DOCTORAL (PhD) DISSERTATION

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THE TEMPORAL DYNAMICS OF PASSION

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The temporal dynamics of passion

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Kelt: Budapest, 2019.01.16.

a doktori értekezés szerzőjének
aláírása

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Table of Abbreviations

ARM	Autoregressive Model
BPNSFS	Basic Psychological Need Satisfaction and Frustration Scale
BSEM	Bayesian Structural Equation Modeling
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CU	Correlated Uniqueness
DIF	Differential Item Functioning
DF	Degrees of Freedom
DMP	Dualistic Model of Passion
EFA	Exploratory Factor Analysis
ESEM	Exploratory Structural Equation Modeling
EwC	ESEM-within-CFA
FIML	Full Information Maximum Likelihood
G-factor	Global or general factor in a bifactor model
HP	Harmonious Passion
IM	Intrinsic Motivation
LGM	Latent Growth Model
LPA	Latent Profile Analysis
MCAR	Missing Completely at Random
MIMIC	Multiple-Indicators-Multiple-Causes-Models
MLR	Robust Maximum Likelihood Estimator
MNLFA	Moderated Nonlinear Factor Analysis
OP	Obsessive Passion
OR	Odds Ratio
PANAS	Positive and Negative Affect Scale
PBI	Parental Bonding Inventory
PC	Criterion items for the Passion Scale
PS	Passion Scale
RMSEA	Root Mean Square Error of Approximation
S-factor	Specific factor in a bifactor model
SDT	Self-Determination Theory
SEM	Structural Equation Modeling
SWLS	Satisfaction with Life Scale
TLI	Tucker-Lewis Index

List of Publications that the Dissertation is Based Upon

Study	Publication	Status	Impact factor
1	**Tóth-Király, I.**, Bőthe, B., Rigó, A., & Orosz, G. (2017). An Illustration of the Exploratory Structural Equation Modeling (ESEM) Framework on the Passion Scale. *Frontiers in Psychology*, *8*, 1968. doi: 10.3389/fpsyg.2017.01968	Accepted, published online	2.089
2	**Tóth-Király, I.**, Bőthe, B., Orosz, G., & Rigó, A. (In Press, Accepted: 24 July 2018). A New Look on the Representation and Criterion Validity of Need Fulfillment: Application of the Bifactor Exploratory Structural Equation Modeling Framework. *Journal of Happiness Studies*. Early view doi: 10.1007/s10902-018-0015-y	Accepted, published online	1.986
3	**Tóth-Király, I.**, Bőthe, B., Orosz, G., & Rigó, A. (under review). On the importance of balanced need fulfillment: A person-centered perspective. *Journal of Happiness Studies.* Early view doi: 10.1007/s10902-018-0066-0	Accepted, published online	1.986
4	**Tóth-Király, I**., Gál, É., Bőthe, B., Orosz, G., & Rigó, A. (under review). Perceived parenting styles matter: care and overprotection as predictors of passion.	Under review	—
5	**Tóth-Király, I.**, Bőthe, B., Jánvári, M., Rigó, A., & Orosz, G. (In Press, Accepted: 19 November 2018). Longitudinal trajectories of passion and their individual and social determinants: A latent growth modeling approach. *Journal of Happiness Studies.* Early view doi: 10.1007/s10902-018-0059-z	Accepted, published online	1.986

Note. Each co-author has granted permission for the given publication to be included in the current dissertation.

Chapter 1: Foreword and Overview

The turn of the millennium was a pivotal point in the history of psychology as an important change was taking place. Due to the events and experiences of World War II, psychology at that time period mostly focused on understanding pathologies, mental illnesses as well as curing diseases. At the same time, less emphasis has been put on the deeper understanding of positive subjective experiences and of what makes people's lives worth living. The seminal work of Seligman and Csikszentmihalyi (2000) sought to address this absence by proposing a framework for the identification and scientific study of factors that could contribute to people having a more fulfilling life and to people functioning optimally. They believed that, apart from focusing on various psychological disorders, it might be equally important not just to explore, but to nurture and strengthen one's positive qualities that might in turn improve one's life. While positive psychology itself appeared to be a relatively new paradigm, it already had deep roots in humanistic psychology pioneered by Maslow, Rogers, Allport, White, Rotter, Atkinson, or Lazarus (see Oláh, 2004a for a more detailed overview). Despite the importance of this humanistic vision, it was not followed by a surge of empirical studies which prevented it from becoming part of the mainstream psychological research in this earlier period. Decades later, the paper of Seligman and Csikszentmihalyi (2000) reinforced the need to empirically study positive human functioning with adequate scientific methodologies.

Within the framework of positive psychology and as a response to Seligman and Csikszentmihalyi (2000), several constructs have been proposed that might have great relevance in relation to optimal functioning and having a fulfilling life. Such constructs are, for instance, optimism (Peterson, 2000), altruism (Eisenberg, 2014; Rushton, Chrisjohn, & Fekken, 1981), character strengths and virtues (Peterson & Seligman, 2004), self-determination (Deci & Ryan, 2000), flourishing (Keyes, 2002), wisdom (Baltes & Staudinger, 2000), creativity (Larson, 2000), flow (Csikszentmihalyi, 1997), or the importance of subjective wellbeing (Diener, 2000) and happiness (Myers, 2000). Interested readers are referred to Snyder and Lopez (2009) or Carr (2011) for a more details. Besides the above-mentioned examples and in line with Seligman and Csikszentmihalyi (2000), Vallerand et al. (2003; see also Vallerand, 2015) proposed the *Dualistic Model of Passion* (DMP) and the notion that *being passionate* for a meaningful activity might indeed contribute not just to one's wellbeing, but to one's optimal functioning as well. After the initial investigation of Vallerand et al. (2003), research on

passion grew consistently and it quickly became an important part of the positive psychological research stream around the world.

Before moving forward, to put the present dissertation into context, it is important to acknowledge the foundations of the positive psychological research in Hungary. Apart from theoretical works and general introductions (e.g., Pléh, 2004; Oláh, 2004a, 2012; Oláh & Kapitány-Fövény, 2012), several Hungarian studies have been conducted within the framework of positive psychology that examined, for instance, coping (Oláh, 1995; Rózsa et al., 2008), psychological immunity (Oláh, 2004b), subjective wellbeing (Martos & Kopp, 2011; Pikó, 2005), spirituality (Pikó, Kovács, & Kriston, 2011), flow (Magyaródi & Oláh, 2015; Oláh, 2005), optimism (Szondy, 2004, 2006), or emotional intelligence (Nagy, 2010; Nagy, Oláh, & G. Tóth, 2009). Interested readers are referred to Magyaródi (2012) for a review of the positive psychological scientific literature between 2000 and 2011. In this way, the present series of studies (and the present dissertation) do not only contribute to the international research on passion, but it also expands the Hungarian positive psychological stream with the introduction of another important construct that might positively contribute to Hungarians' wellbeing. Another passion research line started to develop almost simultaneously that focuses on exploring the associations between passion and exercise addiction (De la Vega, Parastatidou, Ruiz, & Szabó, 2016; Kovácsik et al., 2018; Kovácsik, Soós, De la Vega, Ruiz, & Szabó, 2018; Szabó, 2018; Szabó et al., 2018), further supporting the emerging importance of Hungarian passion research.

Several international and Hungarian studies have been conducted to explore the dynamics of passion as well as to identify its potential determinants and consequences (this point is revisited and expanded upon in the Introduction section). At the same time, the Dualistic Model of Passion also describes the initial and ongoing development of passion and states that passion might be subject of temporal changes over time. However, this proposition has only marginally been investigated in an explicit and direct manner so far. Currently, mostly indirect evidence is available about the potential longitudinal trajectories of passion. Therefore, the aim of the present dissertation was to contribute to a deeper understanding of passion by *directly* testing its temporal dynamics. Apart from actual longitudinal investigations, it is equally important to explore the potential role of other variables that might influence the changes over time in passion. As these changes might possibly be influenced by individual and social factors as well, the present multi-

study investigation applied a multidimensional perspective anchored in social-, positive- and developmental psychology for a more holistic understanding of passion.

For individual factors, the present investigation drew upon the theory of *basic psychological need fulfillment*, a micro-theory of Self-Determination Theory (SDT; Ryan & Deci, 2017; Vansteenkiste, Niemiec, & Soenens, 2010) which states that the fulfillment of three basic psychological needs (i.e., autonomy, competence, and relatedness) is essential for optimal functioning. As for social factors, we focused on early life parenting styles and *perceived parenting behaviors* which are thought to have great relevance in early life and later human development (Bowlby, 2008). An integration of these different psychological perspectives is likely to provide a novel theoretical insight into understanding the temporal changes of passion with positive psychology in general (Seligman & Csikszentmihalyi, 2000) and the DMP (Vallerand, 2015) also recognizing the importance of individual and social environmental factors. These predictors were selected on the basis of their documented importance and their relevance to passion (Vallerand, 2015).

For a careful and thorough examination, we approached the research question in three parts. The first part of this investigation dealt with the identification and psychometric examination of various instruments that were used in subsequent research. This part was necessary to have psychometrically sound measures that can serve as a basis for the studies. Upon examining the instruments, the second part of this investigation employed cross-sectional studies to investigate the associations between passion and need fulfillment as well as passion and perceived parenting styles. This was necessary given that one cannot expect longitudinal associations between variables if they are not related to one another at all. Finally, once ascertaining the presence of the hypothesized associations, the third part of this dissertation focused on the examination of longitudinal passion trajectories and whether the predictors of need fulfillment and perceived parenting styles influence these trajectories.

The structure of the present dissertation is the following: after the present brief foreword and overview (Chapter 1), the Introduction section (Chapter 2) presents a detailed review about the psychology of passion that is known so far. This chapter starts with its philosophical roots, then introduces the DMP and provides a clear delineation between passion and various related constructs. Subsequently, the potential correlates and outcomes of passion are also presented with a special emphasis being put on basic psychological need fulfillment and perceived parenting styles which are of major

importance for the present investigation. Chapters 3 to 7 present five empirical studies that have been realized within the framework of this dissertation, ranging from psychometric examinations of the employed instruments through cross-sectional studies with a short longitudinal study being at the end that is based on the cross-sectional ones. Finally, Chapter 8 concludes this dissertation by providing a general discussion of the findings as well as their potential implications related to future studies and practical applications.

Chapter 2: General Introduction – The Psychology of Passion

The purpose of this chapter is to provide a literature review on passion and to highlight some potential research areas that have been, so far, understudied. More specifically, given that psychological research on passion was preceded by various philosophical works, these philosophical roots are first presented, followed by the introduction of early psychological passion interpretations. Second, the Dualistic Model of Passion (DMP) is presented which is the most commonly used model for understanding passion. One strength of this model is that it does not only describe what constitutes passion from the perspective of psychology, but also presents two distinct, yet related facets of passion: harmonious passion (HP) and obsessive passion (OP). Third, to avoid issues related to jingle-jangle fallacies (Kelley, 1927), passion and some related constructs are compared to one another in order to demonstrate their uniquenesses. Fourth, research so far conducted on passion is introduced with a special focus on highlighting the research gaps that still need to be addressed, particularly pertaining to longitudinal studies. Finally, correlates are introduced in-depth that are of major relevance to the present dissertation, namely need fulfillment and perceived parenting styles.

The Philosophical Roots of Passion

Passion only received little scientific attention from psychology early on. However, philosophy was more than interested in understanding the concept of passion, dating back to the Ancient Greek cultures (see Vallerand, 2015 for more details). The English word "passion" stems from the Greek word "pathos" which can be translated as an emotional state or energy characterized by suffering. The origin of this word gives us the impression that being passionate for an activity is a negative experience in which the passionate individual suffers from this subjective experience. In addition, philosophers of Ancient Greece also thought that people's passion are out their control given it has been given to them by the gods (Vallerand, 2015). The notion that passion is out-of-control versus controllable by one's will is a central point that underlay every philosophers' interpretation of passion regardless of the era they had lived in. The Ancient Romans continued the Greek traditions by suggesting that our passions should either be banned or controlled by reason. At the same time, they also complemented the Greeks by underscoring that not all passions are bad and that there might be some positive forms of passion.

Passion then disappeared from the philosophical thinking and discussions, but re-emerged in the 15-16th century with the work of Descartes (Vallerand, 2015). Philosophers of this era thought that passion is part of the human existence, a strong impulse, and an important element in the mind-body interaction. The tradition of positive and negative passions also continued with Descartes describing negative passions as being too intense, leading to these negative passions overriding one's control over them. On the other hand, positive passions are still intense impulses that remain under one's control. We can see a slight turn toward understanding passion in a more positive light, something which was further continued by British philosophers. These philosophers complemented the concept of passion by adding that passion is not only an uncontrollable state, but that it might also be related to striving. Of major importance are German philosophers who separated passion from emotions on the basis that emotions were thought to be short-lived states as opposed to passion which is more enduring in nature. Furthermore, while emotions were thought to be passive, passion was considered to be more active and indicative of at least some level of persistent striving. Philosophers in later centuries went even further from the original Greek interpretation by stating that passion is important for everyone, because it is characterized by high energy toward a direct path or object.

Overall, from this description, it can be seen that the understanding of passion changed substantially over the centuries: passion at first was thought to be an uncontrollable negative emotion that is unequivocally bad. Over the years, this understanding slowly shifted into understanding passion as an intensive persistent striving that can be negative *and/or* positive. This dualistic understanding of being either negative or positive (Vallerand, 2012a) served as an important foundation for the model established by Vallerand et al. (2003).

Psychology's Early Understanding of Passion

While philosophy was highly interested in understanding passion, this was not the case for psychology. Early psychological studies, predominantly in the United States, simply neglected passion as a relevant psychological construct (Vallerand, 2015) given the conceptual overlaps and even confusions between the concepts of emotions and passion. They thought that the concept of emotions is more specific than that of passion, thus the former gained even further prominence. Compared to the US, some, mostly French, scholars worked with the concept of passion, although they did not empirically

approach this question. The perspective of these French scholars stemmed from French and German philosophers, thus they considered the short-lived and intense emotions to be distinct from the more intellectual and stable passion, identifying it as an intellectualized emotion. For them, passion was an intense, long-lasting energy that was directed toward an object or an activity. Passion also appeared in research related to romantic relationships in the form of passionate love (Hatfield & Sprecher, 1986; Sternberg, 1986) which can be described as an experienced intense emotion toward another person and even as a disorganizing emotion (Vallerand, 2015).

Finally, we have arrived to the current understanding of passion which takes the perspective of motivations. More specifically, Frijda et al. (1991; 2007) and Hall (2002) interpreted passion as a form of motivation striving toward a certain goal. Frijda et al. (1991) also highlight that when being passionate, people spend time and energy in their life to reach their passionate goals. However, it was not until the initial empirical work of Vallerand et al. (2003) that the concept of passion become more popular. An important step that they took for the "generalization" of passion is that they distanced it from the romantic relationships (which were still in the focus of some studies), but instead of focusing solely on romantic interpersonal relationships, they broadened the research scope for a wide range of activities. In addition, they took a unique approach by aiming to integrate both the relevant philosophical and psychological interpretation of passion to have an exhaustive and in-depth definition for passion. From the above-mentioned early history of passion, we can see that there was a certain degree of overlap not just between different philosophers, but philosophers and psychologists alike. Consequently, it was reasonable to underline these common and frequently occurring points (e.g., passion entails high energy and striving toward an external object, activity, or person as well as passion being a two-faced construct with a positive and a negative side) and to propose the Dualistic Model of Passion.

The Dualistic Model of Passion

Vallerand et al. (2003, see also Vallerand, 2015) described passion as a strong inclination toward a self-defining activity that people like (or even loves), that they find personally important and meaningful, and in which they invest a substantial amount of time and energy. We can see from this definition that it incorporates several aspects from the above-mentioned prior philosophical and psychological works: passion is understood as a motivational construct representing an impulse or persistent striving toward a specific

object. This specific object is highly liked or loved by the individual, and it is even perceived as personally valued, important, and meaningful. Passion can be oriented toward various activities such as work (Vallerand, Paquet, Philippe, & Charest, 2010), actively doing sports (Vallerand et al., 2008) or being a supporter of a team (St-Louis, Verner-Filion, Bergeron, & Vallerand, 2018), online behaviors (e.g., Facebook use or TV series watching; Orosz, Vallerand, Bőthe, Tóth-Király, & Paskuj, 2016), significant others (Carbonneau, Vallerand, Lavigne, & Paquet, 2016), academics (Schellenberg & Bailis, 2015b), music (Bonneville-Roussy, Lavigne, & Vallerand, 2011), pornography (Rosenberg & Kraus, 2014), or sex (Philippe, Vallerand, Bernard-Desrosiers, Guilbault, & Rajotte, 2017). In all these cases, people do not simply play football or play music; when they become passionate, they identify themselves as "football players" or "guitarists", due to the fact that the passionate activity is part of their identity, of who they are.

It is also important to note that people do not become passionate for all activities that they engage in. Indeed, the DMP holds an *organismic view* of humans (deCharms, 1968; Deci & Ryan, 1985, 2000). This organismic view rests on the fundamental assumption that people are naturally active acting agents who aim to fulfill their potentials and achieve self-growth as individuals. In order to do so, people need to "seek out" activities in their surrounding environments and engage in them. Over time, they start to master some of the activities, find them more enjoyable, and start to become more involved with them. If the bond between the activity and the individual is further deepened, then this individual is likely to become passionate for that particular activity. While it is true that non-passionate activities can also lead to self-growth, Vallerand (2015) posits that passionate activities have the highest potential in leading to self-growth by fostering sustained engagement, mastery goals, and positive experiences related to the passionate activity.

The final aspect of the DMP which is particularly relevant is that it proposes the existence of two forms of passions, namely harmonious passion (HP) and obsessive passion (OP). It can clearly be seen that this dualistic distinction of the so-called positive and negative passions originates from passion's philosophical traditions which initially stated that passion can only be negative, but over the centuries, philosophers gradually saw passion in a more positive light and argued that has positive and negative sides as well.

In accordance with the DMP, these two types of passion can be differentiated from one another in terms of how the passionate activity is integrated and internalized into one's life and self, respectively. The process of internalization (Aron, Aron, & Smollan, 1992) stems from Self-Determination Theory (SDT; Deci & Ryan, 2000; Deci, Eghrari, Patrick, & Leone, 1994) and is a central concept of the DMP, referring to the incorporation of the representations of enjoyable and valued activities into one's identity (Vallerand, 2012b; Waterman, 1993). It might be important to note that the internalization process proposed by SDT can be interpreted from two perspectives. From a quantitative perspective, higher amount of internalization is related to higher levels of relative autonomy or self-determination (Howard, Gagné, Morin, & Forest, 2018; Litalien et al., 2017; Ryan & Deci, 2017). On the other hand, from a qualitative perspective, the internalization process might be different as a function of being complete versus partial. The DMP focuses on the latter in which the internalization process (i.e., the quality of internalization) can take up two forms: autonomous internalization (or complete behavioral integration) and controlled internalization (or partial behavioral integration). The type of internalization occurs determines the type of passion that is going to develop toward an activity.

Harmonious passion. Autonomous internalization is thought to be related to harmonious passion. Autonomous internalization entails that the activity is freely accepted by the individuals as being personally important for them, without any contingencies. The absence of contingencies indicates that individuals can fully embrace the activity in a willful manner instead of internal (e.g., low self-esteem) or external (e.g., social environment) pressures orienting them toward the activity. This way, individuals can freely decide when and how to and when and how not to engage in the passionate activity, thus individuals remains in complete control. With this type of passion, the activity takes up a significant but not overwhelming part of one's identity as it is usually in harmony with other aspects of life. Finally, harmonious passion allows individuals to fully partake in the passionate activity in a non-defensive (Hodgins & Knee, 2002), flexible manner which is conductive of positive and adaptive cognitive, affective, and behavioral experiences (Curran, Hill, Appleton, Vallerand, & Standage, 2015).

Taking the example of swimmers with harmonious passion, while they would identify strongly with this sport and spend a substantial amount of time with training, they would also invest time and energy in other aspects of their life such as working, studying, or being with their family and friends. This way, being a swimmer is in balance with these

other life aspects. In addition, these harmoniously passionate athletes should not have any issues when they are prevented from engaging in the activity, they should be able to adapt to the situation and focus their attention on other parts of their lives. Put more simply, swimmers control their passion toward swimming.

Obsessive passion. On the other hand, controlled internalization is thought to be conductive of obsessive passion. As opposed to autonomous internalization, controlled internalization stems from inter- or intrapersonal contingencies and pressures (Hodgins & Knee, 2002). For example, people with low self-esteem might obsessively engage in an activity so that they could enhance their self-esteem and protect their ego-invested self (Lafrenière, Bélanger, Vallerand, & Sedikides, 2011). Another example might be when people obsessively engage in an activity in order to earn social acceptance from their peers. As a result, people with obsessive passion experience an uncontrollable urge to engage in their passionate activity. In other words, instead of the individuals controlling the activity, the activity becomes dominant and starts to control the individuals who cannot help themselves but partake in it, leading to rigid, instead of willful, persistence. With this rigid involvement, the activity is not in congruence with other life aspects, but is in conflict with them and takes up a disproportional space in the individual's identity. Finally, while obsessive passion might lead to positive experiences, these are ephemeral at best and, in a longer term, negative and maladaptive cognitive, affective, and behavioral consequences are likely to manifest (Curran et al., 2015).

Returning to the example of swimmers, athletes with obsessive passion also identify strongly with swimming. One crucial difference is that they are overly invested in this activity and spend more time on it than they should: they go to training early in the morning and in the afternoon as well. As a result, they often neglect their duties or their friends, leading to an imbalance in their lives. Naturally, this imbalance causes stress in these athletes and they feel like swimming is the only thing that makes them happy and satisfied, thus they spend even more time with it. In case they are prevented from swimming due to, for instance, an injury, they might become frustrated that they cannot engage in their activity. Put differently, swimmers are controlled by their passion for swimming.

To summarize, the existence of two types of passion is proposed by the DMP (Vallerand, 2015) which have roots in both psychology and philosophy. Originating from autonomous internalization, HP allows the individual to fully immerse in the activity, but not to the detriment of other life aspects. This generally leads to positive or adaptive

outcomes. On the other hand, OP originates from controlled internalization, indicating that people still fully immerse in the activity, but they just cannot let it go when they should and it is deleterious for other aspects of their lives. As a result, OP is generally associated with negative or maladaptive outcomes.

The Theoretical Distinction of Passion and Related Constructs

       Psychological research is sometimes characterized by constructs that overlap through various degrees. There are studies which highlight the similarities and differences between, for instance, positivity and related constructs of life satisfaction, optimism, and self-esteem (Caprara et al., 2012), social and academic intelligence (Riggio, Messamer, & Throckmorton, 1991), self-compassion and neuroticism (Neff, Tóth-Király, & Colosimo, 2018), emotional intelligence and various Big Five traits (Petrides et al., 2010), problematic pornography use and hypersexuality (Bőthe, Tóth-Király, Potenza, et al., 2018), or self-concept and self-efficacy (Marsh et al., 2018). This phenomenon might be understood in the form of jingle-jangle fallacies (Kelley, 1927) where two similar constructs are labeled differently (jangle fallacy) or the same label is given to conceptually different constructs (jingle fallacy). For this reason, it is highly important for researchers to provide clearly articulated definitions for their constructs of interest as well as conduct construct validity analyses that could empirically support or deny the distinctness of similar constructs.

       In the case of passion, Vallerand (2015) as well as Curran et al. (2015) evaluated the similarities and distinctions between passion and various related constructs. This evaluation is rooted in the core elements of the DMP: (1) passion is a motivation construct, (2) it is oriented toward a specific activity, (3) the specific activity is liked or loved and (4) also personally important and valuable for the individual, (5) substantial time and energy is spent on the passionate activity, (6) the activity becomes part of one's identity, and (7) passion takes a dualistic form with a positive and a negative side.

       If one wishes to compare passion and related constructs, the latter can be organized into five bigger categories: *trait-like* variables such as zest (Peterson & Seligman, 2004) or grit (Duckworth, Peterson, Matthews, & Kelly, 2007); *state-like* variables such as engagement (Schaufeli, Salanova, González-Romá, & Bakker, 2002), flow (Csikszentmihalyi, 1978), or burnout (Maslach, Jackson, Leiter, Schaufeli, & Schwab, 1986); *behavioral* constructs such as overengagement or problematic use/addiction (Griffiths, 2005; Griffiths & Karanika-Murray, 2012); *affective* constructs

such as personal interest (Renninger & Hidi, 2002), and *intrinsic-extrinsic motivations* (Deci & Ryan, 2000). Table 2.1 provides a summary for the comparison and highlights several core passion elements where constructs resemble to and differ from one another. For instance, while the majority of the related constructs refer to specific activities and entail that individuals spend a significant time and energy with them, only a handful of the constructs are motivational or include the element of personal importance and value of the activity in their core definition. Even less of the related constructs posit that the activity is part of one's identity and that the activity needs to be liked or loved. Most importantly, none of them are understood in a dualistic view with potentially positive and negative aspects, thus all of them are interpreted in a unidimensional way. Interested readers are referred to Curran et al. (2015) and Vallerand (2015) where more in-depth and elaborated comparisons and descriptions are presented.

Table 2.1. The comparison of passion and related constructs (adapted from Curran et al., 2015 and Vallerand, 2015)

Core elements of passion	Passion	Trait constructs	State constructs	Behavioral constructs	Intrinsic and extrinsic motivation	Affective constructs
1. Motivation	+	+	ø	+	+	ø
2. Specific activity	+	ø	+	+	+	+
3. Liking or love	+	ø	ø	ø	+/ø	ø
4. Time and energy	+	+	+	+	+	+
5. Important and valuable	+	+	ø	ø	+	+
6. Part of identity	+	ø	ø	ø	ø	ø
7. Duality	+	ø	ø	ø	ø	ø

Note. +: the element of passion is present in the other construct as well: ø: the element of passion is not present in the other construct.

Given the strong influence of SDT on passion research, one might notice conceptual similarities between harmonious passion and intrinsic motivation as well as obsessive passion and addictions. However, a closer inspection might highlight their uniquenesses. For instance, both passion and intrinsic motivation includes liking or loving a certain activity and performing it for itself (Deci, 1971). But in the case of passion, this engagement is a constant part of one's identity, while in the case of intrinsic motivation, this activity is not internalized into the identity in a way that the activity is loved and highly valued. One might even demonstrate intrinsic motivation for a certain activity without actually loving and valuing it. In addition, while SDT posits that *extrinsic* elements can be internalized into the identity, the DMP suggests that intrinsic elements can be further internalized into the identity (Diefendorff, Houlfort, Vallerand, & Krantz,

2018). From this perspective, passion is proposed to be a "crystallization" or integration of intrinsic (and autonomous) motivation and highlights that not all intrinsically interesting activities lead to positive outcomes.

As for passion and extrinsic motivation, the latter generally does not refer to performing an activity for love or enjoyment, but rather for an external reason that is outside of and separate from the activity. With passion, the goal is to perform the activity for itself; with extrinsic motivation, the goal is to achieve something that is separate from the activity itself. These theoretical distinctions are also empirically underpinned by the moderate associations between passion with intrinsic and extrinsic motivation (Curran et al., 2015; Houlfort, Philippe, Vallerand, & Ménard, 2013; Vallerand et al., 2003).

