the need for novelty measure including overall model good fit and adequate composite reliability, AVE, and discriminant validity statistics. The regression analysis provided initial support for the predictive validity of satisfaction of the need for novelty due to its unique prediction of life satisfaction independent of the other need satisfaction variables

### **3. Study 2**

#### **3.1 Method**

##### **3.1.1 Participants**

Participants were 1035 students (539 girls and 496 boys) from the first year of post-compulsory secondary education of two provinces in southeast Spain (one of them different from those of Study 1), with ages ranging between 15 and 24 years ( $M = 16.20; SD = .86$ ).

The students participated in two weekly 55-minute sessions of compulsory PE. Most participants were Caucasian and belonged to middle-income socioeconomic class.

### 3.1.2 Measures

**Basic psychological needs in PE.** The adapted Spanish version (Moreno, González-Cutre, Chillón, & Parra, 2008) of the Basic Psychological Needs in Exercise Scale (BPNES, Vlachopoulos & Michailidou, 2006) was used. The scale was preceded by the common statement “In my PE classes...” and comprised four items per factor to measure satisfaction of the need for competence (e.g., “...I can perform the exercises effectively”), autonomy (e.g., “...the exercises that I perform fit my interests”) and relatedness (e.g., “...I feel very comfortable with my classmates”). Responses were made using 5-point Likert-type scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

**Need for novelty.** The final six-item version of the Novelty Need Satisfaction Scale (NNSS) developed in Study 1 was used to measure satisfaction of the need for novelty in PE. The items were integrated into the BPNES to be administered and, therefore, rated on 5-point Likert-type scales, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

**Motivation in PE.** The Spanish version (Ferriz, González-Cutre, & Sicilia, 2015) of the Perceived Locus of Causality Scale (PLOC, Goudas, Biddle, & Fox, 1994), including items to measure integrated regulation, was used to measure the different motivational styles proposed in self-determination theory. Each of the 24 items was preceded by the common stem “I participate in PE classes...” with four items each tapping the six motivation types: intrinsic motivation refers to a participation in the activity for the enjoyment derived from it (e.g., “...because PE is fun”), integrated regulation represents the integration of the activity into sets of behaviors that reflect an individual’s true sense of self (e.g., “...because I consider that PE is part of me”), identified regulation reflects actions that produce outcomes that are personally valued and internalized (e.g., “...because it is important for me to do well



in PE”), introjected regulation reflects performing actions to avoid externally-referenced negative (guilt and shame) and positive (e.g., non-contingent self-esteem) outcomes (e.g., “...because I would feel bad about myself if I didn’t”), external regulation refers to acting to receive an external incentive or to avoid punishment (e.g., “...so that the teacher won’t yell at me”), and amotivation reflects the absence of motivation or interest in doing an activity (e.g., “...but I can’t see what I’m getting out of PE”). Intrinsic, integrated and identified regulations represent autonomous forms of motivation while introjected and external regulation represent controlled forms. Responses were provided on Likert-type scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

### **3.1.3 Procedure**

Informed consent was requested from the adult participants and the families of the underage participants. The participants were informed that they would participate in a survey on their motivation in PE. The questionnaires were completed anonymously in a classroom setting under the supervision of the researcher. The study was conducted with prior permission from the school administrators and received approval from the research ethics board of the second author’s university prior to data collection.

### **3.1.4 Data Analysis**

First, in order to assess the validity of the Novelty Need Satisfaction Scale in PE, a one-factor CFA was carried out on six-item version of the scale developed in Study 1. Second, in order to examine in this study the extent to which the need for novelty is empirically distinct from measures of competence, autonomy, and relatedness need satisfaction, we tested a four-correlated-factor CFA model in which all of the need satisfaction variables indicated a latent factor and the factors set to freely correlate. Model fit was evaluated using the same goodness-of-fit indices adopted in Study 1 along with composite reliability and AVE statistics.

Third, we examined the latent variable correlations of the novelty need satisfaction measure with the measures of need satisfaction of the other three needs and the different forms of motivation from self-determination theory in a PE context. In addition, as the literature has shown that satisfaction of the three basic psychological needs and the need for novelty are strongly related to intrinsic motivation, we tested the predictive validity of the construct using a structural equation model in which novelty and need satisfaction variables predicted intrinsic motivation as a dependent variable. All the analyses were carried out with the AMOS 22 statistical package.

