On the importance of balanced need fulfillment: A person-centered perspective

István Tóth-Király[1,2,*], Beáta Bőthe[1,2], Gábor Orosz[3,2], Adrien Rigó[2]

[1] Doctoral School of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary
[2] Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary
[3] Department of Psychology, Stanford University, Stanford, CA, USA

*Corresponding author
István Tóth-Király
Institute of Psychology, ELTE Eötvös Loránd University
Izabella utca 46.
Budapest, H-1064, Hungary
E-mail.: tothkiralyistvan@gmail.com; toth-kiraly.istvan@ppk.elte.hu

Abstract

Self-Determination Theory proposes that the fulfillment of the three basic psychological needs of autonomy, competence, and relatedness is important for optimal functioning. While support for this proposition have been well-documented, little attention has been paid to how these needs interact within individuals and whether having equally low, medium or high level of need fulfillment (i.e., balanced need satisfaction) has additional effects over and above the aggregated need fulfillment itself. The present study addresses these questions by examining the importance of having balanced versus imbalanced need fulfillment by adopting latent profile analysis making it possible to distinguish quantitative and qualitative need-related differences. This research also documents the relations of these need profiles in relation to theoretically-relevant profile predictors (perceived interpersonal behaviors) and outcomes (affect and passion). A total of 1094 adults (female = 746, Mage = 26.00, SDage = 7.69) participated in this study. A four-profile solution appeared to be the most optimal: (1) balanced, all needs are highly satisfied, (2) imbalanced, only relatedness is highly satisfied, (3) balanced, all needs are average, and (4) balanced, all needs are frustrated. Interestingly, these profiles differed from one another in terms of obsessive passion, negative affect, and, to a smaller extent, positive affect, but not harmonious passion. Finally, profile membership was predicted by the perceived need nurturing global factor as well as by some of the specific factors. These results support the hypothesis that, apart from need fulfillment, need balance is also important for wellbeing and optimal functioning.

Keywords: balanced basic psychological needs; dualistic model of passion (DMP); interpersonal behavior; latent profile analysis (LPA); person-centered; positive and negative affect

The present investigation is anchored in the framework of substantive-methodological synergies in which complex, substantively important issues are addressed with sophisticated methodologies (Marsh & Hau, 2007). From a *substantive perspective*, the present study is rooted in Self-Determination Theory (Ryan & Deci, 2017) and the theory of basic psychological needs which states that the satisfaction and frustration of the needs for autonomy, competence, and relatedness are essential in relation to fully optimal functioning and non-optimal functioning, respectively. While all three needs are said to be important, Sheldon and Niemiec (2006) proposed that the balance in the satisfaction of all three needs is just as important. So far, very little scientific attention has been paid to the examination of balanced needs; that is, how basic psychological needs interact within individuals and, more importantly, how these interacting needs are associated with variables of key interest. Therefore, from a *methodological perspective*, the current study addresses these substantive issues by adopting the person-centered approach of latent profile analysis (LPA) to adequately disentangle the level (i.e., the tendency of having low, moderate, or high levels of needs) and shape (i.e., the tendency of having a distinct need profile) of basic psychological needs (Morin & Marsh, 2015). The present research extends previous literature on basic psychological needs and the examination of balanced needs by (1) simultaneously considering the satisfaction and frustration of all three basic psychological needs rather than using a reduced number of more global dimensions; (2) relying on the novel latent profile analysis instead of the suboptimal cluster analysis (Meyer & Morin, 2016); (3) investigating the need balance hypothesis of Sheldon and Niemiec (2006) by examining whether balanced or imbalanced profiles emerge; and (4) assessing how the emerging need profiles are related to theoretically-relevant profile predictors (perceived interpersonal behaviors) and outcomes (passion and affect).

Theory of Basic Psychological Needs

Research on SDT has identified three basic psychological needs that are considered to be nutriments of self-determined goal-directed behavior as well as physical and psychological health (Ryan & Deci, 2017). Autonomy refers to experiences related to a sense of volition, self-endorsement, and psychological freedom; competence refers to the experience of effectiveness and sense of mastery when interacting with the environment; and relatedness refers to the experience of reciprocal care and attention with relevant others. Previous studies supported the universality and importance of these needs regardless of cultural background (Chen et al., 2015). Additionally, need satisfaction had been positively associated with different indicators of wellbeing (e.g., Costa, Gugliandolo, Barberis, & Larcan, 2016), improved sleep quality (e.g., Campbell et al., 2017), decreased burnout (e.g., Schultz, Ryan, Niemiec, Legate, & Williams, 2015), increased effort (e.g., Gillet et al., 2017), decreased behavioral addictions (e.g., Weinstein, Przybylski, & Murayama, 2017) or intrinsic motivation (Krijgsman et al., 2017).

While the importance of all three needs have been highlighted by the above-mentioned studies, it has scarcely been investigated whether all three needs should be equally satisfied (i.e., balanced needs) to have optimal functioning or whether the satisfaction of one or two of them (i.e., imbalanced needs) is enough. Some studies appear to support the former proposition. For example, Sheldon and Niemiec (2006) directly examined this question across four studies using diverse methodologies (e.g., cross-sectional, prospective, diary, and multiple rater designs) and investigated whether balance of the three needs is related to higher levels of wellbeing. Their results showed that, apart from endorsing all three needs, need balance was also important for psychological health: when comparing participants with the same level of need satisfaction, people reported higher levels of wellbeing when their needs were balanced relative to those having imbalanced needs. Building on these findings, Milyavskaya et al.'s (2009) three-study cross-cultural investigation examined the balance of adolescents' need satisfaction across distinct life contexts (e.g., at home, at school, at work, and with friends) and its relation with wellbeing. Adolescents having balanced need satisfaction across all life domains reported higher wellbeing and better school adjustment compared to their peers with imbalanced need satisfaction and this balance was uniquely linked to wellbeing and adjustment.

In a subsequent study, Dysvik, Kuvaas, and Gagné (2013) examined three alternative need effects to test the associations between need satisfaction and intrinsic motivation (IM): (a) additive effect where each need uniquely contributed to IM, regardless of others; (b) synergistic effect where all three needs must be satisfied to have IM; and (c) balanced effect where satisfaction must be equal across all three needs to

have IM. They found tentative support for all hypotheses. For the additive hypothesis, only autonomy and relatedness predicted IM, but competence did not. For the synergistic hypothesis, only two-way interactions were found, but not a three-way interaction, suggesting that only the interaction of two needs (e.g., competence with high autonomy or competence with low relatedness) was related to IM. For the balanced hypothesis, although balance was positively related to IM, it did not predict IM over and above the level of need satisfaction. One possible explanation for this lack of effect was that balanced needs might be related to wellbeing (as in Sheldon and Niemiec, 2006), but not to IM (as in Dysvik et al., 2013). Overall, it appears that having small discrepancies or variabilities between the three needs (i.e., balanced needs) is beneficial in terms of wellbeing, and, to a smaller extent, intrinsic motivation as opposed to having larger discrepancies (i.e., imbalanced needs).

Studies examining need balance (Dysvik et al., 2013; Milyavskaya et al., 2009; Sheldon & Niemiec, 2006) calculated a need balance index by computing the difference between each pair of needs, summing the absolute value of these difference scores (resulting in a single difference score for each respondent) and then subtracting this summed difference score from the highest observed score to create an index where higher scores typically reflect more balance. Although these previous variable-centered studies are highly informative, it is important to note that the calculation of a need balance index provides a simplified representation and, instead of a more nuanced and holistic interpretation, represents only a partial test of the SDT proposition that the satisfaction of all three needs must be in balance. Fortunately, person-centered approaches provide a natural way to address these issues by taking into account the combination of basic psychological needs.

Need Profiles

The majority of the previous studies used variable-centered approaches to understand the associations between needs and other variables. Variable-centered approaches, while valuable, have their own inherent limitations as well. First, it is often problematic to interpret interactions involving more than three highly correlated variables, but no such limitation exists for latent profiles. Second, variable-centered analyses implicitly assume that respondents belong to the same group and ignore the possibility that these participants could come from various subpopulations. To address this issue, person-centered approaches make it possible to identify homogenous subgroups of participants on the basis of common psychological need characteristics. Overall, person-centered analyses could provide a more holistic understanding of psychological needs and complement variable-centered studies by investigating the interaction of the different need variables, and are thus suitable to test the potential balance or imbalance between the three needs.