Obsessive passion also bears similarities to problematic and potentially addictive behavior (see Tóth-Király, Bőthe, & Orosz, 2018). Prior studies even reported high associations between the two variables (e.g., Orosz, Tóth-Király, & Bőthe, 2016; Wang & Yang, 2007) which might undermine their theoretical distinctions. However, while both OP and problematic use involve a persistent behavior toward a specific activity, problematic use excludes the components of liking/loving and valuing that is central to passion. Another potential distinction is that OP (or high engagement) might only fulfill the peripheral criteria of addictions (e.g., cognitive salience and euphoria; Ferguson, Coulson, & Barnett, 2011). Indeed, empirical studies have supported that high engagement is different from addiction and that the two should be distinguished (e.g., Charlton, 2002; Charlton & Danforth, 2007; Brunborg et al., 2013). Accordingly, OP might be considered as a precursor or antechamber of addiction and it might be people at greater risk of addictions (Vallerand & Verner-Filion, 2014). Overall, while it is true that passion shares a number of features with related similar constructs, it is also different from them in significant ways.

Passion Research So Far – What Is Known about the Correlates of Passion

Although HP and OP both represent a form of passion and usually correlate positively with one another, they are nevertheless differentially related to various psychological outcomes. Following the meta-analysis of Curran et al. (2015), these outcomes are now categorized into four areas for the sake of simplicity: (1) wellbeing outcomes, (2) motivational outcomes, (3) cognitive outcomes, and (4) behavioral outcomes. The present section only gives a broad overview of prior findings, more details are provided by Curran et al. (2015) as well as Vallerand (2015).

Chapter 2: Introduction

Studies involving passion and *wellbeing or ill-being* examined the associations between HP, OP and various indices of psychological health. Overall, regardless of focusing on the hedonic or eudaimonic (Ryan & Deci, 2001) aspects of wellbeing, HP is generally positively related to positive wellbeing indicators such as positive affect, life satisfaction, subjective vitality, self-realization, personal growth, purpose of life. On the other hand, OP is either not associated with positive outcomes or is associated with negative ones such as negative affect, anxiety or depression (Amiot, Vallerand, & Blanchard, 2006; Carbonneau, Vallerand, & Massicotte, 2010; Lafrenière, Vallerand, Donahue, & Lavigne, 2009; Marsh, Vallerand, et al., 2013; Moé, 2016; Przybylski, Weinstein, Ryan, & Rigby, 2009; Rousseau & Vallerand, 2008; Schellenberg & Bailis, 2014, see also Vallerand 2012 or 2016 for a review). Thus, it appears that HP (but not OP) contributes to psychological wellbeing and functioning.

The second group of studies focused on how passion is related to various *regulatory processes* such as other forms of motivations and behavioral regulations (i.e., autonomous or controlled motivations), achievement goals, and basic psychological needs. In general, HP has been associated with more integrated and autonomous motivational forms, mastery goals, and higher levels of need satisfaction. These findings indicate that when people are harmoniously passionate for their activities, they are more likely engage in these activities out of enjoyment or due to the personal importance of the activity while, at the same time, these people are also more likely to focus on their self-development and feel that their basic psychological needs are satisfied during activity engagement (more on the latter question in the subsequent sections). Conversely, OP has mostly been associated with more controlled forms of motivation (i.e., engaging in an activity due to internal or external pressures), performance goals (i.e., attaining good performance or avoiding bad performance), and lower levels of need satisfaction (Bonneville-Roussy, Lavigne, & Vallerand, 2011; Curran, Appleton, Hill, & Hall, 2013; Houlfort et al., 2013; Lalande et al., 2017; Tóth-Király, Vallerand, Bőthe, Rigó, & Orosz, under review; Vallerand et al., 2007, 2008; Verner-Fillion & Vallerand, 2018).

The third group of studies investigated the relations between passion and *cognitive outcomes* (referring to the psychological presence and focus on a task; Kahn, 1990; Vallerand, 2015) such as concentration, flow, rumination, or activity-life conflicts. Research provided support for the positive links between HP and cognitive outcomes as well as non-significant or negative associations between OP and cognitive outcomes (Carpentier, Mageau, & Donahue et al., 2012; Dubrueil, Forest, & Courcy, 2014; Ho,

Wong, & Lee, 2011; Mageau, Vallerand, Rousseau, Ratelle, & Provencher, 2005; Ratelle, Vallerand, Mageau, Rousseau, & Provencher, 2004; Vallerand et al., 2003). In other words, when people are harmoniously passionate, they are more likely to be completely absorbed in the present moment (i.e., flow), are less likely to ruminate when they cannot engage in their passionate activity and have fewer work-life conflicts. This is not the case for OP.

Finally, the fourth group of studies examined how passion relates to subjective and objective indicators of *behavior and performance*. These indicators include deliberate practice (i.e., highly structured activity to improve oneself, Ericsson, Krampe, & Tesh-Römer, 1993), time spent with an activity, persistence (i.e., duration of continued engagement or intention to continue the activity), problematic behaviors (i.e., engaging in an activity so that it might lead to impairment in relevant life areas) as well as other subjective or objective indicators that were assessed. Results are rather mixed in this area: in some cases, only HP is positively associated with the behavior-based outcomes (Bonneville-Roussy, Vallerand, & Bouffard, 2013; Orosz, Tóth-Király, et al., 2016; Orosz, Vallerand, Bőthe, Tóth-Király, & Paskuj, 2016), while in other cases, both HP and OP are predictive of these outcomes (Bonneville-Roussy et al., 2011; Tóth-Király, Bőthe, Tóth-Fáber, Hága, & Orosz, 2017; Vallerand et al., 2007, 2008). Overall, it appears that passion indeed influences various aspects of our lives.

One strength of passion research is that a diverse range of methods were used for the scientific examination of passion. While the majority of the studies were cross-sectional in nature (e.g., Orosz, Vallerand, et al., 2016; Przybylski et al., 2009; Verner-Filion & Vallerand, 2016), longitudinal (e.g., Lalande et al., 2017; St-Louis et al., 2018) and experimental (Bélanger, Lafrenière, Vallerand, & Kruglanski, 2013a, 2013b; Lafrenière, Vallerand, & Sedikides, 2013) studies were also conducted which converge to the same findings, giving a stronger support for the propositions of the DMP. Still, there is a paucity of research examining the developmental trajectories of passion.

The Temporal Dynamics of Passion

Far less research focused on the temporal dynamics and longitudinal changes of passion despite the fact that the DMP describes the initial and ongoing development of passion. However, the ongoing development of passion has not been explicitly examined so far. At the same time, these studies would definitely provide a more comprehensive understanding of passion by providing answers to relevant, development-oriented

research questions. For instance, when examining a developmental trajectory, how large is the initial value of people's passion? Are there any individual differences in this initial value and if so, how large are the individual differences? More importantly, does this initial value change over time? Does it increase, decrease or remain stable? What is the rate of the growth or the decline? Finally, are there any external variables that predict either the initial values or the growth? Instead of cross-sectional studies due to their inherent limitations (Miller, 1998), these research questions might be answered with longitudinal studies. The present research project sought to add to the understanding of passion by examining its developmental change as well as to respond or react to prior calls for conducting longitudinal studies within the framework of the DMP (Vallerand, 2015).

Longitudinal studies are continuous or repeated measures of the same sample of individuals over time which might range from weeks, months, years, or even decades (Caruana, Roman, Hernández-Sánchez, & Solli, 2015). Compared to cross-sectional studies which are only able to provide a snapshot of the construct of interest (i.e., they are static), longitudinal studies are suitable to investigate, for instance, changes over time or developmental trends (i.e., they are dynamic). Another advantage of longitudinal studies, compared to cross-sectional ones, is that they follow the same individuals, hence minimizing the potential effects of cross-cultural or generational differences. Although they have less power in detecting causal links due to the fact that they are observational (as opposed to experiments that are manipulational), they still provide a way to establish directionality between the constructs of interest.

Despite their importance and relevance, relatively little is known about the developmental path of passion. To date, a number of useful longitudinal studies have been conducted. However, these did not focus on the explicit testing of passion trajectories. One group of longitudinal studies investigated the temporal stability of passion in the form of test-retest correlations of responses provided by the same individuals at two different timepoints. Based on these studies, passion appeared to be relatively stable with test-retest correlations ranging from .57 (Martin, 2016) to .88 (Carbonneau, Vallerand, Fernet, & Guay, 2008), though some temporal fluctuation might take place over a longer period of time.

More frequently, longitudinal passion studies explored the temporal ordering of variables and examined how variables affect one another over a period of time. For example, the study of Carbonneau et al. (2008) measured passion for teaching as well as

different work-related variables such as job satisfaction, burnout, or perceived student behaviors at two time points. Subsequently, Time 2 scores are regressed on Time 1 scores and the coefficients between the prior and later variables inform us about temporal stability. Other studies also reported moderate-to-strong temporal stability of passion scores (e.g., Fernet, Lavigne, Vallerand, & Austin, 2014; Lalande et al., 2017; Lavigne, Forest, & Crevier-Braud, 2012; Mills, Milyavskaya, Mettler, Heath, & Derevensky, 2018). While these results are important, one can only infer information about the temporal changes instead of directly examining it which are lacking in the literature.

The DMP differentiates between the initial and the ongoing development of passion (Vallerand, 2015). The former refers to those cases when one experiences an activity for the first time, while the second one refers to those cases in which one has already engaged in the activity for quite some time. This initial development has been investigated by Mageau et al. (2009). They recruited participants who did not have experience with playing music or using musical instruments before and followed these participants for a period of five months. They reported that after the five-month period, 36% of the participating high schoolers developed passion for their musical instruments. While this proportion might appear to be small at first, it is important to keep in mind that this initial development took place during a relatively short five-month period and that music classes were obligatory for the students. On the basis of these findings, it appears that the initial development of passion occurred in a relatively quick and dynamic way. Similar observations were made by Kovácsik and Szabó (2019, personal communication, 2 January 2019) who reported that both HP and OP increased substantially, over a 12-week period, for new athletes who did not perform other sports before. However, when the ongoing development is considered, Schellenberg and Bailis (2015b) as well as Martin (2016) reported moderate-to-high passion stability. We return to this issue in Chapter 7.

Individual and Social Predictors of Passion Changes

Change does not happen in a vacuum. Indeed, development is thought to be a complex process that involves individual and social characteristics alike. Positive psychology also recognizes that people and their subjective experiences are not separated from one another, but instead these are parts of a multi-layered social context including peer relationships, families, and even cultural norms (Seligman & Csikszentmihalyi, 2000) that shapes said subjective experiences. Thus, it becomes necessary to examine

potential changes in passion through a multidimensional lens by taking into account individual and social factors that could potentially influence one's passion.

Before proceeding, it is worth noting that people's identity (i.e., the concepts or self-representations that people hold about themselves) is not a permanently stable and fixed entity, but rather a malleable construct that is constantly changing as a result of the individual's interaction with the environment (Oyserman, Elmore, & Smith, 2012). Identity formation might even go on throughout life (Ryan & Deci, 2012). As people seek out more activities on their path toward self-growth, they incorporate various elements from the environment into their identity. Naturally, big life events or situation changes (e.g., getting fired, losing a family member or moving to a new country) are more likely to have an impact of the identity-related processes. In the case of passion, a sudden situational change might prompt people to stop doing their passionate activity forever (i.e., it might no longer be part of one's identity). in other cases, this event might prompt them to start doing an activity (i.e., it becomes part of one's identity). In such situations, passion is likely to diminish or develop quickly, respectively. At the same time, as suggested by Oyserman et al. (2012, see also Hogg, 2006 or Tajfel & Turner, 2004), one's identity-related processes might be influenced by distal (e.g., parenting practices or culture) and proximal variables (e.g., psychological implications of a given situation). Ryan and Deci (2017, see also Soenens & Vansteenkiste, 2011) highlight that identity formation is influenced by outer and inner elements as well. For this reason, while acknowledging the potentially larger impact of life event, we believe that inner experiences and interaction with the social environment might also influence identity formation and, in turn, passion.

Passion research has already identified several relevant individual predictors of passion throughout the years. For instance, passion has been investigated in relation to Big Five (Balon, Lecoq, & Rimé, 2013) or Eysenckian (Tosun & Lajunen, 2009) personality traits, perfectionism (Verner-Filion & Vallerand, 2016), identity styles (Bouizegarene et al., 2018), character and temperament (Tóth-Király, Bőthe, Orosz, & Rigó, in prep.), self-esteem (Lafrenière et al., 2011), impulsivity (Orosz, Vallerand, et al., 2016), autonomous personality orientation (Vallerand et al., 2006) and character strengths (Forest, Crevier-Braud, Bergeron, Dubreuil, & Lavigne, 2012). All these studies show that individual factors matter with respect to passion. For this reason, within the present dissertation, we selected an individual factor that does not only have theoretical relevance to passion, but more general ways of functioning as well.

Need fulfillment. As mentioned above, the DMP (Vallerand, 2015) proposes that the quality of the internalization process—through which the activity is integrated into one's self–is a cardinal deciding factor in the development of HP or OP. However, to achieve an optimal (i.e., autonomous) internalization process, high levels of basic psychological need fulfillment should be experienced (Vallerand et al., 2003). The concept of basic psychological needs is one of the central pillars of SDT (Ryan & Deci, 2017) which states that the need for autonomy, competence and relatedness are essential components for growth.

The *need for autonomy* refers to the experiences of volition, choice, psychological freedom, and self-endorsement of one's activity. The *need for competence* refers to experiencing a sense of efficacy and mastery while interacting with one's environment. Finally, the *need for relatedness* refers to the experiencing connection, social embeddedness, and reciprocal care with significant others. These three basic psychological needs are thought to be innate and universal, suggesting that these needs are cardinal throughout one's entire life and that these are necessary for everyone regardless of their gender or culture (Chen et al., 2015; Vansteenkiste et al., 2010). Several studies showed that the fulfillment of these needs is positively related to various indices of subjective wellbeing and optimal functioning (see Deci & Ryan, 2000; Ryan & Deci, 2017 or Vansteenkiste & Ryan, 2013 for more details).

Equally important is the recently proposed distinction between need satisfaction (i.e., the bright side of functioning) and need frustration (i.e., the dark side of functioning), given that the absence of need satisfaction does not equal the presence of need frustration (Vansteenkiste & Ryan, 2013). Contrary to satisfaction, frustration refers to the actively frustrated needs which is associated with various indicators of ill-being, psychopathology, and suboptimal or maladaptive functioning (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013). More specifically, autonomy frustration would entail experiences of psychological pressure and control; competence frustration would indicate feelings of inadequacy and failure; and relatedness frustration would imply social rejection, disrespect or even loneliness. Given the importance of this distinction, the formal investigation of this proposition is presented in Chapter 4 and, to a smaller extent, Chapter 5.

Based on the available literature, it is reasonable to hypothesize that need satisfaction and need frustration might be differentially related to passion (which might be interpreted as an indicator of functioning). There have been some prior studies which

explored the associations between need satisfaction and passion (e.g., Lalande et al., 2017), and only one published article was identified which did the same for passion and need frustration (Mills et al., 2018). Moreover, person-centered studies are lacking. For this reason, Chapter 5 of the present dissertation provides an important contribution to the passion and SDT literature by investigating different need satisfaction and need frustration configurations (i.e., profiles) and their associations with HP and OP. Should levels need satisfaction and need frustration mirror one another within profiles, it would indicate that need satisfaction and need frustration are parts of the same underlying need fulfillment continuum. If these results do not mirror one another, then it would suggest that these two dimensions are two distinct factors.

A final and particularly interesting question pertains to assessing need fulfillment on a general versus on a specific level. *General* need fulfillment refers to one's experiences in life in general and, if imagined in a hierarchy, could be equated with a personality level or global level. On the other hand, *specific* need fulfillment described one's need-based experiences in a particular situation or domain in which people regularly engage (Allen & Andreson, 2018; Milyavskaya, Philippe, & Koestner, 2013). The existence of a hierarchical model has been proposed in other areas of psychology as well such as self-concept (Shavelson, Hubner, & Stanton, 1976), motivation (Vallerand, 1997), or life satisfaction (Heller, Watson, & Ilies, 2004). Empirical findings also support the presence of a similar hierarchical construct in relation to need fulfillment and propose that both top-down and bottom-up processes are involved (Milyavskaya et al., 2013; Ryan & Deci, 2017). For this reason, specific need fulfillment also merits scientific attention, particularly the proposition of Vansteenkiste and Ryan (2013) that experiencing need frustration in an important life domain might be conductive of compensatory behaviors in other areas of life as a way of coping with this state. This point is further elaborated on in Chapter 7.

Perceived parenting styles. Apart from individual factors, passion could also be influenced by the social environment. This proposition has been reinforced by several studies showing that teachers' and team members' behavior is related to passion (Bonneville-Roussy et al., 2013; Mageau et al., 2009; Liu, Chen, & Yao, 2011). However, there is a paucity of research on passion and early life experiences related to parenting styles. Despite the scarcity of these studies, it is important to examine whether parental practices and influences serve as protective or risk factors in both adolescent and adult life. Bowlby (1977) also highlighted the importance of positive parenting practices that

are related to healthy psychological development, while negative parenting practices are mostly associated with suboptimal development and, potentially, the development of various psychopathologies. Indeed, these parenting behaviors have always been considered to be relevant not just for early life development, but for later life human development as well (Bowlby, 1980, 2008; Buchanan, Flouri, & Ten Brinke, 2002; Clark, Dahlen, & Nicholson, 2015; Kalaitzaki & Birtchnell, 2014; Rothrauff, Cooney, & An, 2009; Sadowski, Ugarte, Kolvin, Kaplan, & Barnes, 1999; Stafford, Kuh, Gale, Mishra, & Richards, 2016; see also Ainsworth & Bowlby, 1991). Based on this proposition, early life experiences could also be relevant predictor of passion.

Perceived parenting styles are related to attachment theory which is a well-established model (Bowlby, 1980, 2008) that aims to describe and understand the formative role of interpersonal relationships between people. Arguably, one of the most relevant social agents who could influence one's behavior are parents or adult caregivers who raised the individual. Parenting styles might be defined as the child's perception of the parents' attitudes, behaviors, and perceived responsiveness (Bowlby, 1988; Parker, Tupling, & Brown, 1979). Previous studies have demonstrated the importance of parenting styles in relation to positive outcomes such as psychological wellbeing (Huppert, Abbott, Ploubidis, Richards, & Kuh, 2011), better educational achievement of children (Greenman, Bodovski, & Reed, 2014), intrinsic motivation (Gottfried, Fleming, & Gottfried, 1994), and adolescent adjustment (Lee, Daniels, & Kissinger, 2006). Other studies focused on the importance of parenting styles with respect to negative outcomes such as callous-unemotional trait (Bisby, Kimonis, & Goulter, 2017), adult antisocial personality traits (Reti et al., 2002), adult psychopathic personality (Gao, Raine, Chan, Venables, & Mednick, 2009) as well as body image dissatisfaction (Cheng & Mallinckrodt, 2009), suicidality (Goschin et al., 2013), and various mental disorders (Eun, Paksarian, He, & Merikangas, 2018; Shur-Fen Gau, 2007; Overbeek, ten Have, Vollebergh, de Graaf, 2007). These results further underpin the importance of perceived parental practices.

Although parenting styles are thought to be multidimensional with several relevant parenting dimensions being identified so far (e.g., Ainsworth, Bell, & Stayton, 1975; Hinde, 1974; Parker et al., 1979), two core styles can be mentioned which of major importance in relation to passion, namely care and overprotection. Parental care refers to perceived warmth, closeness, empathy, and affectionate behavior, while overprotection refers to controlling, protective and restrictive parental behaviors (Ngai, 2015; Parker et

al., 1979). In addition, autonomy-support has also been proposed as a third relevant parenting style (Xu, Morin, Marsh, Richards, & Jones, 2018; Ngai et al., 2018).

With respect to passion, parental care, overprotection, and autonomy-support have been investigated to various degrees and pertained to only some of these styles. More specifically, Bonneville-Roussy et al. (2013), Liu et al. (2011), and Mageau et al. (2009) showed that autonomy-support is positively related to HP. At the same time, autonomy-support was not associated with OP in any of these studies. The investigation of Mageau et al. (2009) is particularly important given that they examined parental autonomy-support. In the case of overprotection (which might include elements of controlling behavior that is the opposite of autonomy-support), it is possible that, in line with the DMP, overprotection is related to controlled internalization and, in turn, OP. Bonneville-Roussy et al. (2013) reported that psychological control (akin to overprotection) was related to OP. Outside the framework of the DMP, several studies showed that overprotection is positively associated with obsessive traits (Cavedo & Parker, 1994; Klimidis, Minas, Ata, & Stuart, 1992) or problematic behaviors (Grant & Kim, 2002; Kalaitzaki & Birtchnell, 2014; Lin & Gau, 2013; Mak & Kinsella, 1996; Siomos et al., 2012) which, in general, closely resembles OP. Finally, as for parental care, no prior study is available that could serve as a basis for this link. Still, parental care might provide people with a sense of security and a safe environment that could foster the development and appearance of HP. These questions are addressed in Chapter 6.

Overarching Research Questions

Reaching a clearer understanding of the processes involved in passion trajectories would prove to be central in devising practical approaches to nourish HP or tame OP. For this reason, the central question of the present dissertation pertains to examining the longitudinal trajectories of passion. More precisely, the overarching goal of this dissertation is to examine the temporal dynamics of passion and investigate whether it is stable over time or whether it fluctuates. The necessity of longitudinal studies has been highlighted by Vallerand (2015), thus the present dissertation aims to address this research gap. A secondary goal was to examine whether individual and social factors indeed influence the changes in passion and if so, to what extent. Basic psychological need fulfillment and perceived parenting styles were selected as individual and social factors, respectively, given their theoretical relevance. To achieve these goals, five empirical studies were conducted.

Specific Research Questions Related to the Five Empirical Studies

Study 1 focused on the cultural adaptation and validation of the Passion Scale (Marsh, Vallerand, et al., 2013) which is the only available instrument that was explicitly designed to measure the two aspects of the DMP, namely HP and OP. Given recent methodological advancements and considerations, confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) models were also tested and subsequently compared on two large samples with one being a community sample and the second being a comprehensive sample. In addition, for a thorough psychometric examination, measurement invariance and differential item functioning (DIF) was investigated with three alternative methods. It was expected that the Passion Scale would have adequate factor structure and reliability and that the ESEM representation would be superior relative to the corresponding CFA representation. It was also expected that high levels of measurement invariance and low levels of DIF would be achieved.

Study 2 focused on re-examining the representation and criterion-related validity of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) which has recently been constructed to address the numerous issues pertaining to the measurement of need satisfaction and need frustration. In addition, this instrument was recently adapted to Hungarian by Tóth-Király, Morin, Bőthe, Orosz, and Rigó (2018), making it particularly well-suited for the purpose of the present dissertation. Psychometric examination entailed the comparison of alternative CFA- and ESEM-based first-order and bifactor models. It was expected that the bifactor ESEM would be superior to other solutions. Apart from examining its representation, it was also tested how need fulfillment and its various aspects are related to positive and negative affect. It was hypothesized that a global need fulfillment factor would have the highest predictive effect on the outcomes, followed by some (but not all) specific factors.

Upon identifying adequate instrument to measure the target constructs, *Study 3* investigated how general need satisfaction and need frustration would be related to HP and OP. More specifically, this study focused on general need fulfillment profiles (i.e., the within-individual interaction of the three basic psychological needs) and investigated the importance of having balanced (i.e., all needs being on the same level) versus imbalanced (i.e., not all needs being on the same level) needs. Several profiles were expected to emerge, characterized by distinct levels of need fulfillment. Need balance was also expected to be important with respect to the outcomes. The construct validity of these profiles was tested in relation to theoretically-relevant profile predictors (i.e.,

perceived interpersonal behaviors) and outcomes with the latter including positive and negative affect, and, more importantly, passion. Finally, more positive interpersonal behaviors were expected to be associated with more satisfied profiles, where more satisfied profiles were expected to be predictive of more positive (and fewer negative) outcomes (e.g., higher HP and lower OP).

Instead of individual factors, *Study 4* focused on the role of the social environment in predicting passion. Given their relevance of human development, this study investigated how early life experiences in the form of the perceived parenting styles of care, overprotection, and autonomy-support are related to HP and OP across two samples including adolescents and adults. Parental care and autonomy-support was expected to predict HP, while overprotection was expected to predict OP. We also tested how HP and OP are related to subjective wellbeing.

Finally, building on all previous studies, *Study 5* focused on the developmental trajectories of passion to directly investigate whether level of passion fluctuate or remain stable over a period of four months. Moderate-to-strong stability and temporal stability was expected. Apart from examining these temporal dynamics, need fulfillment and perceived parenting styles were also incorporated as individual and social determinants of the growth trajectories, respectively, and expectations about the associations were expected to be in line with the cross-sectional studies detailed above.

Chapter 3: An Illustration of the Exploratory Structural Equation Modeling (ESEM) Framework on the Passion Scale (Study 1)[6]

Note. The article has been accepted for publication and the final pre-published version is presented in this thesis. The final published version as well as the online supplementary materials can be download from the publisher's website (https://www.frontiersin.org/articles/10.3389/fpsyg.2017.01968/full).

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Preface

Embarking on a longitudinal research requires one to have solid "building blocks" that serve as foundations for the research. In the present case, these building blocks are the questionnaires or instruments measuring the target constructs. If the psychometric properties of these instruments are not systematically investigated, then one cannot be sure whether the instruments indeed measure the intended constructs or whether there are measurement inconsistencies across different populations. For this reason, as a first step toward the overarching goals, Study 1 examined the psychometric properties of the Passion Scale (Marsh, Vallerand, et al., 2013; Vallerand, 2015), the only instrument that was developed for assessing passion in general as well as its dualistic aspects in the form of harmonious and obsessive passion. This step would allow future studies to use the Passion Scale in Hungarian language.

The initial validation studies of Vallerand et al. (2003) applied exploratory and confirmatory factor analysis (EFA and CFA, respectively) for psychometric examination. While some studies also followed this procedure (e.g., Zhao, St-Louis, & Vallerand, 2015), more and more studies suggested that exploratory structural equation modeling (ESEM; Asparouhov & Muthén, 2009; Marsh, Morin, Parker, & Kaur, 2014) is a more suitable analytic approach compared to CFA (Bonneville-Roussy & Vallerand, 2018; Chamarro et al., 2015; Marsh, Vallerand, et al., 2013; Schellenberg, Gunnell, Mosewich, & Bailis, 2014). This issue is elaborated on in the paper. Finally, given that relatively large samples were available, it was also thoroughly investigated whether the dualistic representation of passion generalizes to various combinations of gender and age groups via tests of measurement invariance, multiple-indicators-multiple-causes models (MIMIC) as well as a hybrid model based on these two methods.

Abstract

While exploratory factor analysis (EFA) provides a more realistic presentation of the data with the allowance of item cross-loadings, confirmatory factor analysis (CFA) includes many methodological advances that the former does not. To create a synergy of the two, exploratory structural equation modeling (ESEM) was proposed as an alternative solution, incorporating the advantages of EFA and CFA. The present investigation is thus an illustrative demonstration of the applicability and flexibility of ESEM. To achieve this goal, we compared CFA and ESEM models, then thoroughly tested measurement invariance and differential item functioning through multiple-indicators-multiple-causes (MIMIC) models on the Passion Scale, the only measure of the Dualistic Model of Passion which differentiates between harmonious and obsessive forms of passion. Moreover, a hybrid model was also created to overcome the drawbacks of the two methods. Analyses of the first large community sample ($N = 7,466$; 67.7% females; $M_{age} = 26.01$) revealed the superiority of the ESEM model relative to CFA in terms of improved goodness-of-fit and less correlated factors, while at the same time retaining the high definition of the factors. However, this fit was only achieved with the inclusion of three correlated uniquenesses, two of which appeared in previous studies and one of which was specific to the current investigation. These findings were replicated on a second, comprehensive sample ($N = 504$; 51.8% females; $M_{age} = 39.59$). After combining the two samples, complete measurement invariance (factor loadings, item intercepts, item uniquenesses, factor variances-covariances, and latent means) was achieved across gender and partial invariance across age groups and their combination. Only one item intercept was non-invariant across both multigroup and MIMIC approaches, an observation that was further corroborated by the hybrid model. While obsessive passion showed a slight decline in the hybrid model, harmonious passion did not. Overall, the ESEM framework is a viable alternative of CFA that could be used and even extended to address substantially important questions and researchers should systematically compare these two approaches to identify the most suitable one.