## **3.2 Results and Discussion**

### **3.2.1 Confirmatory Factor Analysis**

The one-factor CFA of the six-item version of the novelty need satisfaction measure exhibited acceptable goodness-of-fit indices ( $\chi^2 (9, N = 1035) = 65.03, p < .001$ ; CFI = .98; IFI = .98; RMSEA = .078 (90% CI = .061-.096); SRMR = .021). Descriptive statistics and factor loadings of the items are provided in Table 4. The four-correlated-factor CFA yielded acceptable fit indices with the data ( $\chi^2 (129, N = 1035) = 748.15, p < .001$ ; CFI = .93; IFI = .93; RMSEA = .068 (90% CI = .063-.073); SRMR = .075). Latent factor correlations between novelty need satisfaction and the competence ( $\phi = .46$ ; 90% CI = .36-.53), autonomy ( $\phi = .79$ ; 90% CI = .74-.83) and relatedness ( $\phi = .29$ ; 90% CI = .22-.35) need satisfaction scales support the convergent validity of the novelty need satisfaction factor. Discriminant validity was supported because the factor correlations were less than unity by 1.96 times the standard error of the correlation. Composite reliability ( $\rho = .90$ ) and AVE (.61) values were acceptable.

[Insert Table 4 here]

### **3.2.2 Predictive Validity Analysis**

Latent factor correlations among the other need satisfaction measures and forms of motivation from self-determination theory are provided in Table 5. The satisfaction of the need for novelty was positively correlated with the most autonomous forms of motivation in PE and with introjected regulation. It did not correlate with external regulation, and it was negatively correlated with amotivation. The pattern of correlations for the need for novelty with the types of motivation in PE was very similar to those obtained with the other three basic psychological needs.

[Insert Table 5 here]

The results of the structural equation model with intrinsic motivation as the dependent variable and the three basic psychological needs as independent variables showed that intrinsic motivation was predicted by satisfaction of the needs for competence ( $\beta = .67, p < .001$ ) and autonomy ( $\beta = .16, p = .005$ ), explaining 58.6% of the variance. Satisfaction of the need for relatedness did not significantly predict intrinsic motivation ( $\beta = -.05, p = .189$ ). The model exhibited acceptable fit according to multiple criteria:  $\chi^2(98, N = 1035) = 595.60, p < .001$ ; CFI = .92; IFI = .92; RMSEA = .070 (90% CI = .065-.076); SRMR = .066. In the second analysis, including novelty as another independent variable (Figure 2), intrinsic motivation was predicted by satisfaction of the need for competence ( $\beta = .71, p < .001$ ), and, in addition, by satisfaction of the need for novelty ( $\beta = .22, p < .001$ ), with 60% of explained variance. Satisfaction of the needs for autonomy ( $\beta = -.04, p = .688$ ) and relatedness ( $\beta = -.06, p = .127$ ) did not significantly predict intrinsic motivation. The model also exhibited acceptable fit with the data ( $\chi^2(199, N = 1035) = 962.32, p < .001$ ; CFI = .93; IFI = .93; RMSEA = .061 (90% CI = .057-.065); SRMR = .069).

[Insert Figure 2 here]

The present study provides further support for the findings of Study 1, this time at the contextual level in PE classes. Satisfaction of the need for novelty exhibited adequate validity and was an independent predictor of intrinsic motivation when accounting for the effects of the other three basic psychological needs from self-determination theory.

#### **4. General Discussion**

The study of novelty as a potential psychological need and potential antecedent of motivation in multiple domains has received relatively little attention but is receiving increased attention given its importance for human development and growth. Furthermore, the need for variety and variability in methods and approaches in psychology is recognized as a means to promote better theories and explanations (Ogden, 2016). The aim of the current research was to propose novelty as a basic psychological need alongside the set of existing needs in self-determination theory and provide empirical support for its validity at the global and contextual levels.

Drawing from self-determination theory principles, there are indications in the literature that novelty could be considered a basic psychological need. It is not our intention in the present research to question self-determination theory, quite the contrary. Self-determination theory is currently one of the most prominent motivational theories, and this research is an attempt to contribute to refining it to explain more variance of motivation and associated behaviors (Sheldon, 2011). We therefore reviewed theoretical and empirical contributions on the importance of novelty to human motivation, beginning with a review of classic studies on self-determination theory (Deci, 1975; Deci & Ryan, 1985, 1991, 2000; Ryan & Deci, 2000b). We also drew from other contemporary approaches to novelty (Kashdan, 2004; Roth & Hammelstein, 2012; Silvia, 2005; Sylvester et al., 2014) in which novelty has also been conceptualized as a need and linked to self-determination theory. Our review revealed that

novelty has been characterized as a need and that novelty is an important defining component of intrinsic motivation.