While there is a scarcity of person-centered studies in relation to basic psychological needs, there are some results that provide basis for the present investigation (see Table 1 for an overview). Generally speaking, these studies examined need profiles in different contexts (e.g., education, work, or general), across different samples (e.g., youngsters, young adults, elderly people), with different methodologies (e.g., cluster analysis or latent profile analysis), and in relation to various outcomes (e.g., different indicators of wellbeing or motivations). Multiple numbers of profiles have been identified, typically ranging from two to four. Two common "core" profile configurations have emerged with the first being a profile with an overall low level of need satisfaction on all three needs, while the second profile demonstrating an overall high level of need satisfaction on all three needs (e.g., Ferrand, Martinent, & Durmaz, 2014). Additional "peripheral" profiles were also identified in some cases where only one of the needs was elevated: for instance, high competence coupled with average autonomy and relatedness (Earl, 2017) or high autonomy with average competence and relatedness (Esdar, Gorges, & Wild, 2016). While none of these studies interpreted whether the profiles were balanced or imbalanced, it is reasonable to assume that need profiles were balanced where all three needs were equally satisfied or frustrated (i.e., the core profiles), whereas need profiles were imbalanced where only one of the needs was elevated (i.e., the peripheral profiles). On the basis of these results, we expected two core profiles to emerge in the present case with either one or more peripheral profiles being present.

In the present study, the state-of-the-art latent profile analysis (LPA) was used because it is a more flexible and powerful classification approach compared to cluster analysis (Meyer & Morin, 2016; Morin,

2016; Morin & Wang, 2016; Vermunt & Magidson, 2002). More specifically, compared to LPA, cluster analysis relies on rigid assumptions (i.e., invariance of parameters) and suboptimal clustering algorithms that "force" participants into a single profile instead of them having a likelihood of membership in all profiles. Moreover, there are no clear guidelines to select the optimal number of profiles and the results of the cluster analysis are sensitive to the distribution of the variables used during the analyses. LPA provides a solution to these limitations by having less stringent assumptions that can even be explicitly tested, presents a probability of membership, and has guidelines for the selection of optimal models. However, to support the substantive interpretation of the profiles, LPA still needs to be complemented with meaningful profile predictors and outcomes (Marsh, Lüdtke, Trautwein, & Morin, 2009; Morin, Morizot, Boudrias, & Madore, 2011).

Predictors of Need Profiles: Perceived Interpersonal Behaviors

It is reasonable to assume that the fulfillment and balance of the basic psychological needs might be a function of several factors such as individual differences (e.g., personality or temperament) or social-environmental factors. Within the latter, one should consider the need supportive and thwarting characteristics of their social environments as proposed by the SDT (Deci & Ryan, 1985; Yu, Chen, Levesque-Bristol, & Vansteenkiste, 2018). Indeed, basic psychological needs are impacted by the relevant social agents constructing the social environment. Other people's need-supportive or need-thwarting interpersonal behavior can impact the satisfaction/frustration of our psychological needs which in turn influences a wide range of outcomes such as motivations, behavioral engagement, and even wellbeing (Yu et al., 2018).

From the perspective of SDT (Rocchi, Pelletier, Cheung, Baxter, & Beaudry, 2017a; Rocchi, Pelletier, & Desmarais, 2017b; Ryan & Deci, 2017), perceived interpersonal behavior can be deconstructed into six subdimensions (three need-supportive and three need-thwarting), each of them corresponding to one of the three needs. *Autonomy supportive* behavior refers to provision of choice, rational for tasks, and the acknowledgement of others' perspectives. By contrast, *autonomy thwarting* includes the use of controlling language, rewards and punishment as well as conditional regard. *Competence support* involves the use of encouragement, the provision of positive feedback, and believing in others' capabilities. On the other hand, *competence thwarting* implies discouragement, evoking feelings of incompetence and emphasizing faults. Finally, *relatedness support* refers to the understanding, support, and care for others, whereas *relatedness thwarting* involves being distant, not being available, or even rejecting others.

Past research supports the proposition of SDT in that need-supportive behaviors are positively related to need satisfaction, whereas need-thwarting behaviors to need frustration. More specifically, Pulido, Sánchez-Oliva, Leo, Sánchez-Cano, and García-Calvo (2018) investigated the associations between need-supportive/need-thwarting behaviors and need satisfaction/frustration and reported positive associations between a global need supportive factor and participants' level of autonomy, competence, and relatedness need satisfaction. They also reported negative associations between a global need supportive behavior factor and participants' level of autonomy, competence, and relatedness need frustration; positive associations between a global need thwarting behavior factor and participants' level of autonomy, competence, and relatedness need frustration, and negative associations between a global need thwarting behavior factor and participants' level of autonomy, competence, and relatedness need satisfaction. Similar results were obtained in other studies which included the six interpersonal behaviors and the specific factors of need satisfaction and frustration: supportive behavior factors were positively related to need satisfaction and negatively related to need frustration, whereas thwarting behavior factors showed opposite associations (Rocchi et al., 2017a, 2017b). These associations were similar in direction and magnitude regardless of examining a total need-supportive factor score (Niemiec et al., 2006), a total need-thwarting factor score (Bartholomew et al., 2011), or distinct measures of autonomy, competence, and relatedness supportive and thwarting behaviors (Rocchi et al., 2017a, 2017b). Interestingly, no previous person-centered studies (Table 1) investigated the role of profile predictors, making the current investigation particularly important.

Profile Outcomes: Affect and Passion

As mentioned above, demonstrating the validity and utility of the extracted profiles is essential not just in relation to profile predictors, but to profile outcomes as well (Marsh et al., 2009; Morin et al., 2011).

One evident outcome of need profiles is wellbeing. Indeed, the associations between different indicators of wellbeing and psychological needs have been widely documented in cross-sectional (e.g., Chen et al., 2015), diary (e.g., Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), and longitudinal (e.g., Sheldon & Elliot, 1999) studies. These results also appear to hold across different life contexts (e.g., Ryan & Deci, 2000), age groups (e.g., Véronneau, Koestner, & Abela, 2005), and even cultures (e.g., Church et al., 2012). While most studies include wellbeing indices in relation to basic psychological needs, we nevertheless wished to extend these studies by including other theoretically-relevant constructs that do not only reflect on the subjective experience of wellbeing, but constitute the activity-based pillars of it. Among these constructs, passion for engaging in different activities appears to have great relevance.

On the basis of the Dualistic Model of Passion (DMP; Vallerand, 2015; Vallerand et al., 2003), passion can be understood as a strong motivational drive towards an activity that one loves, highly values and spends a considerable amount of energy and time with it. The DMP also distinguishes between two types of passions: the first is *harmonious passion* (HP) entails an autonomous internalization where one becomes passionate for an activity due to its inherent characteristics (e.g., it is enjoyable and pleasurable). For HP, activity engagement remains under the control of the individual who decides when and how to engage in the activity in a flexible way. In turn, this flexibility has been associated with a myriad of positive affective and cognitive outcomes (see Curran, Hill, Appleton, Vallerand, & Standage, 2015 for an overview). The second type of passion is *obsessive passion* (OP) stemming from controlled internalization where the activity becomes part of the self as a result of external pressures. For instance, individuals with OP may engage in an activity because their self-esteem is dependent on engagement and performance. Thus, OP is related to a similar strong desire to engage in an activity, but in this case the individual loses control over and rigidly engage in it, leading to predominantly negative outcomes.

So far, only a handful of studies focused on exploring the associations between need satisfaction (but not need frustration) and passion. Lalande et al. (2017) employed cross-sectional, longitudinal and mixed methods to test the potential role of need satisfaction as a determinant of HP and OP across two domains simultaneously: during activity engagement (i.e., domain-specific need satisfaction or need-related experiences in a specific situation such as during work or school) and outside activity engagement (i.e., general need satisfaction or need-related experiences in life in general). Their results suggested that lower general need satisfaction was related to only OP, while higher domain-specific need satisfaction was related to both HP and OP, indicating that OP might be a compensatory response to unsatisfied general needs. One limitation of these variable-centered studies is that need satisfaction was incorporated as a global factor, thus preventing the examination of the effect of the individual need dimensions on passion which are difficult to include simultaneously in predictive models given the high association between these specific factors. Additionally, the authors were unable to test whether balanced or imbalanced needs were differentially related to HP or OP. Person-centered approaches provide a natural solution to this issue by providing a way to take into account the interplay of specific needs.

The Present Investigation

The present study was designed to identify subgroups of participants with distinct need profiles and examine the extracted profiles on the basis of their level (having low, moderate, or high levels of needs), shape (having a distinct need profile), and balance (whether the three needs are balanced or imbalanced). On the basis of previous studies (e.g., Esdar et al., 2016; Ferrand et al., 2014), we expected that both core and peripheral profiles would also emerge. Finally, to better document the meaningfulness of these profiles, we systematically assessed the relations between need profiles and theoretically-relevant profile predictors (i.e., perceived interpersonal behaviors) and outcomes (i.e., positive and negative affect and passion). Should balanced and imbalanced profiles emerge simultaneously, based on previous need balance studies (Dysvik et al., 2013; Milyavskaya et al., 2009; Sheldon & Niemiec, 2006), it was expected that members of the balanced and satisfied profile would have higher levels of positive affect and lower levels of negative affect (which were chosen indicators of wellbeing) relative to imbalanced and/or frustrated profile members. Based on Lalande et al. (2017), profiles with higher levels of need satisfaction were expected to be negatively related to OP, but not related to HP. Given that no prior studies investigated the associations between balanced/imbalanced need fulfillment profiles and passion, we did not formulate any hypotheses

for this relationship. As for the profile predictors, supportive interpersonal behaviors were expected to predict membership to the more satisfied profiles compared to the more frustrated ones.