Keywords: differential item functioning (DIF), dualistic model of passion (DMP), exploratory structural equation modeling (ESEM), Hungarian version; hybrid modeling approach, measurement invariance, multiple indicators multiple causes (MIMIC) model, Passion Scale

Introduction

Confirmatory factor analysis (CFA; Jöreskog, 1969) has been at the heart of psychometric research since its inception and quickly became a default, "go-to" method in psychometrics due to the methodological advances associated with it (e.g., goodness-of-fit, estimation of different models, inclusion of method factors or correlated uniquenesses) relative to exploratory factor analysis (EFA). Another important property—and drawback as we will demonstrate—of CFA, compared to EFA, is that items are only allowed to load on their main factors, whereas cross-loadings on the other factors are set to zero. On the other hand, EFA freely estimates all cross-loadings (Marsh et al., 2009; Morin, Nagengast, & Morin, 2013). These all might contribute to the perception that EFA is less useful than or even inferior to CFA.

Although the popularity and usefulness of CFA could be seen as a motivation to create more parsimonious measurement models, these models and items more often than not include a certain level of systematic measurement error in the form of cross-loadings. Given that items are rarely pure indicators of their corresponding constructs, they are fallible in nature, thus at least some degree of construct-relevant association can be expected between items and the non-target, yet conceptually-related constructs (Morin, Arens, & Marsh, 2016). When non-zero cross-loadings are present and unexpressed at the same time, such restrictive constraints (i.e., items can only load on one factor) could inflate the associations between the factors as the misspecified cross-loadings could only be expressed through these factorial associations. Indeed, recent review of simulation studies (Asparouhov, Muthén, & Morin, 2015) showed that even small cross-loadings (as small as .100) should be explicitly taken into account, otherwise, parameter estimates could be inflated and thus biased. Moreover, the goodness-of-fit of the models and the discriminant validity of the factors could also be undermined by these overly restrictive specifications (Marsh et al., 2010; Marsh et al., 2014).

To overcome these serious limitations, the ESEM framework (Asparouhov & Muthén, 2009; Marsh et al., 2014) has been developed which incorporates the advantages of the less restrictive EFA (i.e., allowing cross-loadings) and the more advanced CFA (i.e., goodness-of-fit or multigroup models) at the same time, providing a synergy that is "the best of both worlds" and can adequately account for complex measurement models (see Figure 3.1 for a simplistic visual representation). Generally, ESEM showed to result in improved model fit as well as deflated inter-factor correlations that, in turn, improve the discriminant validity of the factors as well as providing a more realistic representation

of the data (Arens & Morin; 2016; Morin & Maïano, 2011; Morin et al., 2013; Tóth-Király, Bőthe, & Orosz, 2017). Indeed, the superiority of ESEM is now well-established from a variety of studies within the field of SDT in relation to, for instance, academic (Guay, Morin, Litalien, Valois, & Vallerand, 2015; Tóth-Király, Orosz, et al., 2017), and work (Howard et al., 2018) motivations as well as need satisfaction (Sánchez-Oliva et al., 2017). In order to demonstrate the flexibility and strength of this framework, we analyzed responses from two separate samples to the Passion Scale, the only instrument of the Dualistic Model of Passion.

Figure 3.1. Simplified representations of the estimated models
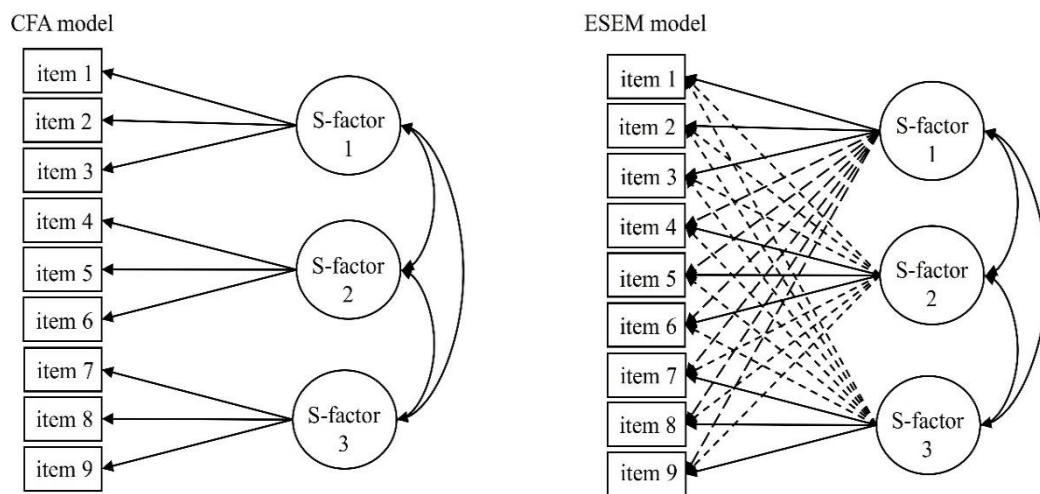
Note. CFA: confirmatory factor analysis; ESEM: exploratory structural equation modeling; S-factor: specific factors. Full one-headed arrows represent main factor loadings, dashed one-headed arrows represent cross-loadings, two-headed arrows represent correlations.

An Illustrative Example: on the Dualistic Model of Passion and the Passion Scale

Over the last decade, research on the field of passion has boomed with the introduction of the Dualistic Model of Passion (DMP; Vallerand, 2015; Vallerand et al., 2003) stemming from the Self-Determination Theory (Deci & Ryan, 1985; Ryan & Deci, 2017). The DMP defines passion as an inclination toward an object, person, or activity that one likes (or even loves), spends a large amount of time and energy with it and finds it important. Additionally, two forms of passion can be differentiated that are qualitatively different from one another as a result of the process of internalization that takes place during activity engagement (e.g., Deci & Ryan, 1985). The first form of the DMP is *harmonious passion* (HP) which develops when autonomous and voluntary

internalization occurs, thus the activity is freely engaged and incorporated into one's identity, without any inter- or intra-personal contingencies. In this case, the individual is in control of the activity. Although engaging in this activity takes up a significant amount of time, it is not overwhelming to the individual, leading to balance with other aspects of life and one's identity. Moreover, HP is predominantly associated with positive and adaptive outcomes (Vallerand, 2015). The second form of the DMP is *obsessive passion* (OP) which is rooted in a controlled internalization process where inter- or intra-personal contingencies are attached to the activity engagement, such as the maintenance of self-esteem or social acceptance (Lafrenière et al., 2011). Due to these external and/or internal contingencies, the individual loses control over the activity and feels an uncontrollable pressure to engage in it, often indirectly creating conflicts with other aspects of life. Finally, experiences of OP are often associated with negative or maladaptive outcomes (Vallerand, 2015). Despite an abundance of research focusing on the possible determinant and outcomes of passion (for a meta-analysis, see Curran et al., 2015 and for a detailed review, see Vallerand, 2015), only a couple of studies (Chamarro et al., 2015; Marsh, Vallerand, et al., 2013; Schellenberg et al., 2014) conducted detailed examinations on the instrument measuring this construct, namely the Passion Scale.

Within the passion research, ESEM has already been demonstrated as a preferable method compared to CFA. The study of Marsh, Vallerand, et al. (2013) was the first that evaluated the construct validity of the Passion Scale in relation to a variety of activities with the comparison of CFA and ESEM models and concluded that ESEM resulted in substantially better fit and more differentiated (i.e., less correlated) factors. These findings have been corroborated by the studies of Schellenberg et al., (2014) and of Chamarro et al. (2015) in relation to sport and exercise. Building on these studies, in the following, we illustrate the usefulness of ESEM framework as it allows the application of advanced statistical methods such as tests of measurement invariance and differential item functioning which is of major relevance to the present investigation.

Measurement Invariance and Differential Item Functioning (DIF)

A critical point in the assessment of psychological constructs and instruments is whether they could be used among individuals with different background characteristics or at different timepoints. If the instrument (and the measurement properties) at hand behave differently in different subgroups of the population, then measurement biases could occur, leading to impossible and/or invalid comparisons. Contrarily, if findings are

similar in different subgroups, then it becomes possible to generalize our findings. In practice, these assumptions could easily be inspected with tests of measurement invariance (Meredith, 1993, Millsap, 2011; Vandenberg & Lance, 2000).

Generally, based on the above-mentioned papers, there are six levels of invariance that are of key importance in these investigations. *Configural invariance* assumes that groups hold the same conceptual framework (i.e., the same factor structure) without any equality constraints on any parameters. Failure to achieve this initial level would mean that the constructs themselves differ. *Weak or metric invariance* posits the equivalence of factor loadings whose achieving is important in comparing factor correlations and relations to other constructs across groups. *Strong or scalar invariance* refers to the invariance of item intercepts and posits that members of different groups have similar item scores when the construct in question is held at the same level (i.e., group-based differences are consistent both in direction and magnitude). If this level of invariance is not achieved, then latent means cannot be compared and one can suspect the presence of DIF (i.e., response bias at the item level). *Strict or residual invariance* tests the invariance of measurement errors across groups and is the prerequisite of manifest score comparisons. Furthermore, the equivalence of latent variances-covariances and latent means can also be examined. While the first four steps investigate the presence of measurement biases and differences, the last two steps investigate the presence of group-based differences on the level of variance, covariances, and means. The taxonomy of Marsh et al. (2009) further expanded these tests by including a total of 13 partially nested invariance models that are various combinations of the preceding ones and allow for a more thorough investigation. This taxonomy is particularly relevant for the present investigation as Marsh, Vallerand, et al. (2013) as well as Schellenberg et al. (2014) have already demonstrated the taxonomy's usefulness in relation to passion and groups based on gender, language, and type of activity.

As for continuous variables, such as age, multiple-indicators-multiple-causes (MIMIC) models could also be pursued. MIMIC models are basically regression models where latent factors can be regressed on a diverse range of predictors. In relation to passion, Marsh, Vallerand, et al. (2013) demonstrated through MIMIC that OP declines with age (a linear effect), but starts to flatten-out and then level off after a certain age (a quadratic effect), whereas HP was not affected by age. These are in line with the findings of Chamarro et al. (2015) to some extent as they have identified linear declines in for both HP and OP (without quadratic effect). However, a limitation of these findings is that DIF

in relation to age was not tested; hence, it is possible that the predictor (i.e., age) has a unique effect on the items that cannot be fully explained by its effect on the latent variable. Researchers may have two options with continuous variables such as age: the first is to leave it as continuous and use MIMIC models to test its effect; the second is to transform age into discrete categories and test measurement invariance. As we will demonstrate, both methods have their own flaws; however, these could be amended by integrating the two methods into a single hybrid model (Marsh, Nagengast, & Morin, 2013; Marsh et al., 2006).

The Present Investigation

Our main objective was to illustrate the flexibility and usefulness of the ESEM framework in relation to the Passion Scale. To this end, we first examined the factor structure of the Passion Scale with CFA and ESEM on a large community sample, then compared to two solutions to choose the most appropriate one. Based on previous studies (e.g., Marsh, Vallerand, et al., 2013; Schellenberg et al., 2014), we expected the ESEM solution to fit the data better. The same procedure was performed on an independent comprehensive sample to assess the extent to which our findings can be replicated. After combining the two samples, we then extended the ESEM model to test measurement invariance across several group configurations (gender, age, and gender × age), evaluated the potential linear and quadratic effects of age through MIMIC models, and then combined the two methods by adding the MIMIC age effects to the gender × age invariance model.

Materials and Methods

Participants and Procedure

Sample 1. The first study relied on data from a total of 7,466 Hungarian adults (5047 female, 67.7%) who were aged between 18 and 74 ($M = 26.01$; $SD = 8.43$). For Sample 1, several samples with previously published and unpublished data were combined which has never been used for the psychometric investigation of the Passion Scale. Participants filled out the Passion Scale in relation to the following activities: Facebook use, series watching, learning new things, dance, playing Pokémon Go, smartphone gaming, online gaming, and sex (see Table S1.1 in the supplementary materials for more details). Participants were recruited through various websites, mailing lists and online forums and filled out the questionnaires online. Before starting the

questionnaire, they were first informed about the aim and the topic of the study. If they were inclined to participate, they had to approve an informed consent by checking a box; otherwise, they were excluded and their responses were recorded as finished. Therefore, the study was carried out with the adequate understanding and consent of the participants and was approved by the University Research Ethics Committee, while following the guidelines of the Declaration of Helsinki.

Sample 2. The second study relied on a comprehensive sample of 504 Hungarian adults who use Internet at least once a week. This sample was recruited with the help of a research market company in May 2017 using a multiple-step, proportionally stratified, probabilistic sampling method (see Tóth-Király, Bőthe, et al., 2017 for more details on the sampling procedure) and was proportionally representative in terms of gender (51.8% female), age (18 to 60 years; $M = 39.59$ years; $SD = 12.03$ years), education (19.8%: primary; 58.3%: secondary; 21.8%: higher) and place of residence (20.2%: capital city; 19.6%: county capitals; 31.9%: cities; 28.2%: country). Participants reported their employment status as full-time (59.7%), part-time (8.9%), occasional (5.6%) and unemployed (25.8%). They were asked to mention an activity that they love, that spend time and energy with and that is important and valuable for them and then completed the Passion Scale with respect to that particular activity. Procedure was the same as in Study 1.

Materials

Passion Scale. This measure (Marsh, Vallerand, et al., 2013; Vallerand, 2015; Vallerand et al., 2003) assesses the level of passion one has for a certain activity on the basis of two dimensions: harmonious passion (six items, e.g., "My activity is in harmony with other things that are part of me.") and obsessive passion (six items, e.g., "I have the impression that my activity controls me."). Respondents indicated their level of agreement on a seven-point scale (1 = not agree at all; 7 = very strongly agree). A standardized back-translation procedure (Beaton, Bombardier, Guillemin, & Ferraz, 2000; Hambleton & Kanjee, 1995) was followed to obtain the final Hungarian version (see Table S1.2 in the supplementary materials).

Statistical Analyses

Preliminary analyses. As data gathering was performed in an online setting, no missing responses were present. Prior to the analyses, data was investigated on the total

sample for univariate normality through the inspection of skewness and kurtosis values; and multivariate normality through Mardia's two-sided test of fit for skewness and kurtosis (Wang & Wang, 2012). For univariate normality, considering the guidelines of Muthén and Kaplan (1985) with a ±1 threshold, neither skewness (ranging from -1.03 to +1.61), nor kurtosis (ranging -1.12 to +2.04) values suggested that the data has univariate normality. This observation was supported by the statistically significant Mardia's test, indicating that the assumption of multivariate normality was violated.

Factorial structure. All analyses were performed with Mplus 7.4 (Muthén & Muthén, 1998-2015) and estimated with the robust maximum likelihood estimator (MLR) which provides standard errors and tests of model fit that are robust to the non-normality of the data. This estimator is also preferred when there are five or more answer categories (Rhemtulla, Brosseau-Liard, & Savalei, 2012) such as in the present case. The first phase of the analyses included the examination of the Passion Scale through the comparison of CFA and ESEM model, as recommended by Marsh et al. (2009). As per typical CFA specification, items only loaded on their respective factor, while cross-loadings were constrained to zero. In ESEM, items loaded on their main factors, whereas cross-loadings were "targeted", but not forced, to be as close to zero as possible with the oblique target rotation procedure (Browne, 2001). Based on previous studies (Chamarro et al., 2015; Marsh, Vallerand, et al., 2013; Schellenberg et al., 2014), we expected that the inclusion of at least two correlated uniquenesses (CU) would be necessary given the wording of the items. Nevertheless, we first tested models without CUs. Sample input files are available in Appendix S1.1-S1.2 in the supplementary materials. When interpreting the magnitude of the factor loadings, the guidelines of Comrey and Lee (1992) were applied: excellent above .71, very good between .63 and .70, good between .55 and .62, fair between .44 and .33, and poor below .32.

Another particularly important issue relates to the inclusion of a priori correlated uniquenesses (CUs; i.e., covariances between the error terms of two different items). While the ad hoc inclusion of CUs should generally be avoided (Marsh et al., 2010), there are certain cases when these are acceptable (Cole, Ciesla, & Steiger, 2007; Marsh, 2007). Examining four previous studies on the Passion Scale revealed that all included at least two CUs in their final measurement models. More specifically, Marsh, Vallerand, et al. (2013) had CUs between HP1-HP8 and OP7-OP9; Schellenberg et al. (2014) also identified two CUs between HP1-HP10 and OP2-OP4. Similarly, Zhao et al. (2015) included two CUs between items HP1-HP10 and OP7-OP9. Finally, the study of

Chamarro et al. (2015) included a total of three CUs (HP1-HP8, OP7-OP9, OP2-OP4). While we did not formulate any specific hypotheses as to which ones should be included, we expected that at least two CUs would be necessary. For this reason, we chose to observe modification indices of the CU-less models and examine whether the necessity to include any of the above-mentioned previous CUs on a step by step, iterative basis (Oort, 1998) is replicated in our study. Without blindly including any, we also examined the content of the target items.

Measurement invariance. In the second phase, the measurement invariance of the most optimal measurement model was tested across the samples from the two studies to verify the replicability of the final model. Invariance tests were performed based on the extended taxonomy of Marsh et al. (2009, see also Morin et al., 2013) including a total of 13 levels of invariance with different combinations of parameters being constrained to equal. However, there are six levels that of key importance in the measurement invariance literature (Meredith, 1993; Morin, Arens, et al., 2016): configural invariance, weak (metric) invariance, strong (scalar) invariance, strict (residual) invariance, latent variance-covariance invariance, and latent means invariance. Were strong measurement invariance achieved, the two samples then would be combined to maximize the available sample size when testing measurement invariance as a function of gender, age, and their interaction (gender × age). As passion is not a personality variable, we opted not to create groups based on typical interpretations of young adulthood (i.e., between 15-30), middle age (i.e., between 31-60) and older age (i.e., between 61-99), but instead trisected the full sample into three groups. This process resulted in three groups and age categories: 18-21 ($n = 2477$), 22-25 ($n = 2563$), and 26-74 ($n = 2930$).

Differential item functioning (DIF). Tests of invariance and DIF are rather complex with continuous variables such as age compared to variables with distinct categories (such as gender). One of the possible approaches is to create categorical variables from the continuous ones (as above). Although it allows for a more thorough and rigorous invariance testing, it has problems inherent to the suboptimal transformation of continuous variables which could potentially result in information loss. In similar situations, (MIMIC) models can be pursued (Morin et al., 2013; Morin, Maïano et al., 2016). Therefore, in the third phase, building on the most invariant gender model, DIF was tested as a function of age within both gender groups where the factors were regressed on the linear and quadratic components of age (i.e., age and age^2) as well. After

standardizing age, three MIMIC models were compared (Morin et al., 2013): (1) a null effect model where the predictors (age and age^2) have no effect on neither the items, nor the factors; (2) a saturated model where paths from the predictors to the items are freely estimated, but paths to the factors are fixed to zero; and (3) a factors-only model where paths to the factors are freely estimated, but paths to the items are constrained to zero. The comparison of the null and saturated models tests the effect of the predictors on the individual items, while the comparison of the saturated and factors-only model reveals whether these effects can be fully explained by the effects on the latent factors (i.e., the presence or absence of DIF).

Hybrid approach of multiple-group and MIMIC models. Although the multigroup solution has a disadvantage due to variable transformation, the MIMIC model is not without limitations either. More specifically, only the invariance of factor means and item intercepts can be examined (but still assumes the invariance of factor loadings and uniquenesses which cannot directly be tested). To solve this shortcoming, Marsh et al. (2006) introduced a hybrid model in which both approaches are integrated for greater precision by adding the MIMIC age effects (i.e., age and age^2) to the multigroup model (i.e., gender × age). Moreover, this hybrid approach has already been used in conjunction with ESEM to evaluate the potential information loss as a result of transforming continuous variables (Marsh, Nagengast, et al., 2013), making it particularly useful for the present investigation.

Model assessment. In interpreting the results, we relied on a combination of common goodness-of-fit indices due to the fact that they provide different information about the measurement models (Brown, 2015): the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA). We considered both adequate and excellent thresholds for these fit indices (Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004; Marsh, Hau, & Grayson, 2005; Marsh, 2007) as strictly adhering to the more conservative "golden rules" could lead to erroneous results (Chen, Curran, Bollen, Kirby, & Paxton, 2008; Henne, Hilbert, Draxler, Ziegler, & Bühner, 2011; Perry, Nicholls, Clough, & Crust, 2015). Thus, as rough guidelines, CFI and TLI values greater than .90 and .95 and considered adequate and excellent, respectively, while RMSEA values smaller than .08 and .06 indicate acceptable and excellent model fit. Although we report the robust chi-square (χ^2) test of exact fit as well, it has to be noted that it tends to be oversensitive to sample size and minor model misspecifications. As for model comparison, changes (Δ) in these goodness-of-fit indices were observed with lack

of invariance being present if CFI and TLI decreases are at least .010 or higher or RMSEA increases are at least .015 or higher (Chen, 2007; Cheung & Rensvold, 2002). It is also worth noting that TLI and RMSEA are corrected for parsimony (i.e., more parsimonious models can fit the data better than less parsimonious ones) as opposed to CFI, which is monotonic to complexity (i.e., more complex models always fit better than less complex ones). This is of major importance given that typically more parameters as estimated in ESEM than in CFA (Marsh et al., 2009; Morin et al., 2013). Therefore, based on previous suggestions (Marsh, 2007; Marsh, Nagengast, et al., 2013), we put a larger emphasis on TLI and RMSEA in model comparisons. However, we want to reinforce that these should only be seen as rough guidelines that one should take into account as well as the statistical and theoretical conformity of the findings (Marsh et al., 2004; Marsh et al., 2005; Morin, Arens, et al., 2016).

Results

Sample 1: Measurement Structure of the Passion Scale – ESEM vs. CFA

Goodness-of-fit indices for this study are presented in the top section of Table 3.1, while standardized parameter estimates are available on the left side of Table 3.2. Although we expected the necessary inclusion of correlated uniquenesses between a subset of items, we examined the two-factor CFA and ESEM models without these modifications as a starting point to see whether the same pair of items requires CUs as in previous studies. Both CU-less CFA and ESEM solutions had unsatisfactory model fit as apparent by the fit indices. The inspection of modification indices for both solutions suggested that the inclusion of three correlated uniquenesses (OP7-OP9, HP1-HP10, and OP4-OP12) would improve model fit substantially which were included on a step by step basis, starting with the pair with the highest modification indices. These modifications resulted in still unsatisfactory fit for the CFA solution, and adequate fit for the ESEM one[7]. However, the appropriate model should not only be chosen based on fit indices, but

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[7] We also tested the two factors separately, as unidimensional constructs to investigate the potential sources of misfit for HP and OP. As for HP, the model with six items showed bad fit to the data ($\chi^2 = 1096.933$, df = 9, CFI = .898, TLI = .831, RMSEA = .127 [90% CI .121-.134]). The examination of modification indices suggested that the error terms of HP1 and HP10 should be allowed to correlate. This modification corresponded with our main analyses and resulted in substantially improved fit ($\chi^2 = 389.793$, df = 8, CFI = .964, TLI = .933, RMSEA = .080 [90% CI .073-.087]). We performed the same analyses for OP which yielded unsatisfactory fit ($\chi^2 = 1237.426$, df = 9, CFI = .912, TLI = .853, RMSEA = .135 [90% CI .129-.142]). Similar to the main analyses, the correlation between the error terms of OP7 and OP9 was freed, resulting in improved fit ($\chi^2 = 521.867$, df = 8, CFI = .963, TLI = .931, RMSEA = .093 [90% CI .086-.100]). As the overall fit was still borderline in relation to the RMSEA, we freed one more error covariance between

it should be complemented by the examination of parameter estimates and theoretical conformity as well (Morin, Arens, et al., 2016).

Table 3.1. Goodness-of-Fit Statistics for the Estimated Models on the Passion Scale

Model	χ^2	df	CFI	TLI	RMSEA	RMSEA 90% CI
Sample 1						
1. CFA (no CU)	5494.047	53	.846	.808	.117	.115-.120
2. ESEM (no CU)	3447.126	43	.904	.852	.103	.100-.106
3. CFA (1 CU)[a]	4749.137	52	.867	.831	.110	.107-.113
4. ESEM (1 CU)[a]	2626.636	42	.927	.885	.091	.088-.094
5. CFA (2 CUs)[b]	3895.072	51	.891	.859	.100	.098-.103
6. ESEM (2 CUs)[b]	2025.023	41	.944	.910	.081	.078-.084
7. CFA (3 CUs)[c]	3686.478	50	.897	.864	.099	.096-.101
8. ESEM (3 CUs)[c]	1775.742	40	.951	.919	.076	.073-.079
Sample 2						
1. CFA (no CU)	350.419	53	.831	.790	.106	.095-.116
2. ESEM (no CU)	196.050	43	.913	.867	.084	.072-.096
3. CFA (1 CU)[a]	287.359	52	.866	.830	.095	.084-.106
4. ESEM (1 CU)[a]	127.600	42	.951	.924	.064	.051-.076
5. CFA (2 CUs)[b]	219.322	51	.904	.876	.081	.070-.092
6. ESEM (2 CUs)[b]	86.804	41	.974	.958	.047	.033-.061
7. CFA (3 CUs)[c]	196.833	50	.917	.890	.076	.065-.088
8. ESEM (3 CUs)[c]	68.561	40	.984	.973	.038	.022-.052

Note. CFA: confirmatory factor analysis; ESEM: exploratory structural equation modeling; χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; CU: correlated uniqueness; [a]: correlated uniqueness between OP7 and OP9; [b]: correlated uniqueness between HP1 and HP10; [c]: correlated uniqueness between OP4 and OP12.

Both solutions resulted in well-defined factors (ESEM: $|\lambda|$ = .416 to .893, *M* = .659; CFA: $|\lambda|$ = .354 to .856, *M* = .678). Although cross-loadings were present in the ESEM model ($|\lambda|$ = .154 to .349, *M* = .147), these did not undermine the definition of the factors. Moreover, some of the cross-loading are reasonable (e.g., HP10 or OP2), given that they tap into opposing aspects of the target constructs. The three correlated uniquenesses were similar in magnitude for both models and these were also similar to previous studies. The first CU (with the highest modification indices) was between OP7 (i.e., "This activity is the only thing that really turns me on") and OP9 (i.e., "If I could, I would only do my activity") which was present in three of the four previous studies mentioned above (Chamarro et al., 2015; Marsh, Vallerand, et al., 2013; Zhao et al., 2015). The wording of these items indicated that both refer to the exclusive place that the activity occupies in one's life. The second CU was between HP1 (i.e., "This activity is in

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OP4 and OP12 based on modification indices. Due to the latter change, model fit was acceptable (χ^2 = 301.362, df = 7, CFI = .979, TLI = .955, RMSEA = .075 [90% CI .068-.082]).

harmony with the other activities in my life") and HP10 (i.e., My activity is in harmony with other things that are part of me.) was present for Schellenberg et al. (2014) and Zhao et al. (2015), both belonged to the harmonious passion factor and referred to the fact that the activity was in harmony with other aspects of life. The third CU was between OP4 (i.e., "I have almost an obsessive feeling for this activity") and OP12 (i.e., "I have the impression that my activity controls me"), and interestingly, despite belonging to the same factor, they had a negative association with each other which might be attributed to the fact that they differentially tap into HP (i.e., OP4 positively, whereas OP12 negatively). As a result of the cross-loadings, factor correlations were also reduced for the ESEM ($r = .587$) model relative to the CFA ($r = .718$). Finally, both factors were reliably in terms of Cronbach's alpha ($\alpha_{HP} = .801$; $\alpha_{OP} = .883$). Although this index is useful when comparing results to previous findings, it tends to be less reliable (Rodriguez, Reise, & Haviland, 2016; Sijtsma, 2009). Therefore, McDonald's model-based composite reliability coefficient (McDonald, 1970) was also calculated as follows: $\omega = (\Sigma|\lambda_i|)^2$ / $([\Sigma|\lambda_i|]^2 + \Sigma\delta_{ii})$ where λ_i are the factor loadings and δ_{ii} the error variances and thus it has the advantage, compared to alpha, of taking into account the strength of association between the items and the latent factors (λ_i) with the specific measurement errors (δ_{ii}). Omega also showed adequate model-based reliabilities ($\omega_{HP} = .778$; $\omega_{OP} = .867$).