However, there has been no proposal to date considering novelty as a basic psychological need. In addition, empirical studies on novelty have focused on the effects of a greater or lesser tendency to seek novelty instead of measuring its level of satisfaction. Developing a measure of the satisfaction of the need for novelty and examining its convergent and predictive validity alongside other psychological need satisfaction measures and types of motivation from self-determination theory as well as life satisfaction could be a first step to consider novelty as a basic psychological need and its potential role in determining well-being and optimal functioning.

The results of the present research provide preliminary support to the validity and reliability of our measure of the satisfaction of the need for novelty, the Novelty Need Satisfaction Scale (NNSS). Developing the scale from an expert-determined pool of candidate items, two studies on demographically different samples revealed that our final six-item novelty need satisfaction measure exhibited construct, discriminant, and convergent validity alongside measures of psychological need satisfaction and forms of motivation from self-determination theory. The pattern of correlations found between satisfaction of the need for novelty and the forms of motivation is very similar to that found for the other three basic psychological needs in prior studies (Ntoumanis, 2012), and consistent with theory postulates. We also demonstrated invariance of the measure across gender and age. Tests of predictive validity were consistent with the predictions of self-determination theory, with unique effects of our satisfaction of the need for novelty measure on life satisfaction and intrinsic motivation independent of other need satisfaction constructs. In addition, our results were tested in a generalized life domain and a specific life context, PE. The application of our findings at two levels of Vallerand's (1997) hierarchy should be highlighted as a strength of

the current data because it shows the potential generalizability of novelty need satisfaction across life domains.

The present research is a first approach to the study of novelty as a basic psychological need from the perspective of self-determination theory. Although the results obtained were in line with our expectations, there are reasons to exercise caution when interpreting the findings. First, with regard to the conceptualization of novelty as a basic psychological need, we acknowledge that this proposal may be controversial. It is a difficult issue for which to provide unequivocal empirical support and to suggest modifications or extensions to the existing tenets of the theory. In this article, we attempted to show the characteristics that allow novelty to be considered a basic psychological need, drawing on self-determination theory principles established in original theoretical and empirical studies, and attempting to provide empirical support to our proposal. Nevertheless, we understand the scientific community may hold other view and perspectives and we encourage further conceptual debate and research on this issue. It is clear that self-determination theory has had considerable success in explaining human motivation based on three basic psychological needs for over three decades. This research offers a contribution to this conceptualization in order to continue to further our understanding of human motivation. Regardless of whether or not novelty is accepted as a basic psychological need within the theory, we hope that it stimulates debate on the role novelty may play in human motivation within the theory.

Second, this research was carried out exclusively in a Spanish context. It would be interesting to analyze satisfaction of the need for novelty in other countries, cultures and contexts, using the Novelty Need Satisfaction Scale. The items were developed to be context and domain neutral but could be adapted to settings like education, work, or physical exercise. We issue a call to researchers in the field to conduct large-scale, highly-powered replications of our current findings in multiple samples from different cultural, socio-

economic, and demographic backgrounds consistent with current trends toward replication and confirmation in psychology (e.g., Hagger et al., 2016). This will lend converging evidence for our proposal for novelty as a separate psychological need within the confines of self-determination theory. This process can also help to refine the scale and to eliminate items that could be identified as problematic in future studies.

Third, the correlational design with self-report measures did not allow us to infer causal effects and to determine unequivocally that novelty is a basic psychological need. Our results showed that satisfaction of the need for novelty is separable from autonomy, competence and relatedness needs satisfaction measures, and that it has unique effects on life satisfaction and intrinsic motivation consistent with theory. Further studies are necessary to analyze longitudinally the importance of the satisfaction of the need for novelty in different stages of life, and its effects on people's well-being and quality of life over time. Experimental designs are also required to test the effect of novelty support in various contexts on adaptive outcomes including autonomous motivation, life satisfaction, and psychological well-being with novelty need satisfaction as a mediator.

Fourth, future studies should analyze the convergent and divergent validity of the novelty need satisfaction construct with other constructs such as interest, curiosity, sensation seeking, and perceived variety. It should also be possible to establish parallels between the causality orientations proposed in self-determination theory and an orientation toward novelty, which would reflect individuals with a tendency to seek novelty. The interaction between personal orientation toward novelty and novelty support from the environment could influence the satisfaction level of this need and its consequences.