Method

Procedure and Participants

The study was conducted in accordance with the Declaration of Helsinki and with the approval of the Research Ethics Committee. Participants were recruited from groups and forums specialized in online activities (e.g., Facebook use, TV series watching, and online gaming)[1]. Upon reading the aims of the study, participants had to provide their consent if they wished to participate. The sample consisted of 1094 Hungarian participants (female = 746), aged between 18 and 73 (M_{age} = 26.00, SD_{age} = 7.69, median = 23). Regarding their level of education, 48 had a primary school degree, 803 had a high school degree, whereas 242 had a higher education degree. Regarding their residence, 480 lived in the capital city of Budapest, 135 in county towns, 304 in towns, and 175 in villages.

Measures

Basic psychological needs. The Hungarian version (Tóth-Király, Bőthe, Orosz, & Rigó, 2018; Tóth-Király, Morin, Bőthe, Orosz, & Rigó, 2018) of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) was used to measure need fulfillment in general. The instrument contains 24 items which can be separated by six factors (four items each) including autonomy satisfaction (e.g., "I feel a sense of choice and freedom in the things I undertake.") and frustration (e.g., "I feel forced to do many things I wouldn't choose to do."), competence satisfaction (e.g., "I feel confident that I can do things well.") and frustration (e.g., "I feel disappointed with many of my performance."), and relatedness satisfaction (e.g., "I feel that the people I care about also care about me.") and frustration (e.g., "I feel the relationships I have are just superficial."). Items were rated on a five-point scale (1 = Not true at all for me; 5 = Very true for me).

Perceived interpersonal behavior. The Interpersonal Behaviors Questionnaire (Rocchi et al., 2017a) was chosen to assess individuals' subjective perception of other people's need-supportive/need-thwarting behavior. Starting with the stem "The people in my life…", the instrument measures a combination of behaviors relating to supporting and thwarting of autonomy (support: "…Give me the freedom to make my own choices."; thwarting: "…Pressure me to do things their way."), competence (support: "…Encourage me to improve my skills."; thwarting: "…Send me the message that I am incompetent."), and relatedness (support: "…Take the time to get to know me."; thwarting: "…Are distant when we spend time together") with 24 items in total, four items on each factor. Participants were able to answer on a seven-point scale (1 = Do not agree at all; 7 = Completely agree). A standardized translation protocol (Beaton, Bombardier, Guillemin, & Ferraz, 2000) was followed to obtain the Hungarian version.

Positive and negative affect. The 10-item version (Gyollai, Simor, Köteles, & Demetrovics, 2011) of the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure the frequency of positive (e.g., determined, inspired, or active) and negative emotions (e.g., nervous, upset, or ashamed) one experienced in life in general. Items are rated on a five-point scale (1 = Very slightly or not at all; 5 = Very much).

Passion (profile outcome). Respondents' passion was assessed with the Passion Scale (Marsh et al., 2013; Tóth-Király, Bőthe, Rigó, & Orosz, 2017) which measures harmonious (six items, e.g., "My activity is in harmony with other things that are part of me.") and obsessive passions (six items, e.g., "I have the impression that my activity controls me."). Given that mostly young adults were targeted, we wished to examine their engagement in relation to online leisure activities that are popular among them and important for them (Richter, 2013). Therefore, in the present case, passion referred to one of the following three popular screen-based leisure activities: Facebook use, TV series watching, or online gaming. Participants indicated their level of agreement on a seven-point scale (1 = Not agree at all; 7 = Very strongly agree).

Statistical Analyses

Latent profile analyses (LPA). The psychometric properties of the measures were verified with preliminary factor analysis which were also used to generate factor scores (with a mean of zero and a

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[1] These online groups and forums included, for instance, PlayerUnknown's Battlegrounds Hungary or Sorozatjunkie.

standard deviation of one), serving as a basis for the LPA. More information is available about these models in Appendix 1 of the online supplementary documents. All models, ranging from one profile to eight profiles, were estimated with Mplus 8.0 (Muthén & Muthén, 1997-2018) with the robust maximum likelihood estimator. All models were estimated with 5000 random sets of start values, 1000 iterations and the 200 best solutions were retained to avoid suboptimal local maximum (Gillet, Morin, Cougot, & Gagné, 2017; Hipp & Bauer, 2006). The means and the variances of the motivational factors were freely estimated in all profiles (Diallo, Morin, & Lu, 2016). The precise process of model selection is reported in Appendix 2 of the supplementary documents.

   Profile predictors and outcomes. Upon identifying the final solution, the auxiliary "BCH" function which is suitable for continuous outcomes (Morin, Houle, & Litalien, 2017) of Mplus was used to test whether the profiles differed in the levels of passion as well as affect. As for the predictors, multinominal logistic regressions were performed to test the associations between the predictors and the likelihood of membership into the different profiles using the Mplus's auxiliary "R3STEP" function for predictors. The resulting regression coefficients show the likelihood of belonging to the target profile compared to the referent one. For better understanding, these coefficients are converted to odds ratios (OR) which indicates the likelihood of group membership into the target group relative to the referent group (e.g., an OR of 3 suggests that respondent is three times more likely to be member of the target profile compared to the referent profile).

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Results

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Preliminary Measurement Models

   To avoid the unnecessary lengthening of this section, detailed results related to the preliminary measurement models are reported in Appendix 3 of the online supplementary documents. Overall, all measurement models had adequate fit. Basic psychological needs were represented with six factors (i.e., satisfaction and frustration × autonomy, competence, and relatedness), perceived interpersonal behavior was modeled with seven factors (i.e., a bifactor model including a global nurturing factor with additional specific factors representing support and thwarting × autonomy, competence, and relatedness)[2], while affect (i.e., positive and negative affect) and passion (i.e., harmonious and obsessive passion) were modeled with two factors each.

Latent Profiles of Need Fulfillment

   A four-profile solution was identified as adequate which is graphically depicted in Figure 1 (more details are provided in Appendix 4 of the supplementary documents). The four profiles differed from one another both quantitatively (i.e., high vs. low levels) and qualitatively (i.e., all factors vs. only a subset of factors) in terms of need satisfaction vs. need frustration. *Profile 1* represented 18.10% of the respondents and was characterized by high levels on all satisfaction factors and low levels on all frustration factors (Satisfied profile). *Profile 2* included 19.10% of the respondents who had high levels of relatedness satisfaction, low levels of relatedness frustration with the other factors being average (Relatedness profile). Interestingly, relatedness satisfaction was higher than in Profile 1. *Profile 3* was the most prevalent (38.76% of the respondents) with average levels on all need dimensions (Average profile). *Profile 4* (where 24.04% of the participants belong) was the exact opposite of Profile 1 with high levels on all frustration dimensions and low levels on all satisfaction dimensions (Frustrated profile).

   As we were not aware of any agreed criteria upon which one can decide whether a profile is balanced or imbalanced, we interpreted a profile as balanced when the difference between the factor means was 0.5 SD or less. Conversely, a profile was considered imbalanced when this difference was larger than 0.5 SD

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[2] While second-order models could also have been investigated (in which the first-order factors are associated with a second-order factor), this modeling approach has been shown to have limitations (see Morin, Arens, & Marsh, 2016 or Morin, Myers, & Lee, 2018). More specifically, higher-order models rest on the assumption that the association between the items and the higher-order factor is indirect and, at the same time, fully mediated by the first-order factors. Also, these models assume that the ratio of global and specific variance is exactly the same for all items associated with a specific first-order factor. However, this assumption is overly stringent and rarely holds in practice (Gignac, 2016; Reise, 2012). For this reason, bifactor models were analyzed that are able to properly partition the indicators' global and specific variance.

(see Gustafsson, Carlin, Podlog, Stenling, & Lindwall, 2018 for a similar application). Based on these guidelines, the Satisfied, the Average, and the Frustrated profiles (Profiles 1, 3, and 4, respectively) were balanced (SDs between the factor means $\leq$ 0.407), whereas the Relatedness profile (Profile 2) was imbalanced (SDs between the factor means $\geq$ 0.530). For the exact profile means and variances, see Appendix 5 Table S1 of the online supplementary documents.