Table 3.2. Standardized Parameter Estimates for the CFA and ESEM solutions of the Passion Scale in Study 1 and Study 2

| Items | Study 1 (N = 7466) | | | | | | Study 2 (N = 504) | | | | | |
| | CFA | | | ESEM | | | CFA | | | ESEM | | |
	HP (λ)	OP (λ)	δ	HP (λ)	OP (λ)	δ	HP (λ)	OP (λ)	δ	HP (λ)	OP (λ)	δ
HP1	**.354**		.875	**.476**	-.154	.836	**.579**		.665	**.613**	*-.062*	.647
HP3	**.725**		.474	**.767**	-.023	.432	**.723**		.478	**.712**	*.021*	.482
HP5	**.773**		.403	**.580**	.259	.420	**.639**		.591	**.539**	.232	.566
HP6	**.777**		.396	**.832**	-.025	.332	**.720**		.482	**.720**	*-.003*	.483
HP8	**.668**		.554	**.416**	.349	.534	**.639**		.591	**.568**	.172	.578
HP10	**.362**		.869	**.532**	-.209	.804	**.564**		.682	**.700**	-.223	.571
OP2		**.733**	.462	-.034	**.753**	.462		**.598**	.643	-.027	**.605**	.645
OP4		**.856**	.267	.147	**.758**	.273		**.831**	.310	.177	**.753**	.307
OP7		**.701**	.509	.207	**.569**	.495		**.606**	.633	.100	**.561**	.635
OP9		**.708**	.499	.157	**.608**	.494		**.577**	.667	.175	**.500**	.657
OP11		**.736**	.458	*.019*	**.725**	.458		**.733**	.462	*-.029*	**.744**	.460
OP12		**.746**	.444	-.181	**.893**	.360		**.794**	.369	-.210	**.904**	.274
Factor correlations and CUs	HP-OP: .718 OP7-OP9: .398 HP1-HP10: .365 OP4-OP12 -.289			HP-OP: .587 OP7-OP9: .389 HP1-HP10 .326 OP4-OP12 -.343			HP-OP: .427 OP7-OP9: .445 HP1-HP10: .434 OP4-OP12: -.441			HP-OP: .355 OP7-OP9: .445 HP1-HP10: .394 OP4-OP12: -.460		

Note. CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; HP: harmonious passion; OP: obsessive passion; λ: Factor loading; δ: Item uniqueness; CU: correlated uniqueness; Target factor loadings are in bold; Non-significant parameters (p ≥ .05) are italicized.

Sample 2: Replication the Measurement Structure of the Passion Scale

Goodness-of-fit indices associated with Study 2 are reported in the bottom section of Table 1, while parameter estimates can be seen on the right side of Table 2. Again, the models without correlated uniquenesses resulted in bad fit. However, the inclusion of these same correlated uniquenesses as in Study 1 resulted in marginal fit for the CFA solution with only CFI and RMSEA indicating acceptable fit, while all indices were excellent for the ESEM solution. The examination of parameter estimates revealed well-defined factors with the same magnitude (ESEM: $|\lambda|$ = .500 to .904, M = .660; CFA: $|\lambda|$ = .564 to .831, M = .667). Cross-loadings were once again small in magnitude ($|\lambda|$ = .003 to .232, M = .119) and the association between HP and OP was reduced in ESEM (r = .355) compared to CFA (r = .427). The reliability of the factors was also highly supported (α_{HP} = .821, α_{OP} = .846; ω_{HP} = .816, ω_{OP} = .841). In sum, based on the findings, the ESEM model was retained as it had better model fit, well-defined and reliable factors and reduced factor correlations.

Measurement Invariance

Upon demonstrating the superiority of the ESEM model for this particular scale, we continued by assessing the extent to which this model could be replicated across the two samples and studies (see Table 3.3) before investigating the effects of gender and age. Although the extended invariance taxonomy is exhaustive, we only interpret the key models (see Appendix S1.3-S1.10 for input for these key models). The configural model (Model S1 in Table 3.3) achieved a satisfactory level of fit to the data, and supported the weak measurement invariance (Model S2 in Table 3.3) of the model across samples (ΔCFI/TLI $\leq$ .010; ΔRMSEA $\leq$ .015). For strong invariance (Model S5 in Table 3.3), although changes in CFI were marginal in relation to cut-off values (ΔCFI = -.011), changes in TLI (ΔTLI = -.005) and RMSEA (ΔRMSEA = +.003) were acceptable. Nevertheless, we explored a model of partial strong invariance involving the relaxation of equality constraints for a single item's (HP5) intercept through the examination of modification indices of the strong invariance model. This model of partial strong invariance (Model S5p) was supported by the data, as well as the remaining models of strict (Model S7) and latent-variance-covariance (Model S9) invariance (ΔCFI/TLI $\leq$ .010; ΔRMSEA $\leq$ .015). Overall, these results confirm that the model was well-replicated across samples. The invariance of latent means was again marginal in relation to typical guidelines (ΔCFI = -.011; TLI = -.010; ΔRMSEA = +.003), thus we opted to probe these

differences. In these cases, the latent means of the referent group are constrained to zero (for the purposes of identification), while freely estimated in the other groups, thus providing a direct estimation of group-based differences, estimated in SD units. When the means of Sample 1 were constrained to zero, the means of Sample 2 proved to be higher on both HP ($+1.077$, $p < .001$) and OP ($+.857$, $p < .001$). The observed differences could be attributed to the fact that, in Study 2, participants had to indicate an activity that they were passionate about, whereas in Study 1, the activities were provided beforehand.

Table 3.3. Tests of Measurement Invariance for the Final Retained Model Across the Two Studies

Model	Invariant parameters[a]	χ^2	df	CFI	TLI	RMSEA	90% CI	Comparison model
Model S1	-	1783.921	83	.952	.924	.072	.069-.075	—
Model S2	1	1927.579	103	.949	.935	.067	.064-.069	S1
Model S3	1,3	2305.691	115	.939	.930	.069	.067-.072	S1, S2
Model S4	1,4	1988.518	106	.947	.934	.067	.064-.069	S1, S2
Model S5	1,2	2317.501	113	.938	.928	.070	.068-.082	S1, S2
Model S5p	1,2	2250.253	112	.940	.930	.069	.067-.072	S1, S2
Model S6	1,3,4	2403.082	118	.936	.929	.070	.067-.072	S1, S2, S3, S4
Model S7	1,2,3	2640.170	124	.930	.925	.071	.069-.074	S1, S2, S3, S5
Model S8	1,2,4	2309.357	115	.939	.930	.069	.067-.072	S1, S2, S4, S5
Model S9	1,2,3,4	2738.334	127	.927	.924	.072	.070-.074	S1-S8
Model S10	1,2,5	2651.469	114	.929	.918	.075	.072-.077	S1, S2, S5
Model S11	1,2,3,5	3048.584	126	.918	.914	.076	.074-.079	S1, S1, S3, S5, S7, S10
Model S12	1,2,4,5	2719.252	117	.927	.918	.075	.072-.077	S1, S2, S4, S5, S6, S10
Model S13	1,2,3,4,5	3148.212	129	.916	.914	.077	.074-.079	S1-S12

Note. χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; [a]: Parameters that are invariant on that particular level are indicated with a number and are based on the taxonomy of Marsh et al. (2009; see also Morin et al., 2013).; 1: invariant factor loadings; 2: invariant item intercepts; 3: invariant item uniquenesses; 4: invariance factor variances and covariances; 5: invariant latent factor means.

In the following step, we addressed the issue of gender and age effects on the combined sample. Considering gender (Table 3.4) and age (Table 3.5) groups separately, complete invariance (loadings, intercepts, uniquenesses, latent variances-covariances, and latent means) was achieved in both cases as apparent by the small changes in fit indices (ΔCFI/TLI ≤ .010; ΔRMSEA ≤ .015). These results confirm the equivalence of ratings on the Passion Scale and support its use in gender or age groups (when divided into discrete categories).

Table 3.4. Tests of Measurement Invariance for the Final Retained Model Across Gender Groups

Model	Invariant parameters[a]	χ^2	df	CFI	TLI	RMSEA	90% CI	Comparison model
Model G1	-	1851.820	83	.954	.927	.073	.070-.076	—
Model G2	1	1925.055	103	.953	.940	.067	.064-.069	G1
Model G3	1,3	1959.804	115	.952	.945	.063	.061-.066	G1, G2
Model G4	1,4	1945.835	106	.953	.941	.066	.063-.069	G1, G2
Model G5	1,2	2047.581	113	.950	.942	.066	.063-.068	G1, G2
Model G6	1,3,4	1985.973	118	.952	.946	.063	.061-.066	G1, G2, G3, G4
Model G7	1,2,3	2080.482	125	.950	.947	.063	.060-.065	G1, G2, G3, G5
Model G8	1,2,4	2067.585	116	.950	.943	.065	.063-.067	G1, G2, G4, G5
Model G9	1,2,3,4	2106.087	128	.949	.947	.062	.060-.065	G1-G8
Model G10	1,2,5	2070.241	115	.950	.942	.065	.063-.068	G1, G2, G5
Model G11	1,2,3,5	2102.791	127	.949	.947	.063	.060-.065	G1, G1, G3, G5, G7, G10
Model G12	1,2,4,5	2089.606	118	.949	.943	.065	.062-.067	G1, G2, G4, G5, G6, G10
Model G13	1,2,3,4,5	2127.695	130	.948	.948	.062	.060-.064	G1-G12

Note. Note. χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; [a]: Parameters that are invariant on that particular level are indicated with a number and are based on the taxonomy of Marsh et al. (2009; see also Morin et al., 2013).; 1: invariant factor loadings; 2: invariant item intercepts; 3: invariant item uniquenesses; 4: invariance factor variances and covariances; 5: invariant latent factor means.

Table 3.5. Tests of Measurement Invariance for the Final Retained Model Across Age Groups

Model	Invariant parameters[a]	χ^2	df	CFI	TLI	RMSEA	90% CI	Comparison model
Model A1	-	1846.501	126	.956	.930	.072	.069-.075	—
Model A2	1	2022.130	166	.952	.943	.065	.062-.067	A1
Model A3	1,3	2112.481	190	.951	.948	.062	.059-.064	A1, A2
Model A4	1,4	2043.195	172	.952	.945	.064	.062-.066	A1, A2
Model A5	1,2	2407.249	186	.943	.939	.067	.065-.069	A1, A2
Model A6	1,3,4	2132.086	196	.950	.950	.061	.059-.063	A1, A2, A3, A4
Model A7	1,2,3	2500.966	210	.941	.944	.064	.062-.066	A1, A2, A3, A5
Model A8	1,2,4	2427.903	192	.942	.941	.066	.064-.069	A1, A2, A4, A5
Model A9	1,2,3,4	2520.412	216	.941	.946	.063	.061-.066	A1-A8
Model A10	1,2,5	2452.164	190	.942	.939	.067	.065-.069	A1, A2, A5
Model A11	1,2,3,5	2546.055	214	.940	.945	.064	.062-.066	A1, A1, A3, A5, A7, A10
Model A12	1,2,4,5	2473.565	196	.941	.941	.066	.064-.068	A1, A2, A4, A5, A6, A10
Model A13	1,2,3,4,5	2566.222	220	.940	.946	.063	.061-.066	A1-A12

Note. χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; [a]: Parameters that are invariant on that particular level are indicated with a number and are based on the taxonomy of Marsh et al. (2009; see also Morin et al., 2013).; 1: invariant factor loadings; 2: invariant item intercepts; 3: invariant item uniquenesses; 4: invariance factor variances and covariances; 5: invariant latent factor means.

In the next step, we performed the same analytic sequence with the interaction of gender and age groups ($3 \times 2 = 6$ groups). Again, we only interpret the key elements of the taxonomy (see Table 3.6). Both the configural (Model GA1 in Table 3.6) and the weak (Model GA2 in Table 3.6) invariance models were satisfactory in terms of model fit and relative change in fit. Next, strong invariance (Model GA5 in Table 3.6) was tested which was not achieved (ΔCFI = -.012; TLI = -.005; ΔRMSEA = +.003), potentially suggesting differential item functioning. Again, partial invariance models were pursued and the equivalence constraint of a single item (HP8) was freed in all groups. This relaxation led to acceptable changes (ΔCFI = -.008; TLI = -.002; ΔRMSEA = +.001) when comparing the strong and weak models. The remaining models of strict (Model GA7), latent-variance-covariance (Model GA9), and latent means (Model GA13) invariance (ΔCFI/TLI $\leq$ .010; ΔRMSEA $\leq$ .015). Overall, these results further confirm invariance of measurements by gender and age groups.

Table 3.6. Tests of Measurement Invariance for the Final Retained Model Across Gender × Age Groups

Model	Invariant parameters[a]	χ^2	df	CFI	TLI	RMSEA	90% CI	Comparison model
Model GA1	-	2001.350	255	.955	.931	.072	.069-.075	—
Model GA2	1	2287.762	355	.951	.945	.064	.062-.067	GA1
Model GA3	1,3	2491.000	415	.947	.949	.061	.059-.064	GA1, GA2
Model GA4	1,4	2333.175	370	.950	.946	.063	.061-.066	GA1, GA2
Model GA5	1,2	2807.866	405	.938	.940	.067	.065-.069	GA1, GA2
Model GA5p	1,2	2634.707	400	.943	.943	.065	.063-.067	GA1, GA2
Model GA6	1,3,4	2541.553	430	.946	.950	.061	.059-.063	GA1, GA2, GA3, GA4
Model GA7	1,2,3	2842.933	460	.939	.947	.062	.060-.065	GA1, GA2, GA3, GA5
Model GA8	1,2,4	2679.594	415	.942	.945	.064	.062-.066	GA1, GA2, GA4, GA5
Model GA9	1,2,3,4	2893.297	475	.938	.948	.062	.060-.064	GA1-GA8
Model GA10	1,2,5	2699.002	410	.941	.943	.065	.063-.067	GA1, GA2, GA5
Model GA11	1,2,3,5	2906.761	470	.938	.947	.063	.060-.065	GA1, GA1, GA3, GA5, GA7, GA10
Model GA12	1,2,4,5	2743.220	425	.941	.945	.064	.062-.066	GA1, GA2, GA4, GA5, GA6, GA10
Model GA13	1,2,3,4,5	2955.778	485	.937	.948	.062	.060-.064	GA1-GA12

Note. χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; [a]: Parameters that are invariant on that particular level are indicated with a number and are based on the taxonomy of Marsh et al. (2009; see also Morin et al., 2013).; 1: invariant factor loadings; 2: invariant item intercepts; 3: invariant item uniquenesses; 4: invariance factor variances and covariances; 5: invariant latent factor means.

Differential Item Functioning

Although tests of measurement invariance provide a rigorous method for testing, it is less practical for continuous variables such as age. Therefore, we incorporated the linear and quadratic age effects in the final invariance model (Model GA13) and contrasted three competing models. The null model (MM1 in Table 3.7) provided good fit to the data, but the saturated model (MM2 in Table 3.7) showed a substantial improvement in model fit relative to the null model (ΔCFI = +.014; TLI = -.003; ΔRMSEA = +.001), indicating that age has an effect on the responses to the Passion Scale. However, the factors-only model (MM3 in Table 4)—where the relations from the predictors to the factors were freely estimated, but not to the items—resulted in a marginal decreased fit (ΔCFI = -.013; TLI = +.001; ΔRMSEA = -.001), suggesting that the age effects cannot be fully explained by the effects on the latent variable and that at least some item responses are affected by it. Although TLI and RMSEA have greater relevance in model comparisons due to the incorporation of correction for parsimony, we investigated DIF through modification indices which suggested that DIF is most likely associated with HP8 (the same item that was identified in measurement invariance). Allowing the direct effects from the predictors to this item resulted in comparable fit to the saturated model (ΔCFI = -.008; TLI = +.005; ΔRMSEA = -.002).

Table 3.7. MIMIC and Hybrid Multigroup-MIMIC Models

Model	Description	χ^2	df	CFI	TLI	RMSEA	90% CI	Comparison model
Standard MIMIC model								
MM1.	null	2697.062	178	.939	.938	.060	.058-.062	—
MM2.	saturated	2065.325	130	.953	.935	.061	.059-.063	MM1
MM3.	factors-only	2633.681	170	.940	.936	.060	.059-.062	MM2
MM3p.	partial factors-only	2439.893	166	.945	.940	.059	.057-.061	MM2
Hybrid Multigroup and MIMIC model								
HY1.	null	3345.094	629	.934	.943	.057	.055-.059	—
HY2.	saturated	2641.023	485	.948	.942	.058	.056-.060	HY1
HY3.	factors-only	3257.657	605	.936	.943	.057	.056-.059	HY2
HY4p.	partial factors-only	3191.998	593	.937	.943	.057	.056-.059	HY2
HY5.	invariant DIF	3230.725	603	.936	.943	.057	.055-.059	HY4p
HY6.	invariant factors-only	3274.683	623	.936	.944	.057	.055-.059	HY5

Note. MIMIC: Multiple indicators multiple causes model; χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; DIF = differential item functioning.

The Hybrid Model of the Multigroup and MIMIC Models

So far, we have seen that the two different methods with which DIF could be identified converge to the same result, supporting their cross-validation. However, as with the multigroup analyses in relation to information loss (as discussed above), there are inherent disadvantages of the MIMIC approach as it rests on the assumption of strict measurement invariance. Moreover, it lacks the ability to test the invariance of other parameters of a model (i.e., factor loadings or uniquenesses). Therefore, to address the shortcomings of both methods, on the basis of Marsh, Nagengast, et al. (2013), we combine these approaches into a single hybrid model by adding the linear and quadratic MIMIC age effects (MM3p of Table 3.7) to the final six-group model (Model GA13 of Table 3.6).

As the first step, we estimated a null model (see HY1 in Table 3.7) which will serve as a baseline comparison. This null model, similar to the standard MIMIC one, posited that there are no MIMIC age effects. This model had adequate fit. The second, saturated model (HY2 in Table 3.7) had paths from the predictors to the items freely estimated. The comparison of these models reveals whether information was lost in forming discrete age categories instead of using it as a continuous variable. The differences between the two models were negligible with the parsimony-corrected indices remaining stable over the two models (ΔTLI = -.001; ΔRMSEA = +.001), suggesting that the MIMIC model does not contribute much beyond the multigroup model with discrete categories.

Next, we only included the direct age and age^2 effects on the latent means (HY3 in Table 3.7). We then added the direct path from the predictors to the item identified in the MIMIC model (HY4p in Table 3.7) and evaluated whether these were invariant across the six groups (HY5 in Table 3.7). The changes in fit indices again remained stable, indicating the equivalence of these paths across the different combinations of gender $\times$ age. In the final model, we constrained the age and age^2 effects to be equal in all groups. Once again, relative changes in fit indices were stable, suggesting that the generalizability of the relations between age, age^2, HP and OP across gender and age groups. These results revealed that, while age does not have an effect on HP (age: $\beta = .005$, $p = .067$; age^2: $\beta = .002$, $p = .213$), OP shows a slight and linear decrease (age: $\beta = -.006$, $p < .050$) with a small nonlinear component (age: $\beta = .004$, $p < .050$) also being significant. Finally, HP8 showed a slight linear increase ($\beta = .014$, $p < .001$) with a negative nonlinear component ($\beta = -.009$, $p < .001$). The final hybrid model is presented in Figure 3.2.

Figure 3.2. The final hybrid model
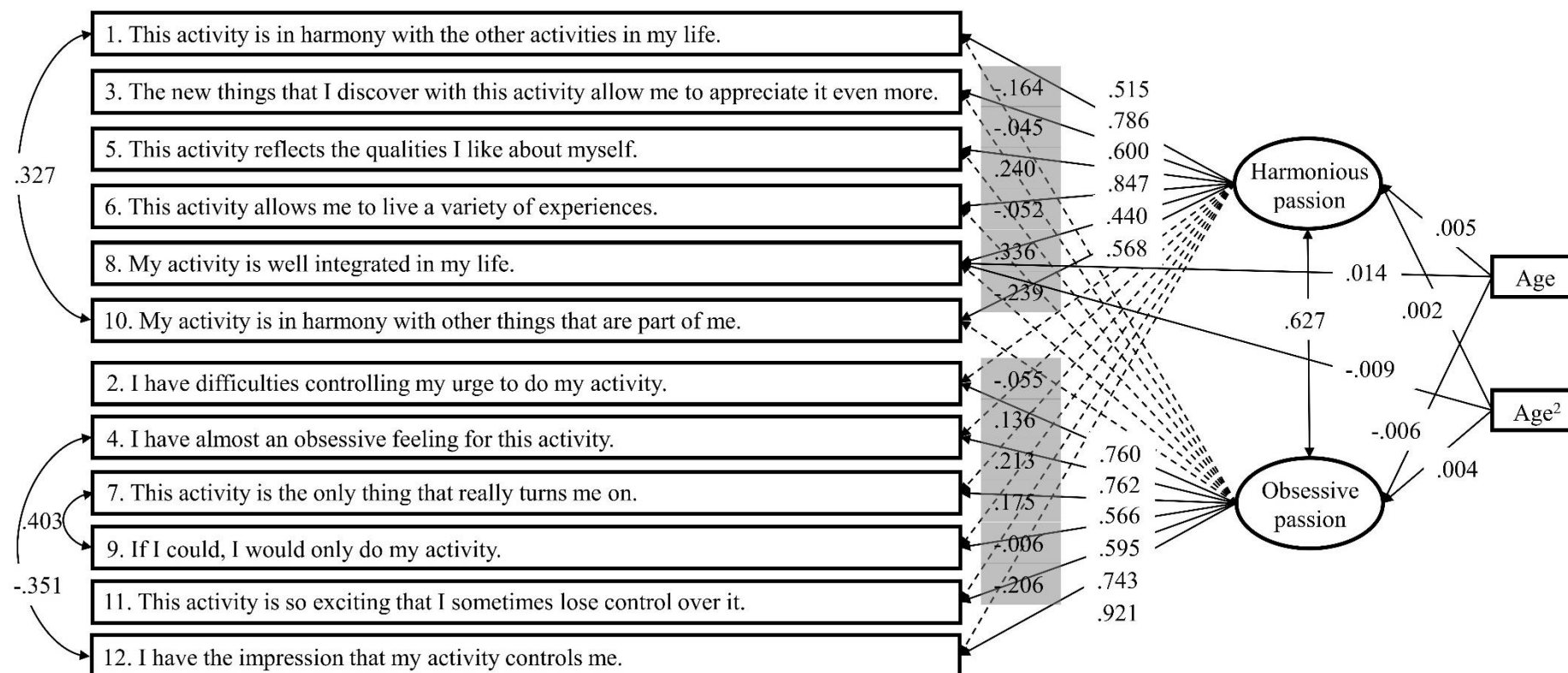
Note. In the case of factor loadings, loadings with full arrows and white background indicate target loadings, whereas number with dashed arrows and gray background indicate cross-loadings. One-headed arrows represent regression paths, two-headed arrows represent correlations. All parameters are standardized and invariant across the six groups.

Discussion

The purpose of the present investigation was to illustrate the applicability of the novel ESEM framework on the Passion Scale—the only instrument designed specifically to measure passion—with two independent samples. Our research fits well with the increasing amount of research on ESEM (for an overview, see Marsh et al., 2014) in that the comparison of alternative solutions revealed that ESEM substantially fit the data better than its traditional CFA counterpart and subsequently resulted in a more realistic representation. We also successfully extended the basic ESEM model with tests of measurement invariance, differential item functioning, and a hybrid model incorporating the two approaches to illustrate its flexibility of this sound framework. We now address in turn each of our results and their implications.

As argued in the introduction and demonstrated in this research, CFA might often be considered insufficient as a result of the overly restrictive assumption that items should only load on their corresponding factors, but not on other, conceptually-relevant ones. On the basis of previous studies in the field of SDT (e.g., Howard et al., 2018; Litalien et al., 2017) and specially in relation to passion (e.g., Marsh, Vallerand, et al., 2013; Schellenberg et al., 2014), ESEM was expected to overcome the limitations related to the overly restrictive CFA both in terms of unsatisfactory goodness-of-fit and inflated factor correlations (e.g., Maïano, Morin, Lanfranchi, & Therme, 2013; Perera, 2015). Our findings on both samples corroborated these expectations. Furthermore, several non-zero cross-loadings were observed that, when remain unexpressed, could undermine the measurement model (as it did so in the CFA solution). However, none of these cross-loadings were large enough to undermine the definitions of the factors. There were items that loaded positively on their respective factors, while negatively on the opposing one (e.g., HP1, HP6, OP2, or OP12) which could be attributed to the fact that although all measure passion for a certain activity, they tap into specific aspects that are unique to either HP or OP. This is justifiable both from the perspective of theory and the wording of the items; moreover, similar phenomena have been described in research on self-concept (Arens & Morin, 2016) or academic motivations (Guay et al., 2015; Tóth-Király, Orosz, et al., 2017). It is also important and, at the same time, interesting to note that HP5 and HP8 had positive cross-loadings on OP. One possible explanation could be that these items are not capturing the unique aspects of either HP or OP, but rather these are more general, reflecting on the identity component of passion itself. For instance, if one has an OP for gaming, this activity could still be "well integrated in his/her life (HP8)". Finally,

it has to be noted that three CUs were included in the final measurement models that largely correspond with previous studies (Marsh, Vallerand, et al., 2013; Schellenberg et al., 2014; Zhao et al., 2015). The first two pairs are likely a result of parallel wording between the items (i.e., exclusive place of the activity and in harmony of other aspects). As for the third one which appears to be specific to this study. One possibility might be that, in Hungary, having an obsessive feeling for an activity is not necessarily considered bad or negative. Still, the examination of cultural effects was outside the scope of this investigation. Nevertheless, the necessity of three CUs for a two-factor scale with 12 items suggest that there might be some issues with the instrument which might warrant a thorough item-level re-examination. These results indicate that passion researchers may consider the possibility of slightly adjusting the wording of these four items of the OP scale and the other two of the HP scale with different synonyms of the relevant words for these to better fit the underlying theoretical background. Ideally, design thinking or A/B testing (Ries, 2011) of alternative synonyms could be tested on smaller samples as this method has already been fruitfully applied in the construction and improvement of social psychological interventions (Yeager et al., 2016). This step could positively contribute to the more precise measurement of the Dualistic Model of Passion.

At a more practical level, the present investigation also demonstrated the applicability of ESEM when one wants to explore latent mean differences, with the first option being tests of measurement invariance. A particular strength of this approach, as demonstrated, is the possibility to test a wide range of invariance tests, especially if based on an extended taxonomy (Marsh et al., 2009). Here, we highlighted this strength by investigating full measurement invariance (i.e., factor loadings, intercepts, uniquenesses, latent variances-covariances, and latent means) across different subsamples based on gender, age, and their combination and found strong support for the equivalence of the Passion Scale in these groups with no substantial latent mean differences. These findings are in line with Marsh, Vallerand, et al. (2013) who also had high levels of invariance across gender and language groups as well as that of Chamarro et al. (2015). However, one limitation of this statistical approach is that items need to be transformed into a smaller number of categories which is particularly problematic for continuous variables such as age (MacCallum, Zhang, Preacher, & Rucker, 2002).