Fifth, predictive validity of the satisfaction of the need for novelty was only related to life satisfaction and motivation in PE and did not show very high predictive power. Future research should test models introducing novelty in the motivational sequence of self-

determination theory. Such a sequence would outline the processes by which environmental and normative support for needs lead to outcomes through need satisfaction and motivation (e.g., social factors → satisfaction of basic psychological needs including need for novelty → motivation → consequences) and it would be important to highlight this in different consequences and other indicators of well-being (hedonic: positive and negative affect; eudaimonic: self-actualization, vitality). Satisfaction of the need for novelty might have more weight in the explanation of some constructs than others. Accordingly, satisfaction of the need for novelty may be more closely linked to intrinsic motivation to experience stimulation, whereas satisfaction of competence may be more closely linked to intrinsic motivation to know and toward accomplishments. Likewise, satisfaction of the need for novelty could explain more variance in other variables such as vitality, self-actualization, and flow state. It would also be interesting to design items to assess thwarting of the need for novelty and its effects, in line with recent approaches to the study of basic psychological needs (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011).

Finally, we suggest analyzing the interaction of the different basic psychological needs. It may be that novelty is positive for human development as long as it is not combined with the thwarting of the other three basic psychological needs. People want to engage in novel activities and pursuits, but only if they are adaptive and do not conflict with other life goals or if they do not feel the novel activities or pursuits are being imposed on them. It would be interesting to establish motivational profiles according to the satisfaction of these fourth needs to analyze how the variation in needs satisfaction is related to different consequences.

The present research offers a new proposal that novelty can be considered as a basic psychological need, and it provides an instrument to measure its satisfaction that exhibits good psychometric properties and predictive validity. Future studies should analyze the viability of this proposal with a view to improving understanding of human motivation.



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Appendix

Novelty Need Satisfaction Scale (NNSS)

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4. I feel I do novel things

8. I frequently feel there are novelties for me

9. I feel new sensations

14. I think that new situations come up for me

15. I have the opportunity to innovate

16. I think I discover new things frequently

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Table 1

*Descriptive Statistics and Factor Loadings for the Final Items of the Novelty Need Satisfaction Scale in Study 1*

Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor loadings
Item 4	4.49	1.51	-.35	-.32	.73
Item 8	4.38	1.42	-.31	-.21	.77
Item 9	4.54	1.44	-.24	-.26	.76
Item 14	4.29	1.40	-.23	-.30	.78
Item 15	4.54	1.53	-.27	-.50	.73
Item 16	4.50	1.51	-.30	-.48	.75

Table 2

*Multi-Group Invariance Analysis across Gender and Age of the Four-Correlated-Factor**Model*

Invariance analysis across gender								
Models	$\chi^2$	<i>df</i>	$\Delta\chi^2$	$\Delta df$	CFI	IFI	SRMR	RMSEA (CI 90%)
Model 1	740.36	366	-	-	.849	.852	.075	.051 (.045-.056)
Model 2	757.99	383	17.63	17	.849	.851	.078	.050 (.044-.055)
Model 3	777.08	393	36.71	27	.845	.847	.081	.050 (.044-.055)
Model 4	809.04	414	68.68*	48	.841	.841	.084	.049 (.044-.054)
Invariance analysis across age								
Models	$\chi^2$	<i>df</i>	$\Delta\chi^2$	$\Delta df$	CFI	IFI	SRMR	RMSEA (CI 90%)
Model 1	980.68	549	-	-	.828	.833	.078	.045 (.040-.049)
Model 2	1011.16	583	30.47	34	.829	.832	.081	.043 (.039-.047)
Model 3	1048.07	603	67.38	54	.822	.824	.085	.043 (.039-.048)
Model 4	1175.51	645	194.82*	96	.788	.787	.088	.046 (.041-.050)

*Note.* Model 1 = unconstrained; Model 2 = invariant factor loadings; Model 3 = invariant structural covariances; Model 4 = invariant measurement residuals.

\* $p < .05$ .

Table 3

*Latent Factor Correlations among Variables in Study 1*

Variables	$\rho$	1	2	3	4	5
1. Novelty	.89		.65**	.30**	.56**	.45**
2. Competence	.73			.69**	.74**	.71**
3. Relatedness	.82				.66**	.41**
4. Autonomy	.64					.56**
5. Life satisfaction	.85					

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\*\* $p < .001$ .