Predictors of Profile Membership

In the next step, predictors were added to the four-profile solution. Results of this multinominal logistic regression are reported in Table 2 and show well-defined pattern of associations between the predictors and the profiles. More specifically, perceived global nurturing differentiated all profiles from one another with a greater likelihood of membership into profiles showing higher levels of need satisfaction relative to lower levels of need satisfaction. For example, when comparing the Satisfied and Frustrated profiles, participants experiencing high levels of general need support had a substantially decreased likelihood of belonging to the Frustrated profile (OR = 0.010). Apart from the global need nurturing factor, the relatedness thwarting specific factor also differentiated between almost all profiles: higher levels of relatedness thwarting were associated with higher likelihood of belonging to the profiles showing lower levels of need satisfaction. For instance, when comparing the Frustrated to the Relatedness profile, respondents experiencing high relatedness thwarting are more than eight times more likely to be members of Frustrated profile relative to Relatedness profile (OR = 8.432). Other specific factors mostly differentiated the Satisfied profile from the other ones: high levels of relatedness support were related to lower likelihood of belonging to the Relatedness, Average, and Frustrated profiles relative to the Satisfied profile (significant ORs ranging from 0.327 to 0.558) as well as lower likelihood of membership into Frustrated profile relative to the Relatedness profile (OR = 0.244). Experiencing autonomy thwarting also predicted higher likelihood of membership into the Relatedness, Average, and Frustrated profiles relative to the Satisfied profile (significant ORs ranging from 1.943 to 2.277). Finally, there were some additional profile differentiators: the Satisfied profile differed from the Average profile and the Frustrated profile on the basis of autonomy support, while the Relatedness profile differed from the Average and the Frustrated profiles on the basis of competence support.

Outcomes of Profile Membership

Finally, the four profiles were compared based on their levels of positive and negative affect which is of major importance for the present study (see Table 3 for the exact means and their corresponding standard errors). All profiles differed with respect to negative affect: members of the Frustrated profile had the highest levels of negative affect, then the Average, the Relatedness, and the Satisfied profiles, respectively. As for positive affect, the Satisfied profile had the highest levels, followed by the Relatedness, the Average, and the Frustrated profiles. Note that the Relatedness and the Average profiles did not differ from one another in this dimension (see Figure 2 for a visual representation of the findings). To further document the meaningfulness of the profiles, HP and OP were also included as outcomes. Again, all four profiles differed from one another in relation to OP with the Frustrated profile having the highest means, followed by the Average, the Relatedness, and the Satisfied profiles, respectively. Interestingly, the profiles did not differ from one another in terms of HP.

Discussion

The aim of the present study was to examine the nature of general need fulfillment by identifying distinct profiles of respondents using the state-of-the-art LPA. Many studies have shown the importance of basic psychological needs (Ryan & Deci, 2017), yet very little scientific attention has been allocated to understanding and explicitly testing whether having balanced needs is indeed related to higher wellbeing compared to having imbalanced needs. The current study provides an incremental contribution to the SDT literature with the identification of four need fulfillment profiles which differed from one another not just in terms of overall level (i.e., high, moderate, and low levels of need satisfaction), but shape (i.e., forming distinct need profiles) and balance (i.e., being balanced or imbalanced) as well (Morin & Marsh, 2015; Sheldon & Niemiec, 2006). Thus, it appeared to be critical to understand how basic psychological needs combine within individuals. The reliance on person-centered strategies proved to be particularly well-suited to this investigation, highlighting a way to assess how the satisfaction and frustration of autonomy,

competence, and relatedness are combined into different need fulfillment profiles. Moreover, these profiles were differentially related to theoretically-relevant key profile predictors (i.e., perceived need nurturing behaviors) and outcomes (i.e., passion, and affect). These latter findings are of great importance, given that previous studies lacked these examinations.

In line with prior research conducted within the field of SDT, our results revealed four latent profiles: (1) all needs are highly satisfied, (2) only relatedness is highly satisfied, (3) all needs are average, and (4) all needs are frustrated. These profiles correspond to the results of previous studies (e.g., Earl, 2017; see also Table 1) where similar numbers of profiles were identified. The highly satisfied profile was characterized by high satisfaction and low frustration on all three needs; that is, individuals belonging to this profile experienced choice and psychological freedom (autonomy satisfaction), feelings of mastery and efficacy in their environment (competence satisfaction), and closeness and connection with their significant others (relatedness satisfaction). This particular profile was also identified as being balanced, given the relatively small difference between the means of the factors. Another common profile, corresponding to previous findings (e.g., Hawkins et al., 2014), is characterized by average levels on all three needs and also has a balanced representation, for reasons similar to that of the highly satisfied profile. The third profile, similar to Vanhove-Meriaux, Martinent, and Ferrand (2018), was the mirror image of highly satisfied profile in that it was characterized by high levels of need frustration and low levels of need satisfaction on all three factors as well as being balanced. Respondents of this profile experienced that they had to behave in a certain way (autonomy frustration), felt like a failure during their tasks (competence frustration), and felt rejected by others (relatedness frustration). Overall, it appears that three "core" profiles (Howard, Gagné, Morin, & Van den Broeck, 2016) have been identified which commonly occur in different contexts.

It is also noteworthy that a less common profile also appeared and was characterized by high relatedness satisfaction (and consequently low relatedness frustration), whereas other factors had generally average levels. This configuration was only identified in one study (Earl, 2017), suggesting that it might be a "peripheral" profile (Howard et al., 2016) which may only arise in specific circumstances or in specific subgroups. For instance, the present study focused on participants who were invested in online leisure-time activities. One of the basic functions of these leisure activities relates to their social aspects: they facilitate the development and maintenance of relationships with others (i.e., need for relatedness) either by directly connecting them or providing a common topic that they can talk about. Naturally, people use Facebook for communication, but online gaming might also provide a source for the need for relatedness as people might interact with one another during gameplay and might even talk about the game with their friends and fellow players when they are not playing. As for TV series watching, people might watch TV series together with others or talk about them as it is an unharmful topic even among strangers. This proposition is supported by the fact that talking about TV series is even integrated into the social belonging intervention as a potential topic of discussion (Walton, Murphy, Logel, Yeager, & The College Transition Collaborative, 2017). Additionally, social connection has been identified as one of the most typical motivational factors for each of these leisure activities (i.e., Aladwani, 2014; Demetrovics et al., 2011; Tóth-Király, Bőthe, Tóth-Fáber, Hága, & Orosz, 2017). Future studies should investigate whether similar or different peripheral profiles emerge in various settings. Still, the presence of this profile supports the finer-grained representation of need fulfillment by taking into account the interaction between the three need factors instead of focusing on two higher-order and simplified dimensions of need satisfaction and need frustration. The extraction of this profile was also of major theoretical relevance to the present study, given that the difference between the factor means was so high that this profile identified as an imbalanced one. The presence of this profile made it possible to directly test whether having balanced versus imbalanced needs is differentially related to correlates of key interest.

The Role of Perceived Interpersonal Behavior in Predicting Need Fulfillment Profiles

As far as the authors know, no studies have been conducted to identify the social predictors of need fulfillment profiles, a limitation which we sought to address in the present research with the inclusion of need nurturing interpersonal behaviors. This decision was based on previous studies proposing that the need-supportive or need-thwarting interpersonal behavior of the social environment could contribute to the satisfaction or frustration of basic psychological needs (Bartholomew et al., 2011; Deci & Ryan, 1985). Our

results provide further support for this proposition and revealed that the relative likelihood of profile membership differed as a function of perceived need nurturing behaviors. By relying on the bifactor exploratory structural equation modeling framework (Morin et al., 2016), we were able to disaggregate the global and specific effects of need nurturing behaviors and test their potential additive effects.

The present results first showed that high levels of perceived need nurturing predicted an increased likelihood of membership in the more satisfied profiles relative to all less desirable, frustrated ones (e.g., belonging to the Satisfied profile compared to the Average one, or belonging to the Relatedness profile compared to the Frustrated one). In other words, when individuals perceive that their surrounding social environment supports their needs for autonomy, competence, and relatedness (i.e., higher global levels of need supportive behaviors and lower global levels of need thwarting behaviors), they experience higher levels of need satisfaction and lower levels of need frustration which is in line with the proposition of SDT (e.g., Bartholomew et al., 2011; Haerens et al., 2015; Ryan & Deci, 2017). Once the effect of the global factor was accounted for, the specific need-supportive/need-thwarting factors also had differentiating roles. More specifically, relatedness thwarting predicted a higher likelihood of membership into the more frustrated profiles relative to all satisfied ones (e.g., belonging to the Average profile compared to the Relatedness one, or belonging to the Frustrated profile compared to the Satisfied one). Thus, experiencing rejection, coldness and disinterest from the social environment could elicit experiences of need frustration and potential experiences of loneliness. In turn, as it has been widely documented, loneliness could have adverse negative effects on one's life such as the emergence of depression (Hagerty & Williams, 1999), peer victimization (Storch, Brassard, & Masia-Warner, 2003), problematic behaviors (Bőthe et al., 2018), or increased mortality (Luo, Hawkley, Waite, & Cacioppo, 2012).