One potential solution for this issue, and a second option to investigate latent mean differences, is to use a MIMIC model in which continuous variables could be incorporated. It is also more parsimonious relative to the multigroup analyses and can be

performed with a sample of moderate size. Yet, only intercept and latent mean invariance can be tested, without addressing the invariance of the other model parameters. In order to counterbalance the shortcoming of both approaches, a hybrid solution (Marsh et al., 2006; Marsh, Nagengast, et al., 2013) was also explored that combined the MIMIC effects in the multigroup model for a more precise investigation. In the first step, we contrasted the separate multigroup and MIMIC model and these yielded the same results with HP8 appeared to be non-invariant in both cases. However, it has to be noted that the non-invariance of HP8 was only weakly supported. For a more thorough investigation, one should identify non-invariant items via constraining the factor loading and intercept of the first item of each scale and subsequently comparing other items to this referent (Cheung & Rensvold, 1999). The subsequent hybrid combination revealed that the MIMIC part did not contribute much beyond the categorization. Of additional interest, this model also revealed similar results to that of Marsh, Vallerand, et al. (2013) and Chamarro et al. (2015); although to a smaller extent, but age had a negative overall effect on OP with a positive nonlinear component. Our results also generalized across the six groups (gender × age). It might potentially be attributed to the midlife crisis that people could experience around the ages of 40 and 50; in this case, they might realize that they should spend more time with the activities that they are passionate about, which in turn might lead to small increase as one gets older. However, future studies are needed to uncover these potential effects.

All in all, ESEM proved to be an adequate statistical framework for the Passion Scale via the incorporation of EFA and CFA features. The explicit expression of cross-loadings provides a more accurate estimation of the construct in question and as long as these remain relatively small in magnitude, they do not undermine the definition of the factors. One could argue that as ESEM is less restrictive, it always results in improved model fit. However, even if cross-loadings are seldom present in our measurement model, ESEM still results in unbiased parameter estimates in terms of factor correlations (Asparouhov et al., 2015). Our findings also reinforce the notion that scale items are not perfect indicators of their respective target factors, thus CFA and ESEM models should systematically be contrasted to take into account a systematic type of measurement error related to the fallible nature of indicators, which in turn helps in identifying a better representation of the data. In relation to the Passion Scale, there is a certain degree of overlap between the items, suggesting that some of them might not only tap into one aspect of passion, but both, and that HP and OP might not easily be distinguished in and

of themselves, but by the other variables they are associated with. It is also possible that changes could occur between HP and OP as a result of external events (e.g., one might have HP for work, but due to a relationship conflict, [s]he starts to demonstrate signs of OP for work) which might influence the level of HP and OP. Future studies are needed to better understand the nature and the dynamics of HP and OP.

While the ESEM approach is certainly promising, the Bayesian Structural Equation Modeling (BSEM; Asparouhov & Muthén, 2012)—which is similar to ESEM in terms of freely estimating cross-loadings and giving them a small value—recently came under criticism (Stromeyer, Miller, Sriramachandramurthy, & DeMartino, 2015). The first concern of the authors was that introducing cross-loadings should be interpreted as modeling noise that masks poorly constructed items and thus justifies the use of an improper instrument. In the present case, some of these cross-loadings were reasonable and meaningful in direction (i.e., HP items loaded positively on HP, but negatively on OP and vice versa), while others were not, suggesting that some items might need to be revised to more strongly be associated with their target factors. The second, similar concern referred to the fact that cross-loadings should not be theoretically permissible and researchers should create items and instruments that can adequately capture the target construct without being associated with other, non-target ones. While we agree with the authors in that items should be as precisely constructed as possible and researchers should strive to achieve this precision, completely pure items are rarely present in social sciences. However, if cross-loadings are to be completely disregarded, then EFA—which serves as a basis for ESEM—should also be neglected. Moreover, as Asparouhov et al. (2015) pointed out, even carefully constructed indicators are likely to present at least some degree of true score associations with non-target constructs. The third and final concern pertained to the fact that cross-loadings that are minimal (i.e., close to zero) should not be included in a measurement model as these only artificially reduce the correlations between the factors. Instead, when multicollinearity is present, a bifactor solution (Reise, 2012) should be pursued which might be able to explain the high associations between the factors. This issue could easily be tested with the recently introduced bifactor-ESEM framework (Morin, Arens, et al., 2016; Morin, Arens, Tran, & Caci, 2016) and already been successfully used (e.g., Fadda, Scalas, Meleddu, & Morin, 2017; Litalien et al., 2017; Tóth-Király, Morin, et al., 2018) in investigating the two sources of construct-relevant psychometric multidimensionality referring to the presence of conceptually-

related and global/specific constructs[8]. Overall, while we believe that ESEM should not be used to hide or "partially mend" poor indicators, this framework could still provide a more realistic representation of the constructs at hand.

Although we were able to illustrate the applicability and richness of the ESEM framework with two independent samples, there are some limitations that need to be addressed. Our data was based on cross-sectional and self-reported questionnaires that could be influenced by bias. The findings about small changes in OP could be complemented by longitudinal settings to examine the temporal changes in HP and OP and to investigate the potential personality- and social variables that could influence passion among adults and younger respondents as well. While we conducted a DIF test, we have to note that scale indeterminacy (Cheong & Kamata, 2013; Wang, 2004) might have caused an issue in the interpretation of the findings. Future studies should aim to circumvent these issues with more advanced and sophisticated methods. For instance, the recently developed moderated nonlinear factor analysis (MNLFA; Bauer, 2017) combines the strengths and advantages of the multigroup and MIMIC approaches and could be used in future statistical research. Regarding the Passion Scale itself, while it is a short, two-factor instrument, the inclusion of three CUs suggests the scale and the items might need to be thoroughly investigated and potentially improved upon. Regarding the ESEM framework, a relatively large number of parameters need to be estimated, thus smaller sample sizes could lead to decreased precision in model estimation. The current operationalization of ESEM also prevents its direct inclusion in more complex, predictive, or hierarchical models. However, using the ESEM-within-CFA method (Morin et al., 2013), one could easily transform the ESEM solution into the standard CFA framework and could perform the analyses mentioned above. For the present illustration of the ESEM framework, we only used the Passion Scale; other scales may function differently depending on their various properties such as length, the number of items, the number of items per factor or the correlations between the factors (for more examples, see Marsh et al., 2014). As the cut-off values for the fit indices originate from studies with CFA and the basic maximum likelihood estimation, future simulation studies are needed to investigate the functioning of these cut-off values with ESEM and different estimators.

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[8] Separate (unreported) analyses were performed to investigate the presence of the global/specific source of multidimensionality of the Passion Scale. However, the results did not support the need to incorporate a global factor as was apparent by the worse fit indices and the less-defined factors by their respective factor loadings.

Notwithstanding these limitations, this investigation showed that ESEM as a synergy of EFA and CFA is effective in the psychometric examination of multidimensional instruments and it can also be complemented with or transformed into other modeling approaches. Generally, when one suspects the presence of multidimensionality stemming from the assessment of conceptually-related construct (Morin, Arens, et al., 2016), then it is possible that the restrictive assumption of CFA is violated, and a comparison of CFA and ESEM models should be performed. Moreover, the latter is preferred if it has better goodness-of-fit, well-defined factors by their target loadings, and meaningfully reduced factor correlations. However, if the psychometric properties are the same in the CFA solution, then that model is preferable as it is more parsimonious. Nevertheless, we believe that ESEM could be a viable and flexible alternative to CFA and, as we demonstrated, could further be fruitfully extended to address substantially important issues.

Chapter 4: A New Look on the Representation and Criterion Validity of Need Fulfillment: Application of the Bifactor Exploratory Structural Equation Modeling Framework (Study 2)[9]

Note. The article has been accepted for publication and the final pre-published version is presented in this thesis. The final published version as well as the online supplementary materials can be download from the publisher's website (https://link.springer.com/article/10.1007/s10902-018-0015-y).

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Preface

Study 1 reported the psychometric examination of the Passion Scale in great detail, given that no prior instruments were available in Hungarian that one could use in subsequent studies. Study 2 presented here had a similar goal as the assessment of need fulfillment is particularly interesting: for a relatively long time, studies mostly focused on need satisfaction and used the Basic Psychological Need Satisfaction Scale (Deci & Ryan, 2000; Gagné, 2003). However, this instrument came under criticism due to its unsatisfactory psychometric properties and various other issues being associated with it (Johnston & Finney, 2010; Sheldon & Hilpert, 2012). At the same time, SDT began to recognize the importance of formally distinguishing need satisfaction from need frustration. These two events resulted in an international collaboration and the development of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015). This new instrument was not only translated to Dutch, Chinese, English, and Spanish, but was also recently adapted to Hungarian (Tóth-Király, Morin, et al., 2018), making it suitable for the present dissertation.

Despite the promising results of Tóth-Király, Morin et al. (2018), it was only one study that provided an improved representation of need fulfillment by incorporating both need satisfaction and need frustration. The replicability of their findings needs to be further tested which was the goal of the present study. In addition, Tóth-Király, Morin, et al. (2018) also failed to investigate the criterion-related validity of the improved need fulfillment representation which is of major importance for establishing the interpretation of the factors. To rectify this issue, the present study sought to re-investigate this recently proposed representation and also tested the interpretation of the factors in relation to theoretically-relevant indicators of wellbeing, namely positive affect and negative affect.

Abstract

The present study re-investigated whether need satisfaction and frustration are better represented as two opposite ends of the same continuum or two distinct constructs through the application of the bifactor exploratory structural equation modeling (bifactor-ESEM) framework. Also, the criterion-related validity of the final representation was tested in relation to indicators of wellbeing. Using a sample of 774 participants (501 females, M_{age} = 27.86, SD_{age} = 9.52), several alternative models were contrasted. The results supported the multidimensional bifactor-ESEM representation including one global factor of need fulfillment and the six specific factors being the combination of satisfaction and frustration with autonomy, competence, and relatedness. Most items tapped into meaningful specificity once the global factor was accounted for. Finally, the global factor was substantially and positively related to positive affect and negatively to negative affect. Competence satisfaction further predicted positive affect, while competence and relatedness frustration predicted negative affect.

Keywords: bifactor exploratory structural equation modeling (bifactor ESEM); need fulfillment; need satisfaction and frustration; positive and negative affect; self-determination theory (SDT); wellbeing

Introduction

Self-Determination Theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2017) is an organismic macro-theory of human motivation, personality, and development. One of its central tenets proposes that humans have a basic tendency toward growth and development which is necessary for optimal functioning. It is also posited that growth and wellbeing are intimately linked to the satisfaction of three basic psychological needs of autonomy, competence, and relatedness. While previous need conceptualizations emphasized the differentiation of need satisfaction and need frustration (e.g., Krijgsman et al., 2017; Vansteenkiste & Ryan, 2013), a more recent investigation (Tóth-Király, Morin, et al., 2018) provided initial support for the need fulfillment hypothesis; that is, apart from the six specific factors (satisfaction and frustration × autonomy, competence, and relatedness), on the global level, need satisfaction and need frustration are better represented by an underlying continuum of need fulfillment (with satisfaction and frustration being at the opposite extremes) as opposed to being two distinct dimensions (i.e., their levels do not vary independently from one another within the same person). However, despite the promising findings, more studies should be conducted to test the criterion-related validity of this improved representation which, at the same time, could provide a more precise definition of the factors. Thus, the present study sought to test alternative representations of need fulfillment and to investigate the criterion-related validity of the most appropriate representation in relation to outcomes of wellbeing.

The Theory of Basic Psychological Needs

SDT rests on the assumption that basic psychological needs are nutrients that are necessary and essential conditions for growth, health, and integrity (Deci & Ryan, 2000). More specifically, the three needs are autonomy (i.e., the experience of choice, volition, and personal control), competence (i.e., the experience of effectiveness, mastery, and a sense of accomplishment) and relatedness (i.e., the experience of closeness, reciprocal care, and connection with others). The application of these needs has been considered universal, and their satisfaction have been associated with relevant outcomes in several different life domains, including work (Deci et al., 2001), education (Cox & Williams, 2008) or sport (Adie, Duda, & Ntoumanis, 2008). Within these domains, the fulfillment of the three needs was positively associated with indicators of wellbeing and optimal functioning such as vitality, positive affect, effort, intrinsic motivation, job performance, and better sleep quality, and was negatively associated with indicators of ill-being and

maladaptive functioning such as depression, negative affect, somatization, anxiety, daytime dysfunction, burnout, turnover intentions, and problematic online behaviors (Baard, Deci, & Ryan, 2004; Campbell et al., 2015; Chen et al., 2015; Cordeiro, Paixão, Lens, Lacante, & Luyckx, 2016; Gillet et al., 2017; Gunnell, Crocker, Mack, Wilson, & Zumbo, 2014; Krijgsman et al., 2017; Landry et al., 2016; Schultz, Ryan, Niemiec, Legate, & Williams, 2015). These findings were valid in cases when need fulfillment was measured as a global construct (e.g., Chen et al., 2015; Gillet et al., 2017) and even when the three needs were separately measured (e.g., Costa, Gugliandolo, Barberis, & Larcan, 2016; Landry et al., 2016), suggesting that all three are important from the perspective of outcomes such as wellbeing.

Within SDT literature, there is an ongoing discussion about the dimensionality and representation of basic psychological needs. With the recent empirical differentiation of need satisfaction and need frustration (Vansteenkiste & Ryan, 2013), some researchers have argued that need frustration goes beyond the lack of satisfaction and is directly influenced by the need thwarting environment, suggesting that the two dimensions should be considered distinct. Subsequent psychometric investigations (e.g., Chen et al., 2015; Cordeiro et al., 2016) initially supported a six-factor representation (satisfaction and frustration × autonomy, competence, and relatedness), while others (e.g., Campbell et al., 2017; Krijgsman et al., 2017) relied on the incorporation of general need satisfaction and frustration dimensions as well. However, one limitation of these representations is that they did not simultaneously take into account the presence of construct-relevant psychometric multidimensionality that is often present in the case of multidimensional constructs.

The Bifactor Exploratory Structural Equation Modeling Framework

One limitation of the studies mentioned above is that they failed to take into account two potential sources of construct-relevant multidimensionality that is expected to be present in the data and that, when not explicitly accounted for, could result in biased estimates and erroneous conclusions (Morin, Arens, et al. 2016; Morin, Arens, Tran, et al., 2016). Typically, confirmatory factor analysis (CFA) has been the most commonly used approach to examine the representation of different psychological constructs. However, an important limitation of CFA is rooted in its independent cluster assumption; that is, scale indicators reflect scores on a single factor only. This assumption was shown

to be unrealistic and overly strict for instruments measuring complex multidimensional constructs (Marsh et al., 2014).

The first source of construct-relevant multidimensionality refers to the assessment of conceptually-related constructs. This source stems from the fact that scale indicators are naturally fallible in psychological research and are often associated with other conceptually-related non-target constructs over and above their target factors. For instance, levels of competence satisfaction may influence responses to items measuring one's level of competence frustration. CFA forces these meaningful associations to zero, resulting in biased estimates (i.e., substantially increased factor correlations) and erroneous conclusions (Marsh et al., 2014). When one is suspect of this source of multidimensionality, exploratory structural equation modeling (ESEM; Asparouhov & Muthén, 2009; Marsh et al., 2014) could be used as an alternative to CFA as ESEM allows the expression of association between indicators and the conceptually-related non-target construct in the form of cross-loadings. Review of statistical evidence also highlighted that even small cross-loadings need to be expressed to avoid biased measurement models and parameter estimates (Asparouhov et al., 2015). The added value of ESEM has already been highlighted in previous studies inside (e.g., Guay et al., 2015; Litalien et al., 2015; Tóth-Király, Orosz, et al., 2017) and outside (e.g., Arens & Morin, 2016; Neff et al., 2018; Tóth-Király, Bőthe, et al., 2017) the field of SDT.

The second source of construct-relevant multidimensionality refers to the hypothesized co-existence of global (need satisfaction/frustration) and specific constructs (autonomy, competence, and relatedness). This source has typically been investigated in the form of higher-order models where indicators are associated with first-order factors which themselves are associated with higher-order factors. More precisely, higher-order models assume that the associations between the indicators and the higher-order factors are indirect and fully mediated by the first-order factors. In addition, higher-order models also assume that the ratio of variance explained by the global versus specific factors is forced to be the same for all items related to the specific first-order factor (Gignac, 2016; Reise, 2012). As argued, however, this assumption is extremely stringent and is rarely verified (Gignac, 2016; Morin et al., 2016a). Conversely, bifactor modeling approaches have been suggested as viable alternatives as these models are not constrained by this unrealistic assumption (Reise, 2012; Rodriguez et al., 2016). With bifactor models, a general/global construct (i.e., a G-factor underlying responses to all items) and specific constructs (i.e., S-factors providing specificities not accounted for by the G-factor) are

extracted at the same time which are orthogonal to one another, facilitating interpretation. Previous studies of bifactor modeling have demonstrated its value in relation to need satisfaction (Brunet, Gunnel, Teixeira, Sabiston, & Bélanger, 2016), need frustration (Myers, Martin, Ntoumanis, Celimli, & Bartholomew, 2014), and motivations (Gunnel & Gaudreau, 2015) in that, when hypothesized, one should consider the global and specific factors.

As an integrative approach, the bifactor-ESEM framework (Morin, Arens, et al., 2016; Morin, Arens, Tran, et al., 2016) has been proposed that accounts for both relevant sources of psychometric multidimensionality. While there are only a few studies that applied the bifactor-ESEM framework inside SDT (Howard et al., 2018; Litalien et al., 2017), these findings underscored its importance. More specifically, these studies were able to identify a G-factor representing a self-determination continuum pertaining to work and education, respectively, as well as several theoretically and empirically meaningful S-factors that co-exist with the G-factor. Furthermore, all these factors were uniquely related to relevant outcomes (e.g., commitment, vitality or ill-being). Of particular relevance to the present study, Tóth-Király, Morin, et al. (2018) investigated the multidimensionality of need fulfillment and concluded that it is better represented by the co-existence of the six specific factors and an overarching need fulfillment continuum with the latter encompassing need satisfaction and need frustration as the endpoints of the said continuum. Sánchez-Oliva et al. (2017) also identified a global need satisfaction factor, as well as three S-factors, in a work context. Moreover, need satisfaction and the specific factors of autonomy, competence, and relatedness differentially predicted outcomes of burnout and professional efficacy.

The Present Study

The first aim of this study was to provide further investigation of the representation of need fulfillment through the bifactor-ESEM framework to assess its replicability. We contrasted six alternative representations: (1a-b) six-factor CFA and six-factor ESEM; (2a-b) bifactor-CFA and bifactor-ESEM including one G-factor and six S-factors; and (3a-b) bifactor-CFA and bifactor-ESEM including two G-factors and six S-factors. We expected the bifactor ESEM solution (2b) to be superior relative to other alternative solutions. A second aim of this study was to test the criterion-related validity of the final solution to better document its meaningfulness by including variables of wellbeing in the form of positive and negative affect. We expected the need fulfillment

G-factor to be positively and negatively related to positive and negative affect, respectively. However, while we did not have clear a priori expectations about the associations between the S-factors and the correlates, we expected that at least some of them would be related to the outcomes over and above the G-factor.

Methods

Procedure and Participants

The study was conducted in accordance with the Declaration of Helsinki and with the approval of the University Research Ethics Committee. Participants were invited via general websites, online forums, and mailing lists to complete an online questionnaire set. They were first informed about the aim of the study and ensured about their anonymity. They had to indicate their willingness to participate by checking a box; otherwise, they were excluded.

The final sample consisted of 774 Hungarian respondents (501 females, 64.7%) who were aged between 18 and 73 ($M = 27.86$, $SD = 9.52$). Participants reported their place of residence as the capital city (43.3%), county capital (13.8%), city (27.0%), and country (15.9%); their level of education as primary (6.6%), secondary (65.1%), and higher (28.3%) and their status of employment as full-time (32.7%), part-time (14.2%), occasional (12.7%), and unemployed (40.4%).

Measures

Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS). To assess need satisfaction and frustration, the BPNSFS was administered (Chen et al., 2015). It is a 24-item measure comprised of six factors (each represented by four items): autonomy satisfaction ($\alpha = .750$; e.g., "I feel that my decisions reflect what I really want.") and frustration ($\alpha = .677$; e.g., "Most of the things I do feel like 'I have to'."), relatedness satisfaction ($\alpha = .807$; e.g., "I feel connected with people who care for me, and for whom I care.") and frustration ($\alpha = .795$; e.g., "I feel that people who are important to me are cold and distant towards me."), and competence satisfaction ($\alpha = .820$; e.g., "I feel capable at what I do.") and frustration ($\alpha = .827$; e.g., "I have serious doubts about whether I can do things well."). Participants rated the items of a five-point scale (1 = not true at all for me; 5 = very true for me). The results of Tóth-Király, Morin, et al. (2018) provided support for the factorial validity, generalizability and the scale score reliability of the Hungarian version.

Positive and Negative Affect Scale (PANAS). To measure hedonic wellbeing, the 10-item Hungarian version (Gyollai, Simor, Köteles, & Demetrovics, 2011) of the PANAS was used (Thompson, 2007; Watson et al., 1988) which is a 10-item scale measuring general dimension of positive (α = .762; e.g., "alert, inspired, determined, attentive, and active") and negative (α = .712; e.g., upset, hostile, ashamed, nervous, and afraid) affect with five items each. Participants were asked to rate the extent to which they experienced each emotion in general (1 = very slightly or not at all; 5 = very much). Previous studies (e.g., Gyollai et al., 2011; Simor et al., 2018) tended to support its reliability and factorial structure.

Statistical Analyses

All analyses were performed in Mplus 8 (Muthén & Muthén, 1998-2017) and models were estimated with the robust maximum likelihood (MLR) estimator as it provides tests of model fit and standard errors that are robust to the non-normality of the data. The analyses were conducted in two phases. In the first phase, six alternative models were tested and compared (Morin, Arens, et al., 2016; Morin, Arens, Tran, et al., 2016; Tóth-Király, Morin, et al., 2018): six-factor first-order CFA and ESEM (Model 1a, 1b), bifactor-CFA and bifactor-ESEM including one G-factor and six S-factors (Model 2a, 2b) and bifactor-CFA and bifactor-ESEM including two G-factors and six S-factors (Model 3a, 3b). Following previous applications (e.g., Morin, Boudrias, Marsh, Madore, & Desrumaux, 2016; Tóth-Király, Bőthe, Rigó, et al., 2017), all models were specified with the target rotation procedure (Browne, 2001). More details are provided in the online supplementary documents about model estimation (see Appendix S2.1). In the second phase, to investigate the criterion-related validity of the retained representation, the latent CFA model of the PANAS was incorporated into the final solution. For additive effects, standardized regression coefficients (β) and the percentage of explained variance (R^2) were compared.

In model evaluation, the following indices were examined: 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). Following common interpretation guidelines (Hu & Bentler, 1999; Marsh et al., 2004, 2005), CFI and TLI were considered acceptable and adequate with values over .90 and .95, respectively, while values below .08 and .06 are indicative of acceptable and good fit for RMSEA. Finally, model-based omega coefficient of composite reliability (ω) was also calculated based on the formula of McDonald (1970)

to investigate the reliability of the final factors. Relative to Cronbach's alpha, this index has the advantage of taking into account the strength of the association between the factors and items and the measurement errors specific to the items (Dunn, Baguley, & Brunsden, 2014; Sijtsma, 2009).

Based on the guidelines of Morin et al. (2016a, 2016b, 2018), selection of the most optimal model should not be based solely on fit indices, but should be coupled with the evaluation of theoretical conformity of the models and the inspection of key parameter estimates (i.e., factor loadings, factor correlations). First, the correlations and the factor loadings of the first-order CFA and ESEM model should be compared. The latter solution should be retained as long as factor definitions are reasonably good and the correlations are reduced compared to the CFA solution, given that ESEM provides more exact parameter estimates (Asparouhov et al., 2015). Second, the retained CFA or ESEM model should be compared to its bifactor counterpart and the bifactor model should be preferred as a final solution when it has a well-defined G-factor and at least some well-defined S-factors. When comparing the different bifactor models with one or two G-factors, it is important to put a special emphasis on the association of the factors and the definition of the two G-factors. If the (1) correlations are too large or (2) the factors are weakly defined by the target factor loadings, then the model with one G-factor should be preferred.

Results

Structural Analyses of Need Fulfillment

Goodness-of-fit indices for the six tested models is presented in Table 4.1. Starting with the comparison the first-order CFA (1a) and ESEM (1b) solutions, while both had adequate fit to the data, the ESEM solution yielded substantially better fit (ΔCFI = +.030; ΔTLI = +.019; ΔRMSEA = -.008). The examination of standardized parameter estimates (see Table S2.1 and Table S2.2 of the supplementary document) associated with each model revealed well-defined factors (CFA: $|\lambda|$ = .266 to .829, M = .695; ESEM: $|\lambda|$ = .297 to .884, M = .583) and reduced inter-factor correlations in the ESEM solution ($|r|$ = .241 to .647, M = .425) compared to the CFA solution ($|r|$ = .401 to .802, M = .588). Additionally, the ESEM solution also highlighted several statistically significant and relatively low cross-loadings ($|\lambda|$ = .001 to .365, M = .078) which indicate that these items tap into more than one source of psychometric multidimensionality. Based on the available theoretical and statistical information, the ESEM solution was retained.

Table 4.1. Goodness-of-Fit Statistics for the Estimated Models on the Basic Psychological Need Satisfaction and Frustration Scale

Model	χ^2	df	CFI	TLI	RMSEA	RMSEA 90% CI
Model 1a. Six-factor CFA	541.647*	237	.949	.941	.041	.036-.045
Model 1b. Six-factor ESEM	273.978*	147	.979	.960	.033	.027-.039
Model 2a. Bifactor CFA (1 G-factor and 6 S-factors)	743.917*	228	.914	.896	.054	.050-.058
Model 2b. Bifactor ESEM (1 G-factor and 6 S-factors)	196.624*	129	.989	.976	.026	.018-.033
Model 3a. Bifactor CFA (2 G-factors and 6 S-factors)	720.609*	227	.918	.900	.053	.049-.057
Model 3b. Bifactor ESEM (2 G-factors and 6 S-factors)	187.986*	122	.989	.975	.026	.019-.034
Model 4. Criterion validity	793.856*	408	.955	.939	.035	.031-.039

Note. CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; B: Bifactor model; χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; *$p < 0.01$.

In the following step, a general need fulfillment factor was incorporated into the ESEM solution (2b) which also revealed substantially better fit relative to the bifactor-CFA with one G-factor (2a, see Table S2.3 of the supplementary documents for the parameter estimates of this model) model (ΔCFI = +.075; ΔTLI = +.080; ΔRMSEA = -.028) and the first-order ESEM model (ΔCFI = +.010; ΔTLI = +.016; ΔRMSEA = -.007). The alternative models including two G-factors (3a, 3b) also had acceptable fit (see Table 4.1). In this case, the examination of parameter estimates could be informative. In the bifactor-CFA solution with two G-factors (3a, see Table S2.4 of the supplementary documents), although the two satisfaction and frustration G-factors were relatively well-defined (satisfaction: $|\lambda| = .404$ to .703, $M = .560$; frustration: $|\lambda| = .140$ to .721, $M = .546$), the association between them was so high that it questions the discriminant validity of the factors ($r = -.880$, $p < .001$). While this correlation was reduced in the bifactor-ESEM model with two G-factors (3b, $r = .348$, $p = .301$), these G-factors were weakly defined by their respective factor loadings (satisfaction: $|\lambda| = .144$ to .681, $M = .328$; frustration: $|\lambda| = .022$ to .451, $M = .190$, see Table S2.5 of the supplementary documents), suggesting that it is not necessary to include a second G-factor and suggest the superiority of the bifactor-ESEM model with one G-factor representing need fulfillment.