Table 4

*Descriptive Statistics and Factor Loadings for the Final Items of the Novelty Need Satisfaction Scale in Study 2*

Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor loadings
Item 4	2.88	1.14	.08	-.70	.80
Item 8	2.84	1.13	.12	-.71	.79
Item 9	2.92	1.15	.02	-.78	.78
Item 14	2.74	1.13	.18	-.68	.82
Item 15	2.85	1.12	.13	-.67	.70
Item 16	2.84	1.12	.17	-.67	.79

Table 5

*Latent Factor Correlations among Variables in Study 2*

Variables	$\rho$	1	2	3	4	5	6	7	8	9	10
1. Novelty	.90		.46**	.29**	.79**	.50**	.36**	.47**	.35**	-.03	-.19**
2. Competence	.72			.54**	.71**	.75**	.73**	.72**	.47**	-.29**	-.44**
3. Relatedness	.81				.39**	.37**	.26**	.35**	.26**	.03	-.18**
4. Autonomy	.77					.62**	.55**	.60**	.46**	-.06	-.27**
5. Intrinsic	.84						.86**	.98**	.67**	-.24**	-.50**
6. Integrated	.91							.88**	.62**	-.32**	-.47**
7. Identified	.84								.76**	-.19**	-.50**
8. Introjected	.69									.36**	-.15**
9. External	.65										.64**
10. Amotivation	.79										

\*\* $p < .001$ .