Apart from relatedness thwarting, other need nurturing specific factors also significantly predicted profile membership, albeit to a lesser extent. That is, relatedness support was associated with lower likelihood of membership to the Relatedness, Average, and Frustrated profiles relative to the Satisfied profile, lending support for the importance of social belonging and connectedness with others. In contrast, autonomy thwarting predicted higher likelihood of membership to the Relatedness, Average, and Frustrated profiles relative to the Satisfied one. Finally, two additional effects need to be mentioned that do not pertain to all profiles, but only to a subset of them. First, autonomy support predicted lower likelihood of membership to the Average and Frustrated profiles compared to the Satisfied profile. Likewise, respondents had a lower likelihood of belonging to the Average and Frustrated profiles (compared to the Relatedness profile) when they experienced competence support from the social environment. These findings are all in line with SDT (Ryan & Deci, 2017), further highlighting the importance of specific need supportive behaviors. Taken together, these results are aligned with the observation that need nurturing interpersonal behaviors play a key role in the emergence of need fulfillment profiles characterized by high levels of need satisfaction and low levels of need frustration.

Affective and Engagement-related Outcomes of Need Fulfillment Profiles

Finally, to further document the construct validity of the extracted profiles, we examined their association with two theoretically-relevant key outcomes: one being positive-negative affect, while the other being harmonious-obsessive passion. More importantly, these investigations allowed us to directly test the need (im)balance hypothesis of Sheldon and Niemiec (2006, see also Milyavskaya et al., 2009). Our findings lend support for their proposition. The four profiles were related to different levels of negative affect and, to a smaller extent, positive affect with the more satisfied profiles having lower negative affect and higher positive affect. The sole exception was the comparison between the imbalanced Relatedness profile and the balanced Average profile which did not differ from one another with respect to positive affect. Thus, having a balanced profile might not be associated with increased positive affect, but rather decreased negative affect.

In line with the explanation of Sheldon and Niemiec (2006), discrepancies or variabilities in the three needs may be related to experiences of stress and conflict which in turn could undermine wellbeing. Imbalance could also be attributed to the imbalanced allocation of energy and time. For instance, an athlete might train or exercise a lot to further his career and consequently has high levels of competence satisfaction. However, as a result, he is not able to meet his friends as often as he would like to, leading to moderate

levels of relatedness satisfaction and overall lower levels of wellbeing compared to athletes who allocate time for other activities and life contexts as well. Interestingly, the results of Milyavskaya et al. (2009) support this notion as they found that adolescents had higher wellbeing and better school adjustment when their needs were satisfied and balanced across different contexts (e.g., school, home, friends, or work), further highlighting their important role in optimal functioning.

From the perspective of passion, similar to negative affect, more satisfied profiles were associated with lower levels of obsessive passion, aligning with the results of Lalande et al. (2017). In the state of need frustration, a number of potential coping strategies are likely to emerge to counteract these experiences, one of them being obsessive passion as a form of compensatory behavior (Vansteenkiste & Ryan, 2013). More specifically, when the needs for autonomy, competence, and relatedness are frustrated, people are more likely to become sensitive to environmental cues that have the possibility to compensate for these frustrating deficits. Subsequently, when such an activity is found, people are more likely to engage in it in an obsessive manner which, in turn, could temporarily restore the need deficits. However, one might lose control over the activity in this process of compensatory behavior. Consequently, in the state of need satisfaction, one's regulation is generally more autonomous, which engenders less defensiveness and compensation (Vansteenkiste & Ryan, 2013). Finally, it is interesting to note that harmonious passion did not differ across groups. This result is not that surprising, given that need satisfaction in a general context was not associated with harmonious passion (Lalande et al., 2017).

Overall, the results suggest that Profile 1 (balanced in satisfaction) is the most optimal one with all needs being highly satisfied and this profile was also reasonably related to different outcomes. In case this optimal configuration cannot be achieved (e.g., the environment does not support the satisfaction of all three needs), it might be important for the individual to have at least one of the needs satisfied (Profile 2), because it might still be considered protective against negative correlates (e.g., negative affect and obsessive passion), while at the same time not being related to positive ones. Members of Profile 3 might be considered vulnerable to negative experiences, given that none of the needs stood out which might prompt individuals to search for activities that could counter this experience. Finally, the least optimal was Profile 4 (balanced in frustration) where all needs are frustrated and thus members of this group frequently experience negative emotions and they are more likely to be obsessively passionate for an activity to counterbalance this frustrated state. Additionally, need balance matters with respect to affective and engagement outcomes as well, but only if the needs are satisfied on a relatively high level. When needs are not adequately satisfied (Profile 3) or even frustrated (Profile 4), balance might indicate vulnerability.

Limitations and Future Directions

The present study made some significant contributions to the SDT literature. First, it examined different specific need configurations instead of relying on more global, simplified dimensions. Second, the state-of-the-art LPA was used to examine said need configurations which made it possible to directly test the need balance hypothesis of Sheldon and Niemiec (2006). Third, theoretically-relevant profile predictors and outcomes were included to test the validity of the emerging profiles. Still, there are some limitations that need to be mentioned. The cross-sectional nature of the study prevents any causal inferences. Future experimental studies should test whether manipulating one need or more needs simultaneously corroborates the present findings. Longitudinal studies should also be pursued to test the temporal stability of the profiles and to assess the hypothesized directionality between the examined constructs. These endeavors could also allow the investigation of within-person and between-person changes of need profiles, possibly across different life contexts (e.g., sport, work, education). The self-reported nature of the constructs at hand should also be balanced with more objective measures to avoid potential social desirability or self-report biases. For instance, with respect to perceived interpersonal behaviors, it might be fruitful to ask the social agents of the environment about their interpersonal behaviors in a 360-degree assessment. Also, different wellbeing indices (e.g., depression, self-esteem, life satisfaction, other indices of eudaimonic wellbeing) could also be used to more fully grasp the potential differences between the need profiles. Despite their popularity (e.g., Facebook, 2017; Fisher & Robinson, 2011; Konrad, 2017), it also has to be noted as one of the limitations that the Passion Scale only focused on three pre-selected online leisure activities which might have affected the obtained results. Future studies should include other activities for a more comprehensive investigation.

Given that the study only included Hungarian respondents, future studies should examine whether similar profile configurations emerge in different countries or among respondents with different cultural background.

Practical Implications

The present results could also have implications related to practice. As our findings suggested that need nurturing behaviors substantially impacts need fulfillment profile membership, it might be beneficial to incorporate elements of need nurturing behavior into practice (Ryan & Deci, 2017; Soenens, Deci, & Vansteenkiste, 2017). One of the most basic elements is *autonomy support* which relates to the need for autonomy and includes the provision of choices and rationale as well as the use of informative and non-evaluative communication style as opposed to a more controlling style (Soenens et al., 2007). The second element is *structure*, contributing to the need of competence, it describes the perceived association between the behavior and its consequences. Structure incorporates clear rules, guidelines, and optimally challenging tasks to effectively achieve the outcome of the behavior (Grolnick & Ryan, 1989). On the other hand, chaos stems from contradictory rules, unclear demands and expectations which can undermine the feelings of competence. The third element is *involvement* which primarily contributes to the need for relatedness. It includes perspective taking, responsiveness, and warmth from the social environment, while its opposite would foster relatedness frustration by means of coldness, indifference, and rejection (Ratelle, Larose, Guay, & Senécal, 2005). These elements have been successfully incorporated into interventions and training programs that were implemented with promising results across a variety of contexts, such as education (Jang, Reeve, & Halusic, 2016), sport (Tessier, Sarrazin, & Ntoumanis, 2010), and even health (Ryan, Patrick, Deci, & Williams, 2008). Overall, demonstrating need-supportive interpersonal behaviors provides a way to replenish the three nutriments of basic psychological needs which in turn lead to more organismic growth, well-integrated behaviors (e.g., passion), and wellbeing (e.g., affect).