This bifactor-ESEM model is also of great theoretical importance due to the fact that it provides a direct estimate of the global need fulfillment dimension. Standardized parameter estimates for this final model, which support the underlying continuum identified by Tóth-Király, Morin, et al. (2018), are reported in Table 4.2. The G-factor was well-defined ($|\lambda| = .141$ to .764, $M = .538$, $\omega = .909$) by all scale items with the positive and the negative items contributing to the same degree. Apart from the G-factor, most S-factor retained a moderate degree of specificity (relatedness satisfaction: $|\lambda| = .389$ to .678, $M = .539$, $\omega = .627$[10]; competence satisfaction: $|\lambda| = .260$ to .579, $M = .409$, $\omega = .449$; autonomy frustration: $|\lambda| = .260$ to .517, $M = .407$, $\omega = .445$; relatedness frustration: $|\lambda| = .366$ to .548, $M = .443$, $\omega = .495$; competence frustration: $|\lambda| = .289$ to .469, $M = .399$, $\omega = .433$) with the exception of the autonomy satisfaction S-factor ($|\lambda| = .007$ to .650, $M = .217$, $\omega = .174$), suggesting that the latter does not tap into any meaningful specificity once the variance explained by the G-factor is accounted for. Finally, the magnitude of the cross-loadings also decreased ($|\lambda| = .000$ to .295, $M = .074$) compared to the first-order ESEM model. Overall, on the basis of better model fit and theoretical representation, the bifactor-ESEM solution was retained for the subsequent analyses.

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[10] In the case of omega indices for the bifactor-ESEM model, it has to be noted that the reliability of the S-factors in this particular model is generally lower than in the case of first-order model. Also, the lower levels of reliability are less problematic due to the use of fully latent variables which are controlled for measurement errors.

Table 4.2. Standardized Parameter Estimates (with Standard Errors in Parentheses) of the Bifactor-ESEM Model Including One G-Factor and Six S-Factors (Model 2b)

	Fu (λ)	A-S (λ)	R-S (λ)	C-S (λ)	A-Fr (λ)	R-Fr (λ)	C-Fr (λ)	δ
Autonomy satisfaction (A-S)								
Item 1	**.497(.042)****	**.106(.155)**	-.048(.047)	.094(.053)	-.162(.057)**	.100(.050)*	.200(.051)**	.345
Item 7	**.725(.041)****	**.103(.180)**	-.070(.044)	-.034(.051)	.101(.053)	.168(.047)**	.162(.043)**	.608
Item 13	**.764(.036)****	**.007(.175)**	-.040(.039)	-.032(.055)	.094(.046)*	.258(.044)**	.158(.050)**	.686
Item 19	**.516(.076)****	**.650(.251)****	.055(.052)	.039(.067)	-.133(.069)	.025(.062)	.026(.067)	.713
Relatedness satisfaction (R-S)								
Item 3	**.435(.038)****	.025(.039)	**.411(.044)****	-.131(.043)**	.007(.049)	-.183(.051)**	-.011(.048)	.410
Item 9	**.447(.033)****	.000(.033)	**.677(.047)****	.010(.034)	-.010(.034)	-.089(.047)	.036(.034)	.668
Item 15	**.488(.033)****	-.029(.030)	**.678(.051)****	.004(.030)	.087(.030)**	-.115(.045)*	.052(.038)	.722
Item 21	**.481(.036)****	.124(.083)	**.389(.053)****	-.002(.052)	-.027(.047)	-.214(.059)**	.115(.064)	.458
Competence satisfaction (C-S)								
Item 5	**.581(.041)****	-.082(.056)	-.041(.033)	**.579(.079)****	.042(.041)	.081(.037)*	-.075(.080)	.695
Item 11	**.583(.034)****	.125(.060)*	.000(.040)	**.380(.049)****	.126(.037)**	.093(.042)*	-.125(.040)**	.540
Item 17	**.643(.039)****	.182(.144)	-.034(.038)	**.260(.055)****	.049(.048)	.030(.043)	-.038(.057)	.521
Item 23	**.590(.035)****	-.010(.084)	-.030(.035)	**.416(.070)****	.037(.047)	.082(.040)*	-.158(.042)**	.555
Autonomy frustration (A-Fr)								
Item 2	**-.141(.042)****	-.027(.063)	-.013(.042)	.083(.049)	**.260(.062)****	.000(.049)	.003(.055)	.095
Item 8	**-.507(.033)****	-.119(.091)	.022(.035)	.078(.038)*	**.517(.067)****	.067(.043)	.005(.044)	.549
Item 14	**-.538(.035)****	.041(.038)	.115(.035)**	.046(.038)	**.429(.059)****	-.015(.050)	.070(.059)	.496
Item 20	**-.492(.038)****	-.194(.075)*	-.031(.042)	.043(.048)	**.421(.055)****	.104(.047)	.056(.053)	.474
Relatedness frustration (R-Fr)								
Item 4	**-.504(.036)****	.010(.067)	-.046(.044)	.045(.045)	.019(.054)	**.433(.066)****	.089(.061)	.454
Item 10	**-.520(.042)****	.067(.045)	-.216(.050)**	.101(.047)*	.047(.043)	**.425(.076)****	.061(.055)	.518
Item 16	**-.533(.036)****	.005(.038)	-.173(.041)**	.056(.035)	.036(.038)	**.548(.067)****	.075(.047)	.625
Item 22	**-.494(.037)****	.049(.046)	-.248(.041)**	.087(.050)	.066(.045)	**.366(.058)****	.050(.051)	.456
Competence frustration (C-Fr)								
Item 6	**-.547(.048)****	.134(.113)	.071(.047)	-.295(.044)**	.053(.041)	.111(.056)*	**.289(.077)****	.508
Item 12	**-.648(.038)****	.055(.060)	.062(.037)	-.056(.044)	.018(.036)	.045(.044)	**.469(.080)****	.651
Item 18	**-.587(.035)****	-.023(.057)	.122(.035)**	-.123(.051)*	-.020(.040)	.082(.045)	**.396(.054)****	.540
Item 24	**-.651(.031)****	.020(.037)	.006(.032)	-.015(.041)	.092(.034)**	.086(.041)*	**.443(.055)****	.637

Note. Fu: Global (G-Factor) representing need fulfillment; S-Factors: Specific factors from the bifactor model; S: Need satisfaction; Fr: Need frustration; A: Need for autonomy; C: Need for competence; R: Need for relatedness; λ: Factor loading; δ: Item uniqueness; Target factor loadings are in bold.; *$p < .05$; **$p < .01$.

Criterion Validity of Need Fulfillment

   Finally, the bifactor-ESEM model was re-expressed with the ESEM-within-CFA (EwC) method (Morin et al., 2013) to investigate the predictive effect of the need fulfillment G-factor and the S-factors on positive and negative affect which were incorporated as latent CFA models[11] (see Table 4.1 Model 4 for goodness-of-fit indices and Table 4.3 for standardized estimates). The results revealed that the need fulfillment G-factor predicted the two outcomes in the reasonable direction when it was the sole predictor. Additionally, when the S-factors were also entered into the predictive model, the proportion of explained variance increased by a substantial amount both for positive affect ($\Delta R^2 = .066$) and negative affect ($\Delta R^2 = .108$). The G-factor's effects remained stable and competence satisfaction predicted positive affect, whereas relatedness and competence frustration predicted negative affect over and above the G-factor (see Figure 4.1 for a schematic overview of the results).

Table 4.3. Relations between the bifactor-ESEM factors and the outcomes of positive and negative affect

	Positive affect		Negative affect	
	G only	G+S	G only	G+S
Need fulfillment	.765(.029)**	.734(.036)**	-.777(.032)**	-.729(.033)**
Autonomy satisfaction		.164(.211)		-.011(.068)
Relatedness satisfaction		.046(.052)		-.086(.059)
Competence satisfaction		.263(.098)**		-.054(.066)
Autonomy frustration		.076(.097)		.124(.065)
Relatedness frustration		.051(.071)		.248(.071)**
Competence frustration		-.079(.132)		.304(.068)**
R^2	.586	.652	.604	.712

Note. Numbers represent standardized regression coefficients with standard errors in parentheses; G-factor: global need fulfillment factor; S-factor: specific need fulfillment factors; R^2: proportion of explained variance.; *$p < .05$; **$p < .01$.

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[11] The fit of the PANAS model was adequate ($\chi^2 = 141.216$, df = 32, $p < .001$; CFI = .930; TLI = .902; RMSEA = .066 [90% CI .055-.078]) and included two correlated uniquenesses between items 3-5 and 2-8. The two factors also showed adequate model-based reliabilities ($\omega_{positive} = .740$; $\omega_{negative} = .696$)

Figure 4.1. Schematic representation of the associations between need fulfillment and indicators of wellbeing
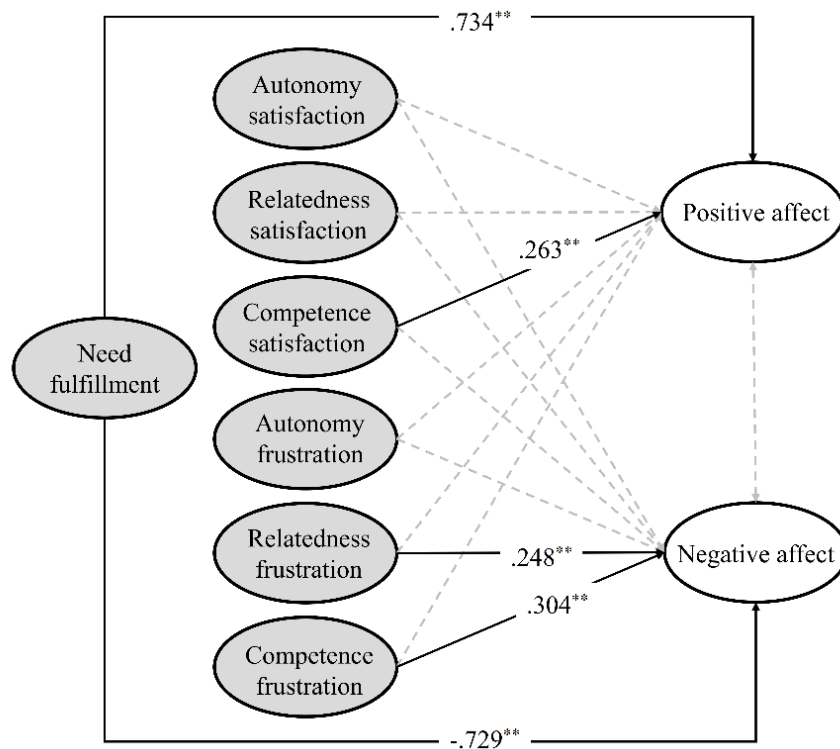
Note. For the sake of simplicity, only latent variables are shown. Variables in grayscale are part of the same bifactor-ESEM model. Need fulfillment was derived from the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015; Tóth-Király, Morin, et al., 2018), while positive and negative affect was derived from the Positive and Negative Affect Scale (Gyollai et al., 2011; Thompson, 2007). One-headed arrows represent regression paths. All parameters are standardized. $*p < .05$, $**p < .01$.

Discussion

The present study—grounded in the well-established SDT (Ryan & Deci, 2017)—re-examined the representation of need fulfillment; that is, whether the satisfaction and frustration of the three basic psychological needs of autonomy, competence, and relatedness are better represented as two extremes of the same underlying continuum or rather as two distinct elements that are related to one another. Our results supported the former hypothesis and replicated the results of Tóth-Király, Morin, et al. (2018). Additionally, we also tested how this representation relates to positive and negative affect as indicators of wellbeing, respectively. While the global level of need fulfillment was a strong predictor of both positive and negative affect, the specific factors also had unique contributions: while competence satisfaction predicted positive affect, relatedness and competence frustration predicted negative affect over and above the G-factor. A number of interesting findings emerged.

Chapter 4: Study 2

First, one of the key findings of the present investigation is that in accordance with the proposition of Tóth-Király, Morin, et al. (2018), the existence of an underlying need fulfillment dimension was further supported by taking into account the two sources of construct-relevant psychometric multidimensionality via the bifactor-ESEM framework (Morin, Arens, et al., 2016; Morin, Arens, Tran, et al., 2016). Both the ESEM and the bifactor-ESEM solutions were superior to their CFA counterparts (both in terms of improved model fit and more precise parameter estimates), suggesting that this statistical method could be used to account for the association between items and non-target conceptually-related factors. Furthermore, a G-factor could also be incorporated into this solution, which in the present case resulted in a well-defined global factor representing the participants' general level of need fulfillment. These findings are in line with previous findings (Brunet et al., 2016; Garn, Morin, & Lonsdale, 2018; Myers et al., 2014; Sánchez-Oliva et al., 2017) where a global need satisfaction or frustration dimension was identified. Moreover, a recent daily diary study also corroborated that need satisfaction and frustration mirror one another (Bidee, Vantilborgh, Pepermans, Griep, & Hofmans, 2016) which also supported the notion of the need fulfillment continuum.

In the field of motivations, the usefulness of the bifactor-ESEM framework was also supported as SDT-based motivations were better represented by a general self-determination factor and specific factors both in the context of work (Howard et al., 2018) and education (Litalien et al., 2018). Indeed, when one suspects the presence of both conceptually-related and hierarchically-ordered constructs, this methodological framework could be suitable such as in the current investigation where apart from the global factor, six co-existing specific factors were also identified. While the alternative models with two general factors representing need satisfaction and frustration also had satisfactory fit to the data, the examination of parameter estimates revealed that these are not adequate alternatives and the two G-factors do not vary independently from one another within the same individual. At the same time, these results reinforce that key parameter estimates should also be examined as well as the model fit and theoretical conformity of the proposed model as suggested by Morin, Arens, et al. (2016) and Morin, Arens, Tran, et al. (2016).

Additionally, apart from the G-factor, several S-factors were extracted, representing the combination of need satisfaction and frustration with the basic psychological needs of autonomy, competence, and relatedness. Almost all S-factors were well-defined once the G-factor was extracted, suggesting that each tap into

meaningful and unique specificity over and above the G-factor. For instance, the relatedness satisfaction S-factor taps into the participants' satisfaction with their relationships with other with the global level of need fulfillment being removed. In contrast, the autonomy satisfaction S-factor, which was also less reliable for Sánchez-Oliva et al. (2017), appeared to retain almost no meaningful specificity with the presence of the G-factor. This finding does not mean that these items (and factor) are redundant and do not tap into a key component of need fulfillment. Rather, it simply suggests that these items only reflect participants' global need fulfillment with no specific variance being left once the global level of need fulfillment is accounted for. This result is in line with Fadda et al. (2017) where not all wellbeing factors retained a high degree of specificity after the global level of eudaimonic wellbeing was taken into account. Finally, one has to remember that the S-factors of a first-order model are interpreted differently than the S-factors in the bifactor-ESEM model (see Litalien et al., 2017), thus both the global and specific components should be interpreted in relation to correlates and other variables of interest.

Findings related to the investigation of criterion validity, similar to Howard et al. (2018) and Litalien et al., (2017), also supported the importance of considering both the G- and S-factors as apparent by the regression coefficients and higher proportion of explained variance in said covariates. Results suggested that respondents' positive and negative affect was greatly predicted by their overall level of need fulfillment; more precisely, whereas need fulfillment was positively associated with more frequent experiences of positive affect, it was negatively related to the frequency of negative affect. This is in line with the assertion of SDT in that global need fulfillment is associated with increased wellbeing and decreased ill-being (Ryan & Deci, 2017).

Once the effect of this global need fulfillment factor was considered, the specific factors added to these predictions: competence satisfaction was related to positive affect, indicating that experiencing mastery, effectiveness, and a sense of accomplishment during everyday tasks and exercises could further increase hedonic wellbeing (as measured by the PANAS). In the context of work, apart from the G-factor, the competence satisfaction S-factor was also a unique contributor to the outcomes of professional efficacy and depersonalization (Sánchez-Oliva et al., 2017). In a similar vein, when examined separately in the form of six specific factors (i.e., first-order model), competence satisfaction was also associated with positive affect (Longo, Alcaraz-Ibáñez, & Sicilia, 2018). When the need for competence is satisfied, the individual feels effective

in interacting with the environment (Ryan & Deci, 2017) and if this interaction is continuous (e.g., in a work context where one spends a significant amount of time in a day or in an educational context, during learning for an exam), then the feelings of constant development may be experienced. Being competent in, for instance, one's work might be associated with result achievement (e.g., Quiroga, Janosz, Bisset, & Morin, 2013); consequently, when we are competent, we may achieve good results and positive feedback, potentially leading to feelings of success (e.g., Gilman & Huebner, 2006) which, in turn, may be interpreted as a form of happiness. This phenomenon could manifest in non-obligatory situations as well, such as when one is performing altruistic acts and is contributing to the community: in such a setting, people might experience a sense of competence as they are able to help others (Ryan, Huta, & Deci, 2008) which might also contribute to their own positive affective experiences. Apart from these findings, diary studies (e.g., Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon, Ryan, & Reis, 1996) also showed that, when considering the three needs separately, competence also contributed to individuals' daily wellbeing and happiness. Interestingly, the other S-factors did not contribute to this outcome, suggesting that when general fulfillment does not underlie the S-factors (such as in the case of first-order models where the S-factors contain both the global and specific components), then the associations between these S-factors and the outcomes become more nuanced.

In the case of negative affect, relatedness frustration and competence frustration had additional effects over and above the G-factor. Previous studies demonstrated that need satisfaction and need frustration are distinctly related to different correlates such as stress or academic motivations (Campbell et al., 2017; Krijgsman et al., 2017). While the distinctness of need satisfaction and need frustration G-factors was not supported, the specific frustration factors indeed uniquely predicted negative affect as proposed previously (Vansteenkiste & Ryan, 2013). That is, the experience of being rejected by others (i.e., relatedness frustration) or perceiving oneself as a failure (i.e., competence frustration) comes hand in hand with more frequent experiences of negative affect. Previous studies have already highlighted that being lonely and isolated (i.e., frustrated need for relatedness) is related to decreased wellbeing and a handful of maladaptive outcomes (e.g., Kim, LaRose, & Peng, 2009; Mellor, Stokes, Firth, Hayashi, & Cummins, 2008). To counter the experiences of need frustration, future studies might employ social belonging interventions which has positive academic- and health-related outcomes (Walton & Cohen, 2011).

Competence appears to be a "double-edged sword" as its satisfaction is related to increased wellbeing, whereas its frustration is related to decreased wellbeing. Cultural characteristics might influence the unique role of competence. For instance, a cross-cultural study (Deci et al., 2001) found that all three needs were related to general self-esteem (i.e., an index of wellbeing reflecting self-acceptance and self-worth; Ryff, 1989) in highly similar direction and magnitude in a Bulgarian sample. On the other hand, competence had the strongest association with self-esteem in the US sample, autonomy only weakly correlated with it, and relatedness was not associated with self-esteem. The differences might stem from the individualistic-collectivistic nature of the countries: Bulgaria is identified as a collectivistic society where an emphasis is put on the groups, while the US (and Hungary) are individualistic where an emphasis is put on the individuals themselves (Hofstede, 2001; Hofstede, Hostede, & Minkov, 2010) and competence/performance might be more important for progress and advancement in individualistic settings. Other studies (e.g., Chen et al., 2015) also highlighted that there might be some variation in the unique role of each needs regardless of cross-cultural equivalence. Future cross-cultural studies should aim to address these questions. Nevertheless, the current study adds to the literature of SDT by demonstrating that specific aspects of need satisfaction and frustration (i.e., the G-factor of need fulfillment and the S-factors of satisfaction and frustration × autonomy, competence, and relatedness) play a critical and important role in relation to wellbeing.

Limitations and Future Directions

Some limitations of the present study should be remembered when interpreting the results. First, data was obtained through self-reported cross-sectional measures which preclude directional or causal inferences; to circumvent these issues, more sophisticated longitudinal, experimental or intervention studies would be necessary. The findings should be replicated in other cultural contexts as well to assess their generalizability. While the sample was relatively large, it was not as comprehensive as in the case of Tóth-Király, Morin, et al. (2018), thus more diverse and heterogeneous samples are needed to investigate the relations between basic psychological needs and outcomes. The reliability of the S-factors also remained moderate, emphasizing the need of relying on latent variables, such as the ones in the present case, which are controlled for measurement error. Future studies should also re-assess the criterion-related validity of this representation by using different measures of wellbeing (e.g., eudaimonic wellbeing) and

ill-being (e.g., depression, anxiety) or other indicators of adaptive functioning (e.g., motivations). Additionally, it would also be interesting to examine the interplay of this representation of need fulfillment and outcomes of wellbeing and ill-being across different levels of generality (i.e., situational level, contextual level, and global level) as proposed by the hierarchical model of Vallerand (1997).

Conclusions

Taken together, by relying on the bifactor-ESEM framework, need fulfillment was identified again as a multidimensional construct characterized by a global continuum component representing need fulfillment with need satisfaction and need frustration being at the opposite ends. Additionally, the specific combinations of satisfaction and frustration with autonomy, competence, and relatedness are also co-existent in this representation as measured by the BPNSFS. While the global need fulfillment factor was substantially related to the outcomes of wellbeing, the specific factors also had unique contributions: competence satisfaction was related to positive affect, while relatedness frustration and competence frustration was related to negative affect besides the global factor. In sum, the present study also underscores that, for a more detailed picture of the need fulfillment representation and of relations between basic psychological needs and covariates, both the global and the specific factors should simultaneously be taken into account.

Chapter 5: On the importance of balanced need fulfillment: A person-centered perspective (Study 3)[12]

Note. The article has been accepted for publication and the final pre-published version is presented in this thesis. The final published version as well as the online supplementary materials can be download from the publisher's website (https://link.springer.com/article/10.1007/s10902-018-0066-0).

Preface

The first two studies reported the psychometric examination of the PS and the BPNSFS that had not been available in Hungarian previously and that are of major relevance for the present dissertation (see them in Table S1.2 and Table S3.0 in the supplementary documents, respectively). The subsequent chapter takes a step forward with the inclusion of a study that focused on the associations between need fulfillment and passion. There have been some prior studies that investigated their relations (e.g., Lalande et al., 2017); however, all of these studies approached this question from a variable-centered perspective (i.e., how two or more variables are associated with one another) and none took a person-centered perspective (i.e., classifying subgroups of participants into profiles based on their shared and common characteristics). The present study was among the first ones to do so. More specifically, the present study focused on need fulfillment profiles and their associations with passion and various other theoretically-relevant correlates.

Another advantage of this person-centered approach is that it was able to provide an alternative test for the dimensionality and representation of need fulfillment. Given that need satisfaction and need frustration were both included as profile indicators, it became possible to test whether their within-profile levels mirror one another. For instance, having a profile simultaneously characterized by high levels of need satisfaction and low levels of need frustration would suggest that the two vary in a complementary manner (i.e., when one is high, the other is always low and vice versa). Conversely, having a profile characterized by high levels of both need satisfaction and need frustration would indicate that the two factors do not necessarily have a complementary role and that they might vary independently from one another. This way, as an auxiliary aim, the present study also examined the same phenomenon as Study 2, just from a different point of view.

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, M_{age} = 26.00, SD_{age} = 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

Introduction

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 et al., 2016), improved sleep quality (e.g., Campbell et al., 2017), decreased burnout (e.g., Schultz et al., 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 5.1 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 study with either one or more peripheral profiles being present.

Table 5.1. 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.

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 as it has 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 the 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, 2017; Rocchi, Pelletier, & Desmarais, 2017; 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, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017). 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, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017). Interestingly, no previous person-centered studies (Table 5.1) 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 et al., 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., 2013). 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 as 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)[13]. 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 (profile indicator). The Hungarian version (Tóth-Király, Bőthe, Orosz, et al., 2018; Tóth-Király, Morin, et al., 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 (profile predictor). The Interpersonal Behaviors Questionnaire (Rocchi, Pelletier, Cheung, et al., 2017) 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

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

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 et al., 2000) was followed to obtain the
Hungarian version.

Positive and negative affect (profile outcome). The 10-item version (Gyollai et
al., 2011) of the Positive and Negative Affect Scale (PANAS; Watson et al., 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, Vallerand, et al., 2013; Tóth-Király, Bőthe, Rigó, et al., 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 standard deviation of one), serving as a basis for the
LPA. More information is available about these models in Appendix S3.1 of the
supplementary documents. All models, ranging from one profile to eight profiles, were
estimated with Mplus 8.0 (Muthén & Muthén, 1998-2017) 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 et al., 2017; Hipp & Bauer, 2006). The means and the variances of the

factors were freely estimated in all profiles (Diallo, Morin, & Lu, 2016). The precise process of model selection is reported in Appendix S3.2 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).

Results

Preliminary Measurement Models

To avoid the unnecessary lengthening of this section, detailed results related to the preliminary measurement models are reported in Appendix S3.3 of the 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)[14], while affect (i.e., positive and negative affect) and passion (i.e., harmonious and obsessive passion) were modeled with two factors each.

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[14] 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, et al., 2016 or Morin, Myers, & Lee, 2018). More specifically, second-order models rest on the assumption that the association between the items and the second-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.

Latent Profiles of Need Fulfillment

A four-profile solution was identified as adequate which is graphically depicted in Figure 5.1 (more details are provided in Appendix S3.4 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).

Figure 5.1. Characteristics of the latent profiles on the basic psychological need fulfillment
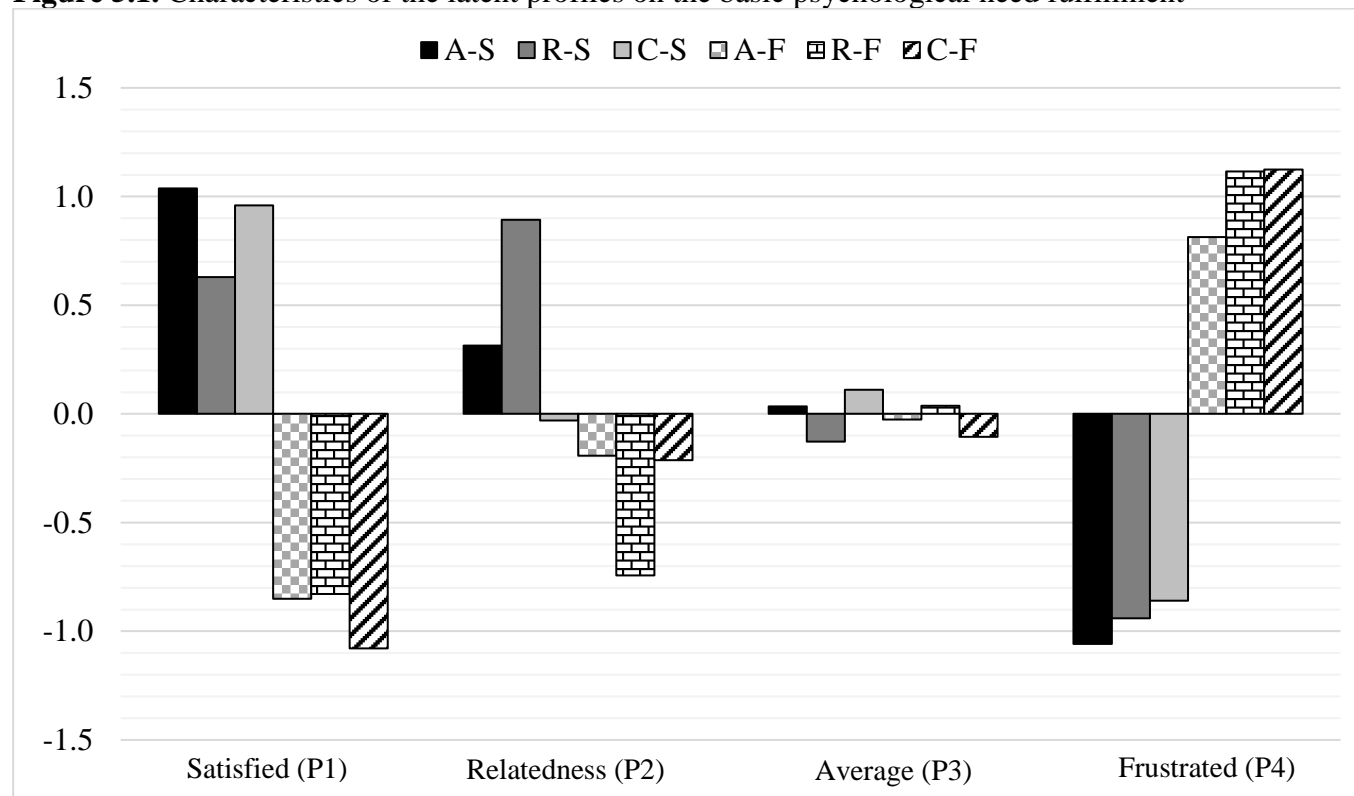
Note. Indicators are estimated from factor scores saved from preliminary measurement models with a mean of 0 and a standard deviation of 1.; Out of all participants, 198 belonged to Profile 1, 209 belonged to Profile 2, 424 belonged to Profile 3, and 263 belonged to Profile 4.; A-S: autonomy satisfaction; R-S: relatedness satisfaction; C-S: competence satisfaction; A-F: autonomy frustration; R-F: relatedness frustration; C-F: competence frustration.; P: profile.