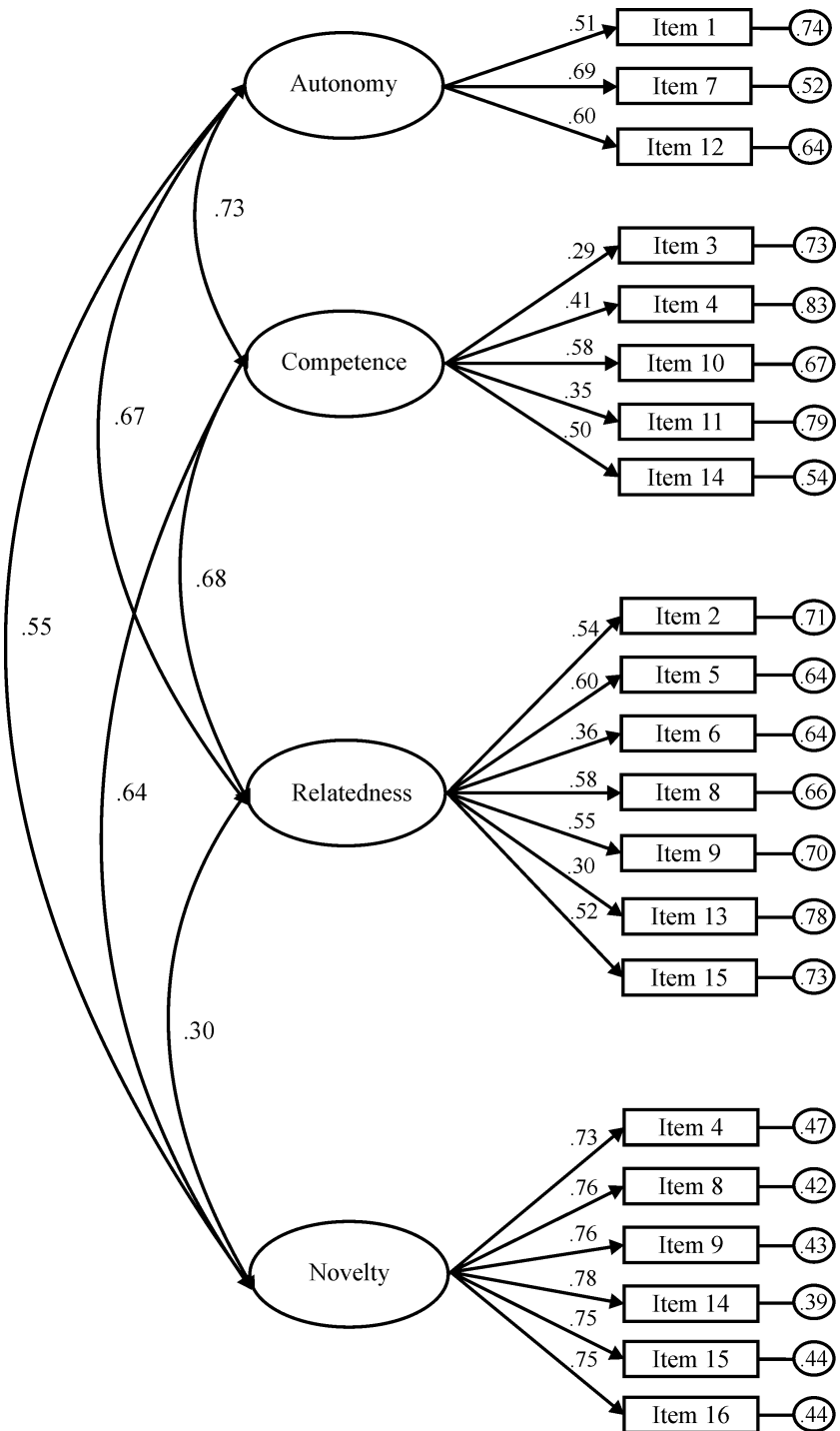
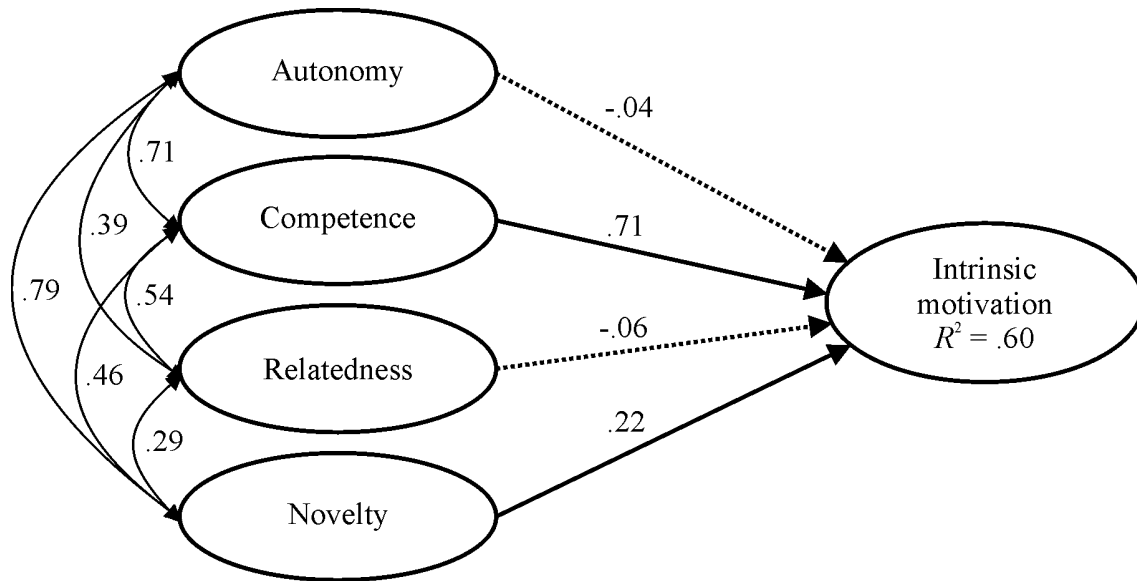


Figure 1. Four-correlated factor model CFA. The ellipses represent the factors and the rectangles represent the diverse items. The error variances are in the small circles. All the parameters are standardized and significant at  $p < .001$ . Novelty items numbering is based on the original NNSS of 19 items, whereas BNSG-S has an independent numbering from 1 to 15.



*Figure 2.* Structural equation modeling showing associations between basic psychological needs (including novelty need satisfaction) and intrinsic motivation. Dashed arrows represent non-significant relations.



Supplementary Data: Candidate Items

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1. I frequently feel I do different things
  2. I perform activities that seem novel to me
  3. I develop new skills
  4. I feel I do novel things
  5. What I do is usually different for me
  6. I feel new emotions
  7. I think that the activities I carry out are varied
  8. I frequently feel there are novelties for me
  9. I feel new sensations
  10. I do not usually slip into routines
  11. I have the opportunity to discover new things
  12. I think I manage to develop my originality
  13. I feel that I frequently do different activities
  14. I think that new situations come up for me
  15. I have the opportunity to innovate
  16. I think I discover new things frequently
  17. I frequently acquire new knowledge
  18. I think I frequently know new things
  19. I think I learn something new every day
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