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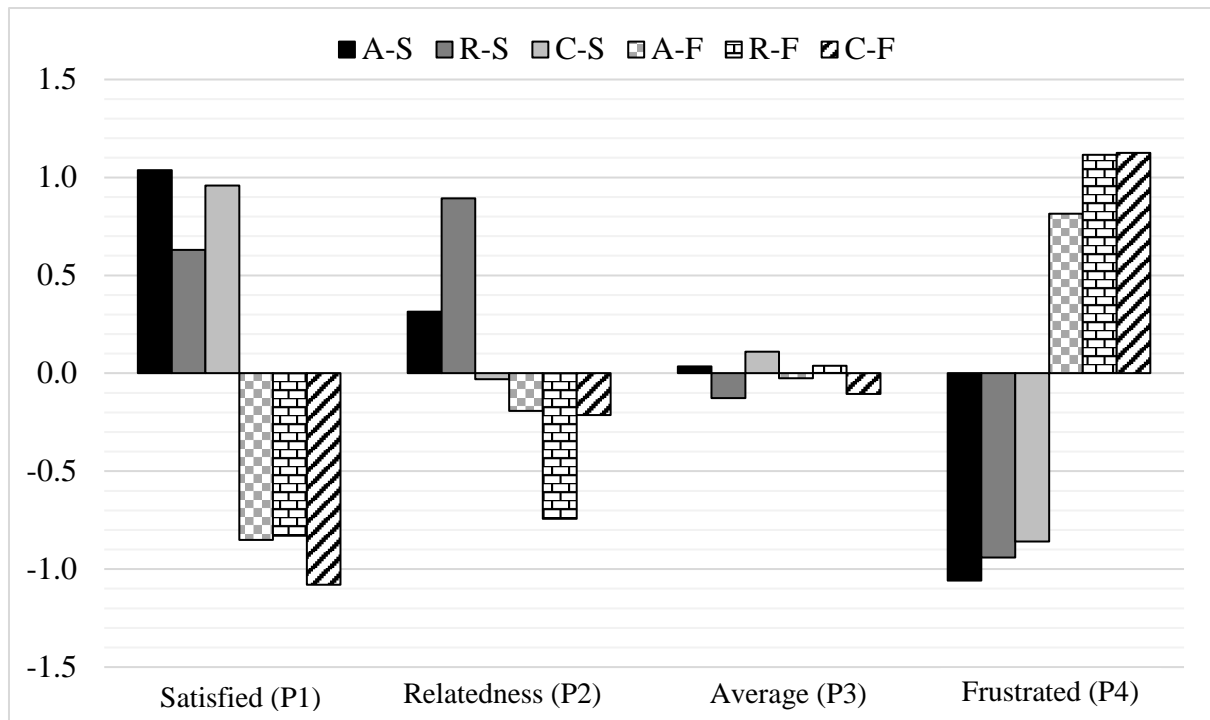
Figure 1

Characteristics of the latent profiles on the basic psychological need fulfillment

Note. Indicators are estimated from factor scores saved from preliminary measurement models with a mean of 0 and a standard deviation of 1.; A-S: autonomy satisfaction; R-S: relatedness satisfaction; C-S: competence satisfaction; A-F: autonomy frustration; R-F: relatedness frustration; C-F: competence frustration.; P: profile.
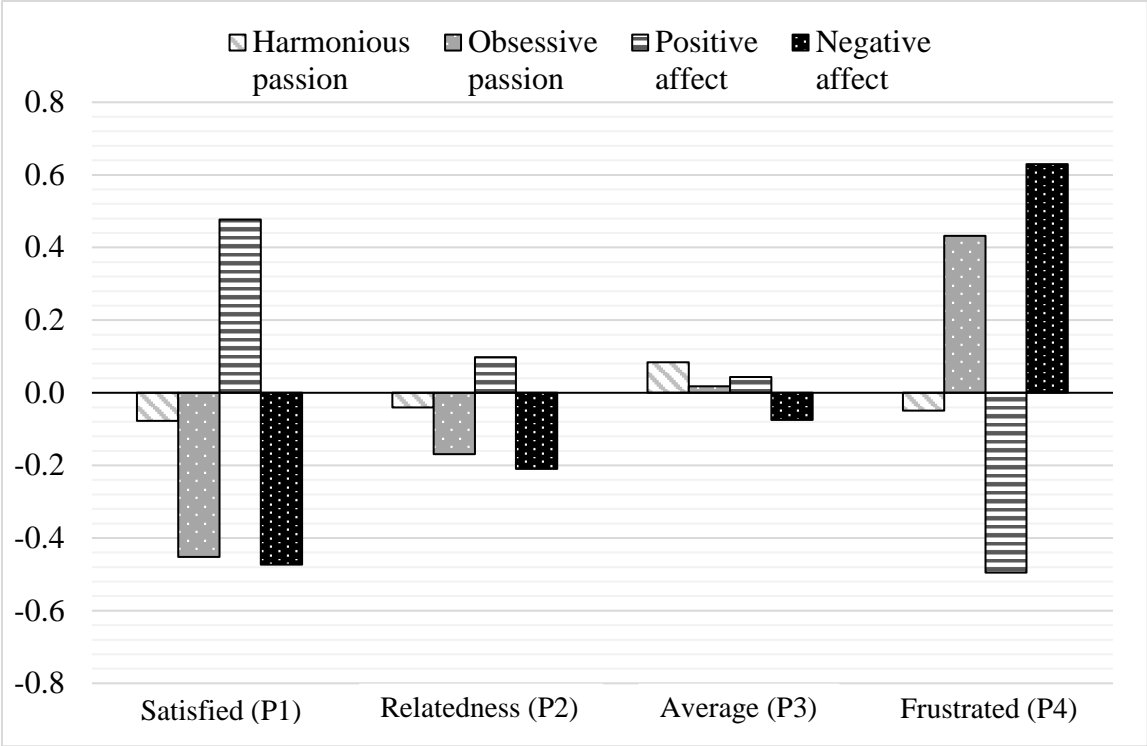
Figure 2

Charateristics of the latent profiles on the outcomes of harmonious-obsessive passion and positive-negative affect

Note. P: profile.

Table 1

Previous person-centered studies on need fulfillment profiles†

Study	Context	Need factors	Participants	Method	# of profiles	Name of profiles
Earl (2017)	Education	Autonomy satisfaction, relatedness satisfaction, competence satisfaction	N = 586 M_{age} = 12.61	Cluster analysis	4	(1) overall low needs (2) overall high needs (3) high competence (4) high relatedness
Esdar et al. (2016)	Work	Autonomy satisfaction, relatedness satisfaction, competence satisfaction	N = 534 M_{age} = 33.10	Latent profile analysis	4	(1) overall low needs (2) overall high needs (3) high competence (4) high autonomy
Ferrand et al. (2014)	General	Autonomy satisfaction, relatedness satisfaction, competence satisfaction	N = 100 M_{age} = 86.70	Cluster analysis	2	(1) overall low needs (2) overall high needs
Hawkins et al. (2014)	Sport	Autonomy, competence, family social support, friend social support	N = 145 M_{age} = 20.02	Cluster analysis	3	(1) overall low needs (2) overall moderate needs (3) overall high needs
Raiziene et al. (2017)	General	Autonomy satisfaction, relatedness satisfaction, competence satisfaction	N = 306 M_{age} = 15.24	Latent profile analysis	2	(1) overall low needs (2) overall average needs
Schmahl & Walper (2012)	Relationship	Autonomy satisfaction, relatedness satisfaction	N = 3828 M_{age} = 32.72	Cluster analysis	4	(1) low autonomy – low relatedness (2) high autonomy – low relatedness (3) low autonomy – high relatedness (4) high autonomy – high relatedness
Vanhove-Meriaux et al. (2018)	General	Autonomy satisfaction, relatedness satisfaction, competence satisfaction, autonomy frustration, relatedness frustration, competence frustration	N = 182 M_{age} = 73.33	Cluster analysis	2	(1) high satisfaction – low frustration (2) moderate satisfaction – moderate frustration

Note. † Literature search was performed on May 7, 2018.; N = sample size; M_{age} = average age of the participants; # of profiles = number of profiles identified in the study.

Table 2

Results from the multinominal logistic regressions for the effects of the predictors on profile membership

Predictors	Satisfied vs. Relatedness (P1 vs. P2)		Satisfied vs. Average (P1 vs. P3)		Satisfied vs. Frustrated (P1 vs. P4)	
	Coeff. (SE)	OR	Coeff. (SE)	OR	Coeff. (SE)	OR
Perceived need nurturing	-0.931(.367)*	0.394	-3.319(.343)***	0.036	-4.586(.390)***	0.010
Autonomy support	-0.416(.218)	0.660	-0.425(.210)*	0.654	-0.575(.241)*	0.563
Relatedness support	-0.584(.256)*	0.558	-0.886(.240)***	0.412	-1.119(.265)***	0.327
Competence support	0.585(.336)	1.795	-0.373(.264)	0.689	-0.522(.294)	0.593
Autonomy thwarting	0.664(.194)**	1.943	0.758(.187)***	2.134	0.823(.219)***	2.277
Relatedness thwarting	-0.729(.364)*	0.482	0.754(.287)***	2.125	1.403(.305)***	4.067
Competence thwarting	0.314(.316)	1.369	0.463(.298)	1.589	0.737(.319)*	2.090
	Relatedness vs. Average (P2 vs. P3)		Relatedness vs. Frustrated (P2 vs. P4)		Average vs. Frustrated (P3 vs. P4)	
	Coeff. (SE)	OR	Coeff. (SE)	OR	Coeff. (SE)	OR
Perceived need nurturing	-2.387(.265)***	0.092	-3.655(.323)***	0.026	-1.268(.168)***	0.281
Autonomy support	-0.008(.182)	0.992	-0.159(.219)	0.853	-0.151(.135)	0.860
Relatedness support	-0.302(.214)	0.739	-0.535(.244)*	0.586	-0.234(.131)	0.791
Competence support	-0.958(.323)**	0.384	-1.107(.353)**	0.331	-0.149(.147)	0.862
Autonomy thwarting	0.094(.133)	1.099	0.158(.176)	1.171	0.065(.124)	1.067
Relatedness thwarting	1.484(.290)***	4.411	2.132(.310)***	8.432	0.649(.127)***	1.914
Competence thwarting	0.149(.190)	1.161	0.423(.224)	1.527	0.274(.144)	1.315

Note. P: profile; SE: standard error associated with the coefficient; OR: odds ratio.; *p < .05; **p < .01; ***p < .001.