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 0.50 SD or less. Conversely, a profile was considered imbalanced when this difference was larger than 0.50 SD (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 ≤ 0.407), whereas the Relatedness profile (Profile 2) was imbalanced (SDs between the factor means ≥ 0.530). For the exact profile means and variances, see Table S3.2 of the 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 5.2 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, 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.

Table 5.2. 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. Profile indicators were derived from the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015; Tóth-Király, Morin, et al., 2018), while the profile predictors were derived from the Interpersonal Behaviors Questionnaire (Rocchi, Pelletier, Cheung, et al., 2017).; P: profile; SE: standard error associated with the coefficient; OR: odds ratio.; *$p < .05$; **$p < .01$; ***$p < .001$.

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 5.3 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 5.2 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.

Table 5.3. 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. Out of all participants, 198 belonged to Profile 1, 209 belonged to Profile 2, 424 belonged to Profile 3, and 263 belonged to Profile 4.; P: profile; SE: standard error.

Figure 5.2. Charateristics of the latent profiles on the outcomes of harmonious-obsessive passion and positive-negative affect
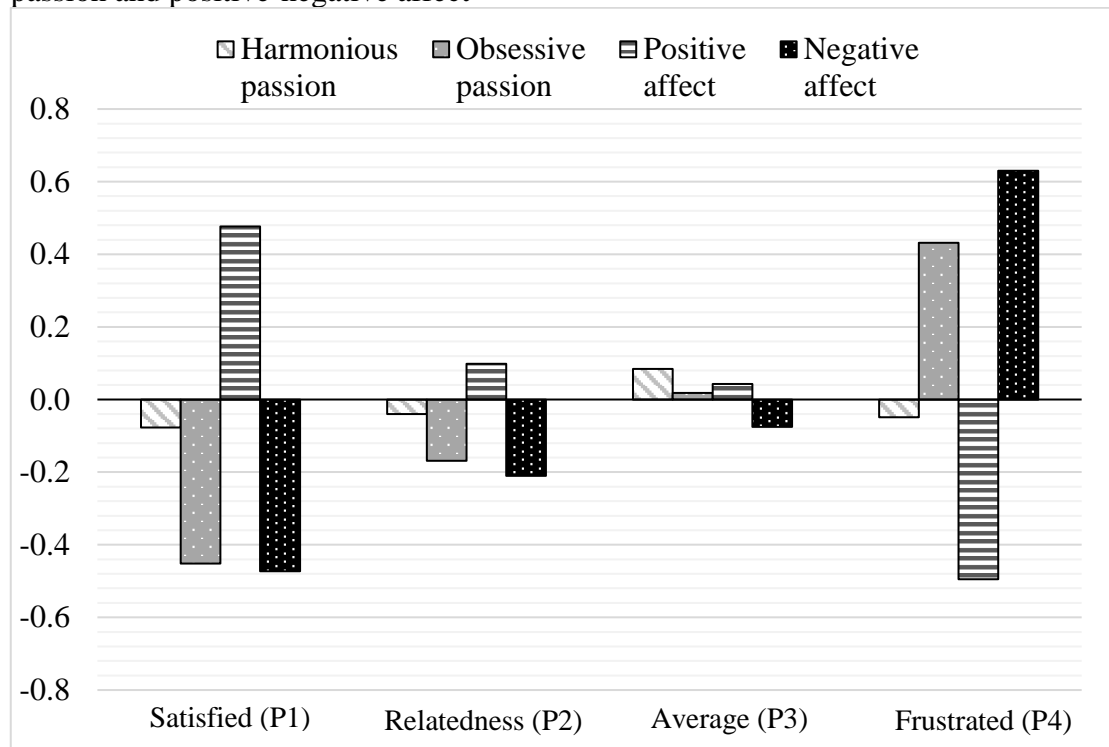
Note. Out of all participants, 198 belonged to Profile 1, 209 belonged to Profile 2, 424 belonged to Profile 3, and 263 belonged to Profile 4.; P: profile.

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 5.1) 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, et al., 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, Tóth-Király, Zsila, 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 be used to more fully grasp the potential differences between the need profiles. Despite their popularity (e.g., Facebook, 2018; 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).

Chapter 6: Perceived parenting styles matter: care and overprotection as predictors of passion (Study 4)[15]

Note. The manuscript is current under review. For this reason, the latest submitted version of the article is presented in this thesis.

Tóth-Király, I., Gál, É., Bőthe, B., Orosz, G., & Rigó, A. (under review). Perceived parenting styles matter: care and overprotection as predictors of passion.

Preface

Study 3 showed that general need fulfillment, as an individual factor, has been associated with OP with more frustrated profiles being associated with higher levels of OP. Conversely, profiles have not been related to levels of HP. These results are also consistent with the person-centered investigation of Lalande et al (2017) as well as Tóth-Király, Bőthe, Márki, Rigó, & Orosz (under review). Overall, general need fulfillment might be considered as a potential protective factor against OP.

While individual factors are important, the DMP suggests that the social environment might equally important in shaping one's passion (Vallerand, 2015). Within this environment, parents (and families) are thought to hold a central role in influencing children's behavior (e.g., Greenberg, Siegel, & Leitch, 1983). For this reason, the subsequent chapter reports a two-study investigation that focused on the role of perceived parental behaviors on passion. Respondents' perception was selected for two reasons: first, it was not feasible within the framework of the present dissertation to conduct a multi-informant data gathering. Second, one's perceptions about the social agents are considered to be important with respect to motivations, not necessarily the actual behavior of the social agents (Deci, 1975).

So far, research on passion and the social environment only focused on parents to a small extent. The present investigation aimed to address this scarcity. At the same time, most previous studies focused on the relative importance of autonomy-support (see Vallerand, 2015). However, other parental characteristics might be just as important. For this reason, apart from autonomy-support, the relative importance of parental care and parental overprotection were also considered.

Abstract

Passion has been proposed as one of the potential constructs that could contribute to a more fulfilling life as well as to subjective wellbeing. The importance of the social environment has been underscored in relation to passion; however, despite its great relevance in human development, less emphasis has been put on the role of parents and perceived parenting styles grounded in attachment theory. The present two-study investigation posited that the perceived parenting styles of care, autonomy-support, and overprotection experienced in adolescence are predictive of harmonious (HP) and obsessive (OP) passion which are, in turn, differentially related to subjective wellbeing. A sample of adolescents (N = 513) and a comprehensive sample of adults (N = 504) were recruited for this research to test the generalizability of the findings. The results were remarkably similar across the two samples: care positively predicted HP, overprotection positively predicted OP, while subjective wellbeing was related to HP, but either negatively or not to OP. Interestingly, autonomy-support was not related to passion among adolescents, but it did predict OP among adults. The present findings highlight that perceived parenting experiences in adolescence are related to different indicators of functioning among adolescents and adults.

Keywords: adolescent; Dualistic Model of Passion (DMP); harmonious passion; obsessive passion; perceived parenting style; subjective wellbeing

Introduction

The positive psychological research stream has been introduced almost two decades ago with the goal of understanding what makes people's lives more fulfilling and what improves the quality of their lives (Seligman & Csikszentmihalyi, 2000). Passion (and being passionate) has been proposed as one of the candidates that contributes to subjective wellbeing. The Dualistic Model of Passion (DMP; Vallerand, 2015; Vallerand et al., 2003) defines passion as a strong inclination towards a specific, self-defining activity that one likes (or even loves) and enjoys, considers it important, and spends a significant amount of time and energy with it. Although much research has investigated the potential determinants and consequences of being passionate for an activity, only a few studies focused on the role of early life experiences or parenting styles, even though the DMP underscores the importance of the social environment in the development and maintenance of passion.

In the present two-study investigation, we posit that early life experiences, in the form of perceived parenting behaviors, which, despite their great relevance in human development (Bowlby, 2008), have been neglected in passion research, may play an integral role with respect to passion. In addition, to our best knowledge, it has never been tested within passion research whether similar mechanisms can be observed among adolescents and adults, with the former group receiving substantially less scientific attention in this field. Thus, the present research is among the firsts to examine the associations between parenting styles and passion, while it also extends previous literature by investigating the role of different parenting styles as a predictor of passion, as well as the role of passion as a predictor of subjective wellbeing. This investigation also contributes to the literature on attachment theory by further highlighting that early childhood experiences are not only related to psychopathology, but also to indicators of functioning. Finally, since early parenting styles are thought to have persistent effects through the life span (Bowlby, 1973, 1980), we tested the generalizability of the results by including both adolescent and adult samples. We believe that the integration of attachment theory, research on parenting styles and passion might yield new insights and directions for future research.

The Dualistic Model of Passion (DMP)

One of the key aspects of the DMP is that it proposes the existence of two qualitatively different types of passion. The first type is *harmonious passion* (HP), which

results from autonomous internalization (Deci & Ryan, 2000) indicating that the activity is authentically and volitionally engaged and incorporated into one's identity. As a result, the individual is in complete control of the activity which takes up a significant, yet not overwhelming amount of time and energy. This form of activity internalization leads to a balance between the activity itself and other aspects of life and one's identity, as well as it leads to potentially adaptive outcomes (Vallerand, 2015). The second type is called *obsessive passion* (OP) which stems from controlled activity internalization where inter- or intra-personal contingencies and ego-invested characteristics are often attached to the activity itself, for instance, maintaining the same level of self-esteem (Lafrenière et al., 2011). As a result of these contingencies, one feels compelled to engage in the activity, thus losing control over it, while everything is gravitating around the activity. This pressured engagement often leads to conflicts with other aspects of life (e.g., relationship) and it is often predictive of maladaptive outcomes (Vallerand, 2015).

Since its inception, research on passion extensively focused on examining the relationship between passion and motivational-, cognitive-, and behavioral outcomes (Curran et al., 2015). For instance, HP and OP has been differentially associated with deliberate practice and performance (e.g., Vallerand et al., 2007), burnout (e.g., Carbonneau et al., 2008), problematic behaviors (e.g., Orosz, Tóth-Király, et al., 2016), and achievement goals (Bonneville-Roussy, Lavigne, & Vallerand, 2011).

Of major importance are the studies that examined the relations between passion and different indicators of subjective wellbeing. Generally, these studies involving both adults and adolescents (e.g., Philippe, Vallerand, & Lavigne, 2009; Schellenberg & Bailis, 2015a; St-Louis et al., 2018; see also Vallerand, 2016) supported the notion that harmonious passion is positively associated with different indicators of subjective wellbeing, whereas obsessive passion is either not or negatively related to the same indicators.

Yet another important line of research focused on the potential predictors of passion. Studies so far have underlined the importance of individual differences as predictors of passion such as perfectionism (e.g., Verner-Filion & Vallerand, 2016), impulsivity (Orosz, Vallerand, et al., 2016), need satisfaction (Lalande et al., 2018), or different identity styles (Bouizegarene et al., 2018). The DMP also attributes great importance to the social environment as a cardinal predictor of passion. Still, considerably less emphasis has been put on the potential environmental determinants of passion,

particularly from the perspective of parenting styles which are of great relevance for human functioning.

Perceived Parenting Styles

Attachment theory (Bowlby, 1973, 1977, 2008), a well-established theoretical and empirical model, also underscores the importance of perceived parenting rearing styles which are the perceptions of the children about the attitudes and behaviors of their parents (Bretherton, 1992; Parker, Tupling, & Brown, 1979). These parenting styles and attachment to parents (i.e., primary caregivers) during childhood have both short- and long-term consequences. More specifically, healthy psychological development is thought to be heavily influenced by parenting styles; in a sensitive and predictable social environment, secure attachment is more likely to form, which provides emotional security and, at the same time, encourage the child to explore the surrounding environment. Via the formation of secure bonds and continuous interaction with the caregiver, healthy internal working models develop within children about themselves and others around them. The presence of this secure working model is related to adequate impulse management and regulation (Grossmann, Grossmann, Kindler, & Zimmermann, 2008) as well as the development of optimal functioning (Ainsworth, Blehar, Waters, & Wall, 1978). On the other hand, in the presence of negative parenting styles, insecure bonds are more likely to develop which have been associated with psychopathologies, negative mental representations, problems in emotion regulation and other behavioral difficulties (e.g., Yap, Pilkington, Ryan, & Jorm, 2014).

Initial studies on parenting styles identified two key dimensions: (1) *parental care* which refers to perceived parental warmth and affectionate behaviors, and (2) *overprotection* which refers to controlling and restrictive parenting behaviors (Gladstone & Parker, 2005; Parker et al., 1979). However, emerging factor analytic findings using Western samples (e.g., Xu et al., 2016, see also Ngai et al., 2018) reported the presence of a third factor, namely *autonomy support*[16]. Given that the present investigation was conducted in a Western culture, we opted to investigate the effect of these three relevant dimensions on passion.

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[16] It has to be noted that an additional fourth factor has been identified which refers to indifference of parents. However, this factor only emerged when non-Western cultures (e.g., Japanese, Chinese, or Persian) were examined, suggesting that cultural characteristics might influence the factor structure of the instrument which was developed for Western cultures.

Perceived positive parenting practices (e.g., high care or autonomy support) has been associated with increased subjective wellbeing (Chirkov & Ryan, 2001), better psychological functioning (Schreiber & Lyddon, 1998), prosocial behaviors (Collins & Steinberg, 2006), improved quality of life (Rikhye et al., 2008), and a lower likelihood of addictive behaviors (Baumrind, 1991). These positive parenting attitudes and behaviors have been associated with mental health among adolescents and adults alike. Conversely, exposure to suboptimal parenting (e.g., low care or overprotection) has been associated with several negative outcomes and psychopathologies in children and adults as well, for instance, depression (Yap et al., 2014), anxiety disorders (Van Der Bruggen, Stams, & Bögels, 2008), suicidality (Goschin, Briggs, Blanco-Lutzen, Cohen, & Galynker, 2013), or chronic pain (Evans, Moloney, Seidman, Zeltzer, & Tsao, 2017). While most studies focused on psychopathologies, we wished to extend these with the inclusion of harmonious and obsessive passion which might be interpreted as optimal and suboptimal forms of human functioning, respectively.

As mentioned above, previous studies neglected the investigation of passion from the perspective of theories on parenting styles and on attachment. Still, there is some evidence supporting the relevance of autonomy support and, to a smaller extent, of overprotection in the development of passion. Using correlational and short-term longitudinal designs across three studies, Mageau et al. (2009, see also Liu et al., 2011) reported that both perceived and actual autonomy-support positively predicted harmonious, but not obsessive passion. Similar results were reported when teachers' behaviors were evaluated (Bonneville-Roussy, Vallerand, & Bouffard, 2013). These findings suggest that an autonomy-supportive environment that fosters choice and exploration facilitates the development of more autonomous processes (e.g., autonomous internalization) which in turn are related to harmonious passion. On the other hand, a controlling environment (e.g., criticism or pressure) is more likely to elicit controlled internalization and subsequently obsessive passion (Vallerand, 2015).

Apart from these scarce direct results, more indirect evidence is available not only for parental care, but overprotection as well. Early studies showed that obsessive traits were associated with higher parental overprotection and lower parental care among clinical (Chen et al., 2017; Hafner, 1988) and non-clinical samples (Cavedo & Parker, 1994; Klimidis, Minas, Ata, & Stuart, 1992). Besides their impact on mental health, parenting behaviors have also been linked to problematic behaviors which are akin to obsessive passion (e.g., Kovácsik et al., 2018; Tóth-Király, Bőthe, Tóth-Fáber, et al.,

2017). Generally, studies demonstrated that negative parenting styles were associated with Internet addiction (Lin, Lin, & Wu, 2009), eating disorders (Eun, Paksarian, He, & Merikangas, 2018), substance abuse (Calafat, García, Juan, Becoña, & Fernández-Hermida, 2014), alcohol use (Mak & Kinsella, 1996), and pathological gambling (Grant & Kim, 2002). These findings are further corroborated by longitudinal studies (e.g., Drake, Belsky, & Pasco Fearon, 2014; Raudino, Fergusson, & Horwood, 2013) indicating that early life experiences are important not only at early age, but later in the development as well.

The Present Study

Parenting styles are thought to have long-lasting consequences on children's cognitive, emotional and social functioning, and they are also predictive of adult behaviors (Bowlby, 2008). Still, to date, perceived parenting styles have not been explicitly examined in conjunction with passion. The present two-study investigation sought to address this gap in the literature by investigating, as a primary aim, the role of parenting styles as predictors of harmonious and obsessive passion. Based on the above-mentioned studies, we posited that perceived care and autonomy-support would be related to harmonious passion, while perceived overprotection to obsessive passion. As a secondary aim related to subjective wellbeing, it was hypothesized to be positively related to harmonious passion while, at the same time, it would not be related to obsessive passion. Finally, we also hypothesized that the relationships between these variables would be highly similar across both adolescent and adult groups.

Materials and Methods

Procedure

The study was conducted in accordance with the Declaration of Helsinki and with the approval of the University Research Ethics Committee. Two samples were recruited for the present investigation. Participants of Sample 1 (i.e., adolescents) were recruited from a Hungarian high school situated in one of the county capitals and questionnaires were filled out via an online system. Adolescents were informed beforehand about the aims and content of the study, and they could participate voluntarily. None of them received compensation or punishment for the participation or non-participation, respectively. Adolescents were assured of their anonymity and that teachers would not be

informed about their responses. Schools and parents were also informed through an opt-out passive consent.

Participants of Sample 2 (i.e., adults) were recruited by a research market company using a multiple-step, proportionally stratified, probabilistic sampling method. With this method, individuals were removed from the panel if they gave responses too quickly (i.e., without paying attention to their responses) and/or had fake (unused) e-mail addresses (see Tóth-Király, Bőthe, et al., 2017 for a similar recruitment process). This comprehensive sample was representative for those Hungarians who used the Internet at least once a week in terms gender, age, level of education, and type of residence.

A priori sample size calculation suggested that at least 400 respondents would be necessary with anticipated effect sizes being 0.20, statistical power level 0.80 with a probability level of 0.05 using a model with six latent and 42 measures variables.

Participants

Sample 1. This sample consisted of 513 adolescents (77.4% female) aged between 15 and 20 (M = 17.24 years, SD = 1.20 years). They reported their class as being 9th grade (27.7%), 10th grade (28.3%), 11th grade (23.8%), and 12th grade (20.3%); and their place of residence as the capital city (1.2%), county capitals (39.6%), cities (41.7%), and villages (17.5%).

Sample 2. This sample consisted of 504 adults (51.8% female) aged between 18 and 60 years (M = 39.59 years, SD = 12.03 years). These participants reported their highest level of education as primary (19.8%), secondary (58.3%), and higher (21.8%) education; and their place of residence as the capital city (20.2%), county capitals (19.6%), cities (31.9%), and villages (28.2%).

Measures

Passion. Participants' level of passion was measured by the Passion Scale (PS; Marsh, Vallerand, et al., 2013; Tóth-Király, Bőthe, Rigó, et al., 2017). It is a 12-item instrument assessing harmonious (6 items, e.g., "This activity is in harmony with the other activities in my life") and obsessive passion (6 items, e.g., "If I could, I would only do my activity") passion. Instead of specifying beforehand the object of passion, participants were asked to think of an activity that corresponded to the criteria of passion (e.g., they liked or loved it, they spent significant amount of time and energy with it, and this activity

was personally important and valuable for them). Participants could indicate their level of agreement on a seven-point scale (1 = not agree at all; 7 = very strongly agree).

Perceived parenting styles. The Parental Bonding Instrument (PBI; Parker et al., 1979; Tóth & Gervai, 1999) is a 25-item self-report instrument about one's recalled experiences about their parents' practices and behaviors during the first 16 years of life. Following Xu et al. (2018), the PBI measured three parenting behaviors: care (12 items, e.g., "Was affectionate to me"), autonomy (6 items, e.g., "Liked me to make my own decisions"), and overprotection (7 items, e.g., "Tried to control everything I did"). The instructions were slightly modified in both studies so that participants were asked to think about their experiences with their families instead of one of their parents. This modification was necessary given the limited time available for data collection which did not permit us to administer the questionnaire for each of the parents separately. Previous studies highlighted the importance of both maternal and paternal behaviors (e.g., Bisby et al., 2017; Gao, Raine, Chan, Venables, & Mednick, 2010; Siomos et al., 2012); therefore, we did not wish to arbitrarily select one of the parents and instead we focused on the family as a unity. Items were formulated in present tense for adolescents and past tense for adults and were rated on a four-point scale (1 = very like this; 4 = very unlike this).

Subjective wellbeing. Subjective wellbeing was measured with the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; Martos, Sallay, Désfalvi, Szabó, & Ittzés, 2014). It is a short 5-item scale assessing participants' level of satisfaction with their lives in general (e.g., "The conditions of my life are excellent"). Participants rated their level of agreement on a seven-point scale (1 = strongly disagree; 7 = strongly agree).

Statistical Analyses

Data was first exported to SPSS 22 for preliminary analyses (e.g., demographics of the participants, means, standard deviations, correlations, and estimation of internal consistency). Prior to the main analyses, preliminary measurement models were tested to examine whether the hypothesized structure of the variables fit the data well (see the online supplementary materials for more details). Subsequently, the proposed model was tested in Mplus 8.1 (Muthén & Muthén, 1998-2017) using structural equation modeling (SEM) with latent variables to reduce the biasing effects of measurement errors (Finkel, 1995) which, in turn, provides a more accurate estimation of the parameters. In order to

account for the potential non-normality of the data, the robust maximum likelihood estimator (MLR) was used.

Because the chi-square (χ^2) test of exact fit tends to be oversensitive to sample size and minor model misspecifications, we relied on the following common goodness-of-fit indexes: the comparative fit index (CFI), the Tucker–Lewis Index (TLI), and the root mean square error of approximation (RMSEA). According to typical interpretation guidelines (e.g., Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005), values greater than .90 and .95 for the CFI and TLI, respectively, are considered to indicate adequate and excellent fit to the data, whereas values smaller than .08 or .06 for the RMSEA, respectively, support acceptable and excellent model fit.

Results

Preliminary Analyses

To avoid the unnecessary lengthening of this section, detailed results related to the preliminary measurement models are reported in the appendix of the supplementary document. Overall, all measurement models had adequate fit and supported the dimensionality of the PS, the PBI, and the SWLS for both adolescents and adults. Table 6.1 presents the descriptive statistics, reliability indices, and the latent correlations among all study variables. These results showed that all variables had adequate levels of reliabilities. Latent correlations were highly similar in both samples and reflected the a priori expectations: harmonious passion was positively related to care and subjective wellbeing, while obsessive passion was positively related to overprotection, but negatively related to care. Interestingly, autonomy was not related to any passion variables.

Table 6.1. Descriptive statistics, reliability indices and latent correlations of the examined variables

Variables	Range	Sample 1 (adolescent, N = 513)				Sample 2 (adult, N = 504)				1	2	3	4	5	6
		M	SD	α	ω	M	SD	α	ω						
1. Harmonious passion	1-7	5.75	1.10	.86	.85	5.77	0.96	.82	.81	—	.35**	.11*	.02	-.03	.16**
2. Obsessive passion	1-7	4.35	1.35	.82	.82	3.76	1.42	.85	.84	.52**	—	-.09*	.07	.32**	-.02
3. Parental care	1-4	3.31	0.59	.91	.91	2.99	0.72	.94	.93	.17**	-.29**	—	.45**	-.39**	.03
4. Parental autonomy	1-4	2.99	0.60	.80	.73	2.69	0.73	.89	.84	.11	-.06	.36**	—	-.26**	.00
5. Parental overprotection	1-4	1.91	0.60	.77	.68	2.08	0.70	.86	.81	-.05	.24**	-.41**	-.41**	—	-.03
6. Subjective wellbeing	1-7	4.74	1.33	.86	.87	4.20	1.38	.91	.92	.35**	-.11	.21**	.09*	-.12**	—

Note. M = mean score; SD = standard deviation; α = Cronbach's alpha; ω = model-based omega coefficient of composite reliability; Correlations below the diagonal are those of Sample 1 (adolescents), while correlations above the diagonal are those of Sample 2 (adults).; *p < .05; *p < .01.

Main Analyses

The hypothesized model was first tested in the adolescent sample and yielded good fit to the data (χ^2 = 1375.995, df = 749; CFI = .923, TLI = .912, RMSEA = .040 [90% CI .037-.044]). Overall, the majority of the effects should be considered small. More specifically, perceived parental care positively predicted harmonious passion, while it was negatively related to obsessive passion. Conversely, overprotection positively predicted obsessive, but not harmonious passion. Autonomy-support was neither related to harmonious, nor to obsessive passion. Subjective wellbeing was positively predicted by harmonious passion, and negatively predicted by obsessive passion. The fit for the same model was even better in the adult sample (χ^2 = 1257.001, df = 749; CFI = .951, TLI = .943, RMSEA = .037 [90% CI .033-.040]). The results are highly similar to those of the adolescent sample with only some minor differences, despite the substantially different composition of the samples. Once again, perceived parental care positively predicted harmonious passion, but it did not predict obsessive passion. Overprotection did positively predict obsessive, but not harmonious passion. Autonomy did not predict harmonious passion in the adult sample either, while it was positively related to obsessive passion. Finally, subjective wellbeing was positively predicted by harmonious, but not by obsessive passion.

Based on the correlation matrix and the regression coefficients, we constructed a more parsimonious model in which autonomy-support was removed. In the same vein, modification indices suggested that the direct paths from parental behaviors to subjective wellbeing should be freely estimated. This revised model (which can be seen in Figure 6.1) also had good fit in the adolescent sample (χ^2 = 979.148, df = 554; CFI = .938, TLI = .930, RMSEA = .039 [90% CI .035-.043]). Harmonious passion was still predicted by parental care (β = .129 [95% CI .012, .246], p = .030), but not overprotection (β = .035 [95% CI -.091, .160], p = .586), while obsessive passion was still predicted by both (care: β = -.151 [95% CI -.270, -.033], p = .013; overprotection: β = .159 [95% CI .041, .276], p = .008). Subjective wellbeing was predicted by parental care (β = .590 [95% CI .488, .692], p < .001) and harmonious passion (β = .234 [95% CI .102, .366], p = .001), but not overprotection (β = -.031 [95% CI -.142, .080], p = .583) or obsessive passion (β = -.012 [95% CI -.137, .112], p = .849).