Table 3

Outcome means and pairwise comparisons between the four profiles

Outcome	Satisfied (P1) Mean (SE)	Relatedness (P2) Mean (SE)	Average (P3) Mean (SE)	Frustrated (P4) Mean (SE)	Differences between profiles
Harmonious passion	-.077 (.078)	-.040 (.068)	.084 (.046)	-.049 (.061)	no significant differences
Obsessive passion	-.452 (.056)	-.169 (.063)	.018 (.047)	.432 (.075)	1 < 2 < 3 < 4
Positive affect	.477 (.030)	.098 (.032)	.043 (.023)	-.495 (.035)	1 < 2 = 3 < 4
Negative affect	-.473 (.022)	-.210 (.028)	-.075 (.023)	.630 (.041)	1 < 2 < 3 < 4

Note. P: profile; SE: standard error.

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We would also be happy to have some of these materials brought back into the main manuscript, or included as published appendices if you deem it useful. We developed these materials to provide additional technical information and to keep the main manuscript from becoming needlessly long.

Table of Contents

Appendix 1. The estimation and assessment of preliminary measurement models

Before conducting latent profile analysis, the psychometric properties of the measures were tested using the robust maximum-likelihood (MLR) estimator in Mplus 8 (Muthén & Muthén, 1998-2017) that provides fit indices and standard errors robust to the non-normality of the data. Given the diverse dimensionality of the constructs at hand as well as theoretical and previous applications, we modeled various representations.

For the two central variables of interest, namely need fulfillment and passion, we contrasted two alternative first-order models with one based on confirmatory factor analysis (CFA) and the other on exploratory structural equation modeling (ESEM). The main difference between the two approaches is that in CFA item cross-loadings to other, non-target factors are set to zero, while is ESEM the cross-loadings are estimated, but are targeted to be as close to zero as possible with target rotation in a confirmatory manner (see Browne, 2001). Simulation studies (Morin, Arens, & Marsh, 2016) and reviews (Asparouhov, Muthén, & Morin, 2015) underscored the importance of freely estimated cross-loadings that, when set to zero, result in biased parameter estimates (i.e., factor correlations) and could potentially modify the meaning of the construct at hand. Additionally, recent investigations in need fulfillment (Myers, Martin, Ntoumanis, Celimli, & Bartholomew, 2014; Sánchez-Oliva et al., 2017; Tóth-Király, Morin, Bőthe, Orosz, & Rigó, 2018) and passion (Marsh et al., 2013; Schellenberg, Gunnell, Mosewich, & Bailis, 2014; Tóth-Király, Bőthe, Rigó, & Orosz, 2017) highlight the importance of contrasting competing CFA and ESEM models as the latter often results in more precise parameter estimates.

To document the substantive interpretability of the extracted profiles, we also included two other relevant constructs, one profile predictor and another profile outcome. In case of perceived interpersonal behavior, we compared four alternative models with the bifactor ESEM framework to investigate two sources of construct-relevant psychometric multidimensionality (Morin, Arens, & Marsh, 2016; Morin, Arens, Tran, & Caci, 2016; Morin, Boudrias, Marsh, Madore, & Desrumeaux, 2016; Morin et al., 2017). This framework makes it possible to investigate the presence of the conceptually-relevant (i.e., associations between items and non-target, but conceptually-related constructs) and the hierarchically-ordered (i.e., the simultaneous presence of global and specific factors) sources of psychometric multidimensionality. The first source is related to the comparison of CFA and ESEM models with a special emphasis on the definition of the factors and the size of the factor correlations. The second source is related to the comparison of first-order and bifactor models with a well-defined general factor (G-factor) and some well-defined specific factors (S-factors) being in focus. Interested readers are referred to the references papers which provide illustrations and tutorials on real-life and simulated data as well. Finally, positive and negative affect were modeled within the standard CFA framework.

To assess the adequacy of the models, commonly used goodness-of-fit indices were relied on: the chi-square test (χ^2), the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA). In the case of CFA and TLI, values higher than .90 and .95 are respectively to indicate adequate and excellent fit to the data; for RMSEA, values smaller than .08 or .06 for the RMSEA support acceptable and excellent model fit, respectively (Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005). Finally, we also report model-based composite reliability indices (McDonald, 1970) which were calculated from the standardized factor loadings and the error variances associated with the scale items. We opted to use this index due to the issues associated with Cronbach's alpha (Sijtsma, 2009; Rodriguez, Reise, & Haviland, 2016).

Appendix 2: Class enumeration procedure

The final preliminary models detailed above were used to save factor scores (with a mean of 0 and a standard deviation of 1) that were used in the main analyses. While factor scores do not explicitly control for measurement error the same way as fully latent variables do, they still provide a partial control by giving more weight to items with lower errors (Morin & Marsh, 2015; Skrondal & Laake, 2001) and thus considered better in profile estimation relative to manifest scores. These factor scores were the basis of the need fulfillment profiles.

To identify the most adequate and optimal profile solution, profile meaningfulness, the theoretical adequacy and the statistical adequacy of the solutions should be considered (Bauer & Curran, 2003; Morin, 2016). Meaningfulness and theoretical adequacy relate to the substantive meaning and the theoretical interpretability of the profiles. For statistical adequacy, a variety of indicators were examined to decide which profile solution is the most adequate: the Akaike Information Criterion (AIC), the

Bayesian Information Criterion (BIC), the Constant AIC (CAIC), the Sample-Size-Adjusted BIC (SSABIC), and the adjusted Lo-Mendell-Rubin (LMR) likelihood ratio test. Lower values on AIC, BIC, CAIC, and SSABIC indicate an overall better profile solution. However, these indicators often keep improving with the addition of more profiles; therefore, a graphical examination of "elbow plots" could facilitate the decision-making process where the point after which the slope flattens suggest that the optimal number of profiles have been reached. The LMR test compares the estimated model (e.g., six classes) with a model having one less class (e.g., five classes) and a non-significant p-value (p > .050) indicates that the model with one less class should be accepted. Finally, entropy highlights the precision of the classification with values ranging from 0 (lower accuracy) to 1 (higher accuracy).

Appendix 3: Results related to the preliminary measurement models

Basic psychological needs. Results related to psychological needs revealed that the six-factor first-order CFA solution had adequate fit to the data (χ^2 = 711.407, df = 237; CFI = .949; TLI = .940; RMSEA = .043 [90% CI .039-.046]). The corresponding ESEM solution was clearly superior (χ^2 = 349.080, df = 147; CFI = .978; TLI = .959; RMSEA = .035 [90% CI .031-.040]). This conclusion was supported by the examination of parameter estimates which revealed well-defined factors ($|\lambda|$ = .338–.923, M = .616) and reduced factor correlations ($|r|$ = .488–.579, M = .466) for the ESEM solution relative to the CFA one ($|\lambda|$ = .365–.824, M = .719; $|r|$ = .395–.844, M = .592). Omega values showed adequate levels of reliability ($\omega_{autonomy\ satisfaction}$ = .769; $\omega_{relatedness\ satisfaction}$ = .772; $\omega_{competence\ satisfaction}$ = .644; $\omega_{autonomy\ frustration}$ = .630; $\omega_{relatedness\ frustration}$ = .756; $\omega_{competence\ frustration}$ = .734).

Perceived interpersonal behavior. As mentioned above, the dimensionality of perceived interpersonal behavior (measured by the IBQ) was investigated with the bifactor ESEM framework in a two-step procedure (Litalien et al., 2017). In the first step, the competing CFA and ESEM models are estimated and compared. The CFA solution showed good fit to the data (χ^2 = 730.829, df = 237; CFI = .959; TLI = .953; RMSEA = .044 [90% CI .040-.047]). The examination of parameter estimates highlighted well-defined factors ($|\lambda|$ = .709–.887, M = .810), but high factor correlations ($|r|$ = .608–.915, M = .768) that could undermine the discriminant validity of the instrument. On the other hand, while the ESEM solution also had good fit (χ^2 = 254.767, df = 147; CFI = .991; TLI = .983; RMSEA = .026 [90% CI .020-.031]) and well-defined factors ($|\lambda|$ = .138–.759, M = .544), it also led to reduced factor correlations ($|r|$ = .301–.633, M = .493). However, it is important to note that there were some relatively large cross loadings ($|\lambda|$ = .001–.481, M = .113) which might suggest the presence of an unmodeled G-factor. On the basis of the available statistical and theoretical information, the ESEM solution was retained.

In the second step of the procedure, the retained ESEM solution was complemented with an overarching G-factor representing a perceived general need supportive behavior and the co-existing S-factors (support and thwarting × autonomy, competence, and relatedness). This G-factor was strongly defined by its target loadings ($|\lambda|$ = .571–.830, M = .714) with positively valenced items loading positively, and negatively valenced items loadings negatively on this G-factor. Some S-factors also retained some degree of meaningful specificity over and above the extracted G-factor. More specifically, the three thwarting S-factors retained a higher degree of specificity (autonomy thwarting: $|\lambda|$ = .480–.554, M = .528; competence thwarting: $|\lambda|$ = .356–.406, M = .380; relatedness thwarting: $|\lambda|$ = .236–.532, M = .421). Conversely, the three support S-factors retained a lower amount of specificity (autonomy support: $|\lambda|$ = .184–.394, M = .292; competence support: $|\lambda|$ = .018–.354, M = .187; relatedness support: $|\lambda|$ = .128–.412, M = .277), suggesting that these factors mostly reflect the global perceived interpersonal behavior and do not retain any meaningful specificity over the variance explained by the global factor. The examination of model-based coefficients of composite reliability were much higher for the G-factor (ω = .962) than the S-factors ($\omega_{autonomy\ support}$ = .272; $\omega_{competence\ support}$ = .129; $\omega_{relatedness\ support}$ = .252; $\omega_{autonomy\ thwarting}$ = .607; $\omega_{competence\ thwarting}$ = .403; $\omega_{relatedness\ thwarting}$ = .467). However, one has to remember that in the case of bifactor solution, the S-factors tend to be weaker as the total item covariance matrix is partitioned into two sources. Also, these results underscore the importance of relying on analyses that are corrected for measurement error, thus making even the weakly defined S-factors reliable.

Positive and negative affect. PANAS was modeled with a two-factor CFA solution, including two correlated uniquenesses between items 3-5 and 2-8, and showed acceptable fit to the data (χ^2 = 189.908, df = 32; CFI = .932; TLI = .905; RMSEA = .067 [90% CI .058-.077]). The two factors were well-defined ($|\lambda|$ = .397–.770, M = .585) and had satisfactory model-based reliabilities ($\omega_{positive\ affect}$ = .746; $\omega_{negative\ affect}$ = .707). An alternative two-factor ESEM model was also tested; however, it did not

improve the representation of positive and negative affect as apparent by the fact that (1) model fit indices did not increase; (2) the main factor loadings did not change in magnitude; (3) cross-loadings were negligible; and (4) the correlation between the two factors did not change substantially. In these cases, as suggested by Marsh, Morin, Parker, and Kaur (2014), the CFA model should be retained given its greater parsimony.

Passion. Following previous model estimation methods, the Passion Scale was also estimated with ESEM. Correlated uniquenesses were also estimated between three pair of items based on Tóth-Király et al. (2017). This decision was corroborated by the unsatisfactory fit of the first-order CFA model (χ^2 = 813.191, df = 50; CFI = .829; TLI = .775; RMSEA = .118 [90% CI .111-.125]) and the satisfactory ESEM model (χ^2 = 248.899, df = 40; CFI = .953; TLI = .923; RMSEA = .069 [90% CI .061-.077]). Factor were well-defined in this ESEM solution ($|\lambda|$ = .256–.825, M = .612) and the correlation between the two factors was also moderate (r = .365). Omega values showed adequate levels of reliability (ω_{HP} = .742; ω_{OP} = .834).

Appendix 4. Selecting the optimal number of profiles

Fit indices for the alternative solutions can be seen in Table S1. Entropy values were high for all profile solutions (> .800), indicating high levels of accuracy in classification. Generally speaking, the AIC, CAIC, BIC, and SSABIC values kept decreasing with the addition of latent profiles. Examining the graphical representation of these information criteria (see Figure S1) revealed that all four reached a plateau around 4 profiles. The non-significant LMR test suggested the four-profile solution as adequate. As the addition of a fifth profile did not add anything meaningful in theoretical terms, the more parsimonious four-profile solution was retained

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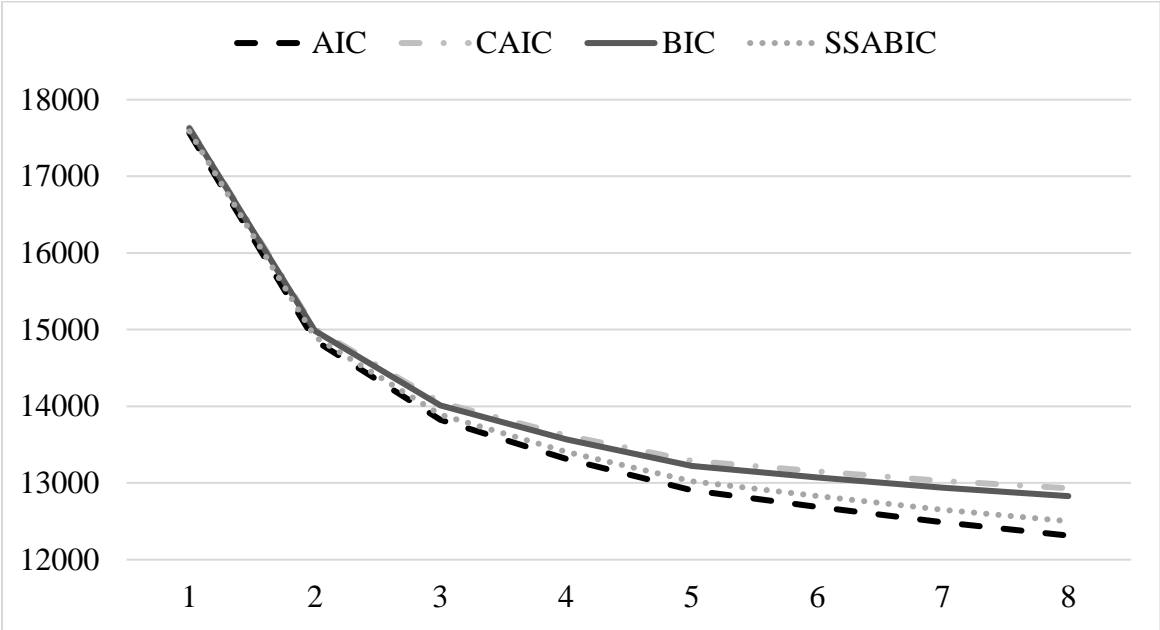
Appendix 4 Figure S1
Elbow plot for the information criteria used in class enumeration

Appendix 4 Table S1

Fit Statistics for the Latent Profiles and Class Enumeration

Model	LL	# of fp	Scaling	AIC	CAIC	BIC	SSABIC	Entropy	LMR
1 Profile	-8770.670	12	1.151	17565.340	17637.311	17625.311	17587.196	—	—
2 Profiles	-7405.713	25	1.195	14861.425	15011.365	14986.365	14906.960	.846	< .001
3 Profiles	-6873.496	38	1.651	13822.992	14050.900	14012.900	13892.204	.850	.107
4 Profiles	**-6606.589**	**51**	**1.319**	**13315.178**	**13621.056**	**13570.056**	**13408.068**	**.869**	**.005**
5 Profiles	-6388.356	64	1.335	12904.712	13288.558	13224.558	13021.279	.873	.072
6 Profiles	-6267.398	77	1.265	12688.797	13150.612	13073.612	12829.042	.848	.118
7 Profiles	-6153.902	90	1.318	12487.805	13027.588	12937.588	12651.728	.857	.187
8 Profiles	-6053.952	103	1.436	12313.903	12931.655	12828.655	12501.504	.852	.527

Note. LL: loglikelihood; # of fp: number of free parameters; AIC: Akaike Information Criterion; CAIC: constant AIC; BIC: Bayesian Information Criterion; SSABIC: Sample-Size Adjusted BIC; LMR: p-value associated with the adjusted Lo-Mendell-Rubin likelihood ratio test. Bold values indicate that the four-profile solution was selected as the final model.

Appendix 5 Table S2

Exact means of the different basic psychological needs in the final retained 4-profile solution

	Profile 1		Profile 2		Profile 3		Profile 4	
	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
1. A-S	1.037	0.241	0.314	0.359	0.035	0.290	-1.058	0.706
2. R-S	0.630	0.171	0.893	0.016	-0.127	0.289	-0.941	1.189
3. C-S	0.959	0.165	-0.030	0.365	0.111	0.373	-0.859	1.005
4. A-F	-0.851	0.291	-0.192	0.529	-0.026	0.469	0.814	0.572
5. R-F	-0.829	0.062	-0.743	0.046	0.038	0.235	1.116	0.889
6. C-F	-1.079	0.042	-0.213	0.252	-0.105	0.305	1.125	0.722

Note. A-S: autonomy satisfaction; R-S: relatedness satisfaction; C-S: competence satisfaction; A-F: autonomy frustration; R-F: relatedness frustration; C-F: competence frustration.; Factors were estimated from factor scores with a mean of 0 and a standard deviation of 1.