The same model was tested in the adult sample, resulting in adequate model fit (χ^2 = 1137.272, df = 554; CFI = .931, TLI = .922, RMSEA = .046 [90% CI .042-.049]). Harmonious passion was not predicted by any of the parental behaviors (care: β = .107

[95% CI -.012, .227], p = .078; overprotection: β = .016 [95% CI .-132, .164], p = .830), while obsessive passion was predicted by overprotection (β = .347 [95% CI .230, .465], p < .001), but not care (β = .084 [95% CI -.020, .188], p = .112). Finally, similar to the other sample, subjective wellbeing was predicted by care (β = .175 [95% CI .055, .295], p = .004) and harmonious passion (β = .140 [95% CI .022, .258], p = .020), but not overprotection (β = -.116 [95% CI -.264, .033], p = .126) or obsessive passion (β = -.021 [95% CI -.136, .094], p = .722).

Figure 6.1. Results of the structural equation modeling analyses
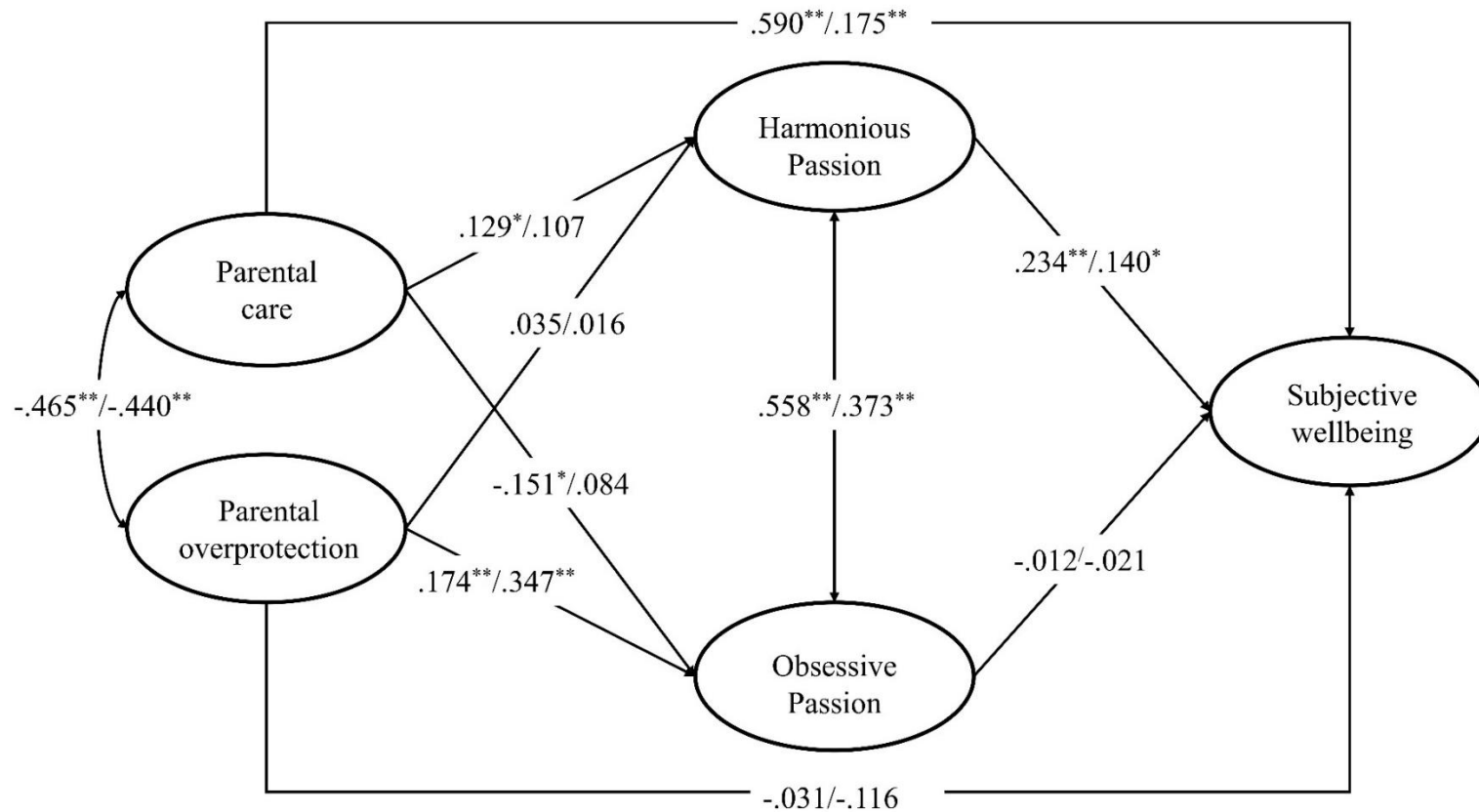
Note. Circles represent latent variables, whereas scale items are not shown for the sake of simplicity. One-headed arrows represent regression coefficients, two-headed arrows represent correlations. All coefficients are standardized. Numbers before the slash sign ("/") refer to Sample 1 (i.e., adolescents, N = 513), while numbers after the slash sign refer to Sample 2 (i.e., adults, N = 504).; Variables on the left are derived from the Parental Bonding Inventory (Parker et al., 1979; Tóth & Gervai, 1999); variables in the middle are derived from the Passion Scale (Marsh, Vallerand, et al., 2013; Tóth-Király, Bőthe, Rigó, et al., 2017); and the variable on the right is derived from the Satisfaction With Life Scale (Diener et al., 1985; Martos et al., 2014).; *p < .05; **p < .01.

Discussion

Understanding the processes of the developmental phase of early childhood might provide insight not just into adolescent and adult health, but psychological functioning as well. Combining parenting styles (Parker et al., 1979) grounded in the well-established attachment theory (Bowlby, 2008), and the Dualistic Model of Passion (Vallerand, 2015), the present two-study investigation set out (1) to examine the role of perceived parenting styles in the prediction of passion, (2) to investigate the role of harmonious and obsessive passion as predictors of subjective wellbeing, and (3) to test the similarity of these associations across a sample of adolescents and a comprehensive sample of adults. In general, effect sizes were small and the results partially supported the hypotheses in both samples: parental care positively predicted harmonious passion among adolescents (but not adults), overprotection positively predicted obsessive passion in both samples, harmonious passion positively predicted subjective wellbeing, while obsessive passion was not related to it. Autonomy-support was not related to passion. At the same time, some sample-specific associations also emerged. These findings lead to some important implications.

Parenting Styles Predict Passion

Among the many potential predictors, the DMP posits that the social environment plays an important role in the development and maintenance of passion (Vallerand, 2015). The present investigation provides an important contribution to the literature by demonstrating that perceived parental care is predictive of harmonious passion among adolescents. Thus, positive parenting practices (i.e., being affectionate, praising, or making the child feel better) might be associated with harmonious passion due to the fact that these practices provide children with positive experiences and might even satisfy their basic psychological needs (Ryan & Deci, 2017). Parental care might provide the child with a sense of security that might allow her to immerse in different activities and to experience enjoyment during these activities. In such a situation, people do not engage in an activity out of some form of pressure, but for its own sake. Parental care might also entail that the activities provided or supported by the parents align with the age, maturity, and personality of the child, thus these activities might reflect on her needs. It is also important to note that these effects might diminish in adulthood (as suggested by the non-significant paths in the adult sample).

On the other hand, overprotection was predictive of obsessive passion in both samples which mirrors comparable findings from the addiction-related literature (e.g., Grant & Kim, 2002). Negative parenting practices (i.e., invading privacy, trying to control the child, or constructing a constantly interdependent environment) might not allow the child to explore the surrounding environment for new experiences. Eventually, the child might find an activity that he likes and, in order to escape this controlling parental milieu, might start to become overengaged with that particular activity. Additionally, the child might also feel that his basic psychological needs are not satisfied by their parents which could motivate them to find an activity that is satisfying for them.

There were some sample-specific results that also need to be addressed. One of the most interesting findings was that autonomy-support was not associated with harmonious passion or obsessive passion which contradicts previous studies on this topic (e.g., Mageau et al., 2009). Although these results might appear to be surprising at first glance, they become more clear-cut upon inspecting the autonomy factor of the PBI. Previous studies (e.g., Bonneville-Roussy et al., 2013; Mageau et al., 2009) measuring autonomy support did so in line with the Self-Determination Theory (Ryan & Deci, 2017) which underscores that autonomy support has three main characteristics (Grolnick, 2003; Reeve, 2006; Soenens & Vansteenkiste, 2010): (1) the provision of clear rules and goals, (2) the possibility of offering guidance and help when necessary, and (3) the provision of constructive, positive feedback. On the other hand, items of the PBI autonomy subscale appear to measure a permissive or laissez-faire style which is characterized by lack of structure, involvement and guidance as well as complete freedom and independence. Given that this parenting style entails relatively few parental constraints, children might experience that any kind of behavior is permitted without consequences which might lead to self-regulatory deficits (Piotrowsky, Lapierre, & Linebarger, 2013). Overall, it seems that a permissive or laissez-faire parenting style that provides "excessive" freedom and imposes few restrictions might not be conductive of passion.

Finally, while parental care was not associated with obsessive passion for adults, it was for adolescents. This suggests that emotionally caring parenting styles might be considered protective factors for adolescents who experience these parental behaviors first hand compared to adults who recalled these experiences. Apart from providing an optimal experience, parental care might also protect adolescents from deleterious activities by complementing their self-regulation which might not be fully matured at a younger age compared to adulthood (Steinberg, 2007). This is also in line with previous

studies (Dishion & McMahon, 1998; Paulussen-Hoogeboom, Stams, Hermanns, Peetsma, & Van Den Wittenboer, 2008) suggesting that positive parenting style might be preventive of problematic behaviors in adolescence.

It has to be noted that even though effect sizes in the current investigation might be considered relatively small, these are comparable to those reported in previous studies (e.g., Bonneville-Roussy et al., 2013; Mak & Kinsella, 1996; Rikhye et al., 2008). Overall, it appears that perceived parenting behaviors predict both forms of passion not only in the case of adolescents but in the case of adults as well.

Apart from direct associations, parenting behaviors might also be related to passion indirectly, through other intervening variables. It has been suggested that self-related processes are central to the distinction of harmonious and obsessive passions (Vallerand et al., 2003) and these processes are presumed to be the results of the interaction between the child and the caregiver (Grolnick & Farkas, 2002). Negative parenting styles (e.g., overprotection or neglect) are more likely to contribute to the development of psychological unsatisfactory self-related processes and vulnerabilities which themselves lead to the compensatory behavior of obsessive passion.

Such an unsatisfactory self-related process might be low self-esteem. If one's self-esteem is low as a result of the negative working model derived from negative parenting practices (Bowlby, 2008), she is more likely to engage in an activity to compensate for this deficit to restore her self-esteem. If the activity is believed to adequately counter the low level of self-esteem and a sense of self-worth is satisfactorily derived from the activity, then the individual might become more and more involved with it. In this case, the activity becomes important for self-protective and defensive reasons which might not fully align with the self and desires of the child, thus obsessive passion is more likely to develop for an activity. These assumptions align with studies which have already showed that individuals with low self-esteem experience higher levels of obsessive passion (Lafrenière et al., 2011; Stenseng & Dalskau, 2010). Crocker et al. (e.g., Crocker, 2002; Crocker & Wolfe, 2001) have also suggested that people might engage in activities to achieve success and avoid failures which, in turn, could contribute to the enhancement and protection of their self-esteem. Given that parenting behaviors had small-to-moderate associations with one's global (e.g., Wichstrøm & von Soest, 2016) and domain-specific self-esteem (e.g., Morin, Maïano, Scalas, Janosz, & Litalien, 2017), future studies could take this factor into account when examining parenting styles and passion.

Another potential unsatisfactory self-related process might be low impulse control. When impulse control is low, the individual is not able to delay enjoyable short-term gratification for the sake of long-term goals (Tice, Bratslavsky, & Baumeister, 2001). It might be plausible that due to negative parenting practices, the child seeks to find comfort in other activities, which might fulfill her needs which are thwarted by her parents' inappropriate parenting practices. Some previous studies support this proposition. More specifically, poor parenting style (e.g., permissive or overprotection) has been associated with impulsivity and subsequent substance use (Patock-Pechkam & Morgan-Lopez, 2006) and anti-social behavior (Jones, Cauffman, & Piquero, 2007). From the perspective of passion and related fields, impulsivity has been identified as a potential predictor of obsessive passion (Orosz, Vallerand, et al., 2016) as well as other problematic behaviors (e.g., Billieux, Rochat, Rebetez, & Van der Linden, 2008; Bőthe, Tóth-Király, Potenza, et al., 2018).

Passion and Subjective Wellbeing

Finally, it was examined whether harmonious and obsessive passions are related to subjective wellbeing. This question is particularly important given the paucity of passion research among adolescents. Harmonious passion positively predicted subjective wellbeing in both groups, while obsessive passion was not related to it. It appears that being engaged in a harmoniously passionate activity might be conductive of subjective wellbeing. Findings of the adult group are comparable to those of Marsh et al. (2013) as well as to the meta-analysis of Curran et al. (2015) in which harmonious passion was related to the subjective wellbeing of adults, whereas obsessive passion was not. It has to be noted that parental care had a larger effect on subjective wellbeing in the adolescent sample compared to the adult sample. One possible explanation for this difference might stem from the different lifestyles of adolescents and adults. More specifically, adults' subjective wellbeing might be influenced by a multitude of factors and responsibilities (e.g., job, family, friends, or financial issues), while adolescents have less tasks to be responsible for (e.g., school or friends) in the vast majority of the cases.

On a general note, having overprotective parents might orient the child to seek control elsewhere, in the form of an activity that she gradually becomes overly involved with. However, this overengagement might not be conductive of subjective wellbeing. If parents feel that their child is obsessively passionate about a specific activity, they might exert more control over her which might potentially prompt the child to seek out other

activities in which her control can be regained, creating a vicious circle in the process. On the other hand, a caring parenting behavior might contribute to a more optimal functioning in the form of harmonious passion among adolescents.

Strengths, Limitations, and Future Directions

One of the strengths of the present investigation is the bridging of two major theories from the field of developmental and positive psychology which so far has been neglected. A second strength was the use of relatively large adolescent and comprehensive adult samples that made it possible to obtain both current reports and retrospective reports on perceived parental behaviors which provided a more accurate representation of the associations between parenting styles and passion. Another strength was the application of sophisticated methodologies that allowed us to minimize biases from a statistical point of view.

At the same time, there are some limitations as well that need to be addressed. Given that the study design was cross-sectional, causality cannot be inferred from these results. To address the directionality of the associations, longitudinal studies would be needed starting from early childhood. The self-reported nature of the instrument should also be taken with caution. While the retrospective recall of past events could be biased which, in turn, could undermine the results, the present findings were relatively stable across the two samples. Previous studies also reported that recall of significant past behaviors was not significantly affected by current mood state among depressive participants (Brewin, Andrews, & Furnham, 1996; Parker, 1990), corroborating the present findings. It would be interesting to ask parents about their self-perceived parenting styles and examine the discrepancy between the reports of children and parents. Another limitation is that while the PBI assesses perceived parenting behaviors which influence the formation of attachment styles, it does not directly evaluate the attachment itself (Gittleman, Klein, Smider, & Essex, 1998). Future studies should also test the potential mediating role of the above-mentioned self-related process (i.e., self-esteem or impulse control). Alternative models might also be possible (e.g., parental practices predict life satisfaction and, in turn, passion).

Finally, the present findings have important practical implications. It appears that obsessive passion might be tamed by not maintaining a controlling, intrusive, and possessive relationship at a younger age and instead putting more focus on a warm, caring, and emotionally responsive parenting style which might protect children from

developing obsessive passions during their adolescence and, at the same time, facilitate the development of harmonious passion.

Chapter 7: Longitudinal trajectories of passion and their individual and social determinants: A latent growth modeling approach (Study 5)[17]

Note. The article has been accepted for publication and the final pre-published version is presented in this thesis. The final published version as well as the online supplementary materials can be download from the publisher's website (https://link.springer.com/article/10.1007/s10902-018-0059-z).

Preface

The prior chapters of this dissertation showed that (1) general need fulfillment was associated with OP, but not HP; (2) parental care predicted HP among adolescents (but not adults); and (3) overprotection predicted OP for both adolescents and adults. The final study presented in this chapter had two goals: first, in line with the overarching goal, it sought to explicitly investigate the developmental trajectories of passion. Second, based on the studies presented in prior chapters, it also sought to examine whether the hypothesized individual and social factors were related to passion changes.

Previous passion studies (e.g., Carbonneau et al., 2008) were extended upon with the inclusion of more than two time points. While any form of longitudinal data could be considered as an improvement over a cross-sectional design, as mentioned by Gillet et al (2018), having data from two time points might only allow researchers to examine rank-order stability, the absolute magnitude of longitudinal change, or cross-lagged relations among various variables. Still, including three or more time points would prove to be useful in understanding inter-individual stability as well as developmental trajectories that might characterize the respondents (Gillet et al., 2018; Grimm, Ram, & Estabrook, 2016). To this end, four time points were included in the present longitudinal study.

An additional feature of the present study was the focus on specific need fulfillment in an important life domain and an unrelated area of passion. While research mostly focuses on need fulfillment and passion within the same domain (e.g., Curran et al., 2013; Verner-Filion & Vallerand, 2018), based on the theoretical work of Vansteenkiste and Ryan (2013), having frustrated needs in an important life domain might lead one to consciously or unconsciously seek out other activities in an attempt to cope with the experience of need frustration. The subsequent study tests this proposition.

Abstract

While the Dualistic Model of Passion posits that passion can fluctuate over time, the investigation of this notion still remains understudied and is mostly assessed indirectly. This study directly examined the ongoing development of passion in a sample of young adults (N = 205) over a period of four months. The contribution of individual (need fulfillment) and social (perceived parental styles) determinants to the growth trajectories were also considered. Via latent growth modeling, the results showed that harmonious passion, obsessive passion, and the passion criteria had elevated levels at the initial measurement, and that passion remained high and stable over the course of four months. As for the predictors, parental autonomy-support predicted all three trajectories, while parental overprotection predicted obsessive passion, and psychological need fulfillment predicted harmonious passion. These findings provide a deeper insight into the temporal dynamics of passion as well as highlight key variables for fostering passion in general or harmonious passion as well as for taming obsessive passion.

Keywords: development; Dualistic Model of Passion (DMP); latent growth modeling (LGM); longitudinal; parenting style; psychological need fulfillment

Introduction

Prior decades of psychological research have put increasing emphasis on the identification of constructs that positively contribute to people's lives; this is essentially the goal of positive psychology (Seligman & Csíkszentmihályi, 2000). Of major relevance to positive psychology is passion which has been proposed as being such a construct. According to the Dualistic Model of Passion (DMP; Vallerand, 2015; Vallerand et al., 2003), it is defined as a strong inclination towards a specific activity that the person loves and enjoys, values, incorporates into his/her identity, and spends a significant amount of time and energy with it. Apart from the general passion construct (called passion criteria, PC), the DMP also differentiates between harmonious (HP) and obsessive passion (OP) on the basis of the internalization process that occurs during activity engagement. Stemming from autonomous internalization, people become harmoniously passionate when they engage in a loved activity for its own sake and inherent characteristics (e.g., it is satisfying). In this case, people decide when and how to engage in the activity. As for OP where controlled internalization is present, the activity is still loved, but it overwhelms the individual who partakes in it due to experiences of intra- or interpersonal pressures, leading to loss of control and rigid engagement. Previous studies generally supported the association between HP and adaptive outcomes as well as OP and maladaptive outcomes (e.g., Carbonneau et al., 2008; Lalande et al., 2017; Orosz, Vallerand, et al., 2016; see also Curran et al., 2015). While the DMP also describes the ongoing development of passion (i.e., when the passionate activity is not engaged for the first time or in a new context), this has never been explicitly tested in research. Still, it is cardinal to examine the longitudinal development of passion for its more comprehensive understanding. This has also been reinforced by prior calls for longitudinal studies within passion research (Vallerand, 2015). Apart from investigating passion changes over time, the present study also considered theoretically-relevant individual (i.e., specific need fulfillment) and social (i.e., perceived parental styles) factors that are thought to influence this development.

Temporal Dynamics of Passion

Vallerand (2015) describes passion as being malleable and the development of passion as being an ongoing process. The amount of passion and the type of passion one has might change or fluctuate over a certain period of time depending on the form of internalization one experiences. Interestingly, the direct examination of the temporal

dynamics of passion has not been in the focus of research despite the fact that these investigations could provide important information about its nature. Still, indirect evidence coming from previous studies employing autoregressive models (e.g., Carbonneau et al., 2008; Fernet et al., 2014; Lalande et al., 2017; Lavigne et al., 2012) suggest that prior harmonious and obsessive passion scores had a moderate-to-strong predictive effect on subsequent passion scores, thus passion appears to be moderately stable over time.

However, one limitation of these studies, from the perspective of passion trajectories, is the use of said autoregressive models (ARM; Bollen & Curran, 2004). This approach rests on the assumption that the current value of a given variable is determined by its corresponding past value in an additive way. Accordingly, ARMs do not assess change directly, but rather indirectly of autoregressions (or auto-predictive effects) and the time-specific residual variances. These effects are interpreted as being the same for all individuals in a given sample. A suitable alternative is latent growth modeling (LGM; Bollen & Curran, 2006) which focuses on individual trajectories of change over time that are summed into a mean growth trajectory. An advantage of this approach is that it does not only examine stability over time, but development as well (i.e., increases or decreases over time). For instance, it is possible that a construct remains stable over time (i.e., people with prior higher scores retain higher scores, while people with prior lower scores retain lower scores), while still demonstrating development (i.e., everyone's score in the sample decreases). Thus, a strength of LGMs is that they provide a direct way to investigate *true* changes over time (see the Appendix S5.1 in the supplements for more details).

Predictors of Passion Trajectories

The development of passion is thought to be a function of individual and social factors (Vallerand, 2015) among which need fulfillment is of major relevance. Need fulfillment stems from Self-Determination Theory (SDT; Ryan & Deci, 2017) which describes three basic psychological needs (i.e., need for autonomy, need for competence, and need for relatedness) that are cardinal for achieving psychological health, optimal functioning, and a complete (instead of partial) internalization process (Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013). The DMP also supports this notion from the perspective of passion, highlighting that experiences of need fulfillment in relevant life contexts—such as education, work or sport—are necessary to achieve a more optimal

internalization process (i.e., autonomous) which might lead to HP. Conversely, unfulfilled needs might be conductive of suboptimal internalization processes (i.e., controlled), leading to OP. While previous studies have investigated the association between need fulfillment and passion (e.g., Lalande et al., 2017), the impact of need fulfillment on temporal passion changes remain understudied.

A particularly important distinction has to be made between general and specific need fulfillment. General need fulfillment refers to one's need-related experiences in life in general, while specific need fulfillment describes one's need-related experiences in a specific and important life domain such as work, school, or sports. Previous studies suggest that greater general or specific need fulfillment is positively associated with wellbeing and optimal functioning (see Ryan & Deci, 2017). One potential indicator of functioning might be passion given its harmonious and obsessive aspects referring to optimal and suboptimal functioning, respectively (see Yu et al., 2018 for an applicable process model). However, the majority of these studies have investigated these associations between variables that are within the same domain (e.g., general need fulfillment and general wellbeing or need fulfillment during sports and passion for sports).

Based on the findings of Lalande et al. (2017), we assumed that having unfulfilled needs in an important life domain might be associated with compensation in another domain or in a specific situation. That is, when one's needs are frustrated in an important life domain (e.g., work), this individual might start to "overengage" in a behavior pertaining to another life domain. Our proposition is also in line with Vansteenkiste and Ryan (2013) in that when psychological needs are obstructed, people are more likely to engage in compensatory behaviors to cope with this deficient state. One of the compensatory behaviors might be rigidly engaging in a certain activity that is thought to be able to provide a sense of structure and security (Vansteenkiste & Ryan, 2013). Examining domain-specific need fulfillment in relation to a passionate activity in a different domain also complements previous studies that solely examined how specific need fulfillment is related to general wellbeing (e.g., Baard et al., 2004; Milyavskaya et al., 2009; Milyavskaya et al., 2013; Slemp & Vella-Brodrick, 2014), but not to various ways of functioning.

Apart from individual characteristics, the social environment also represents an important determinant of passion. Research on passion has only marginally focused on the role of perceived parenting styles (i.e., care, overprotection, and autonomy-support)

despite the fact that these styles are thought to have great relevance for early and later human functioning as well (Bowlby, 2008; Drake et al., 2014). So far, the DMP mostly underscored the importance of autonomy-support not just in the initial, but also in the ongoing development of passion. By behaving in an autonomy-supportive way, the social environment (e.g., parents or family) might facilitate the autonomous internalization of the liked activity which might lead to HP, while parental control might contribute to controlled internalization and, in turn, OP (Bonneville-Roussy et al., 2013; Mageau et al., 2009). Additionally, evidence coming from research on developmental psychology suggested that negative parenting practices (i.e., higher overprotection and lower parental care) have been associated with problematic behaviors such as internet addiction or pathological gambling (e.g., Grant & Kim, 2002; Lin et al., 2009) which are similar to OP (e.g., Kovacsik et al., 2018; Tóth-Király, Bőthe, Tóth-Fáber, et al., 2017). Overall, it appears that both need-based experiences and perceived parenting styles predict passion. Still, no previous study has investigated their potential effect on passion growth trajectories.

The Present Investigation

The present study sought to provide further insight into the temporal dynamics of passion by directly examining the potential changes in HP, OP, and PC over the course of four months, thus contributing to a deeper understanding of passion. More specifically, with latent growth modeling, we investigated (1) the magnitude of mean initial values for HP, OP, and PC; (2) the presence of change over time; (3) the magnitude of this change; and (4) the effect of theoretically-relevant variables on the passion trajectories in the form of specific need fulfillment and perceived parenting styles of care, autonomy-support and overprotection.

<div align="center">

Materials and Methods

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Procedure and Participants

The research was approved by the University Research Ethics Committee of the Eötvös Loránd University and was conducted in accordance with the Declaration of Helsinki. For the purpose of this study, a Hungarian university, situated in the countryside, was contacted for participation. Consent was obtained from the president of the university, the professors, and the participants. They received information about the purpose of the study, and that participation was voluntary and confidential. They did not

receive any compensation for participation and they also provided written consent. Data gathering occurred during a four-month period from February 2018 (the beginning of the academic semester) to May 2018 (the end of the academic semester) where participants filled out paper and pencil questionnaires monthly. A total of 205 adult university students (64.4% female), aged between 19 and 41 (M = 22.14, SD = 2.54), participated in this study. The majority of them (82.4%) had a higher education degree, 42.9% lived in city with an additional 36.1% living in villages. The rational for this sample size was anchored in two reasons. First, practical limitations prevented us from recruiting participants from a larger initial pool. Second, previous studies reported that LGM models should include at least 100 participants (Curran, Obeidat, & Losardo, 2010; Hamilton, Gagné, & Hancock, 2003), with around 200 or more being preferable for 15 observed variables (Muthén & Muthén, 2002; Park & Schutz, 2005). Given that our models included eight observed variables (see below), 205 participants appeared to be satisfactory for the present case. Overall, the 205 participants completed a total of 600 time-specific questionnaires with 83.9% of participants provided at least 2 out of the 4 waves of data.

Measures

  Passion. At each wave, the Hungarian version (Tóth-Király, Bőthe, Rigó, et al., 2017) of the Passion Scale (Marsh, Vallerand, et al., 2013; Vallerand, 2015) was used which measures harmonious passion (HP; 6 items, e.g., "My activity is in harmony with other things that are part of me"), obsessive passion (OP; 6 items, e.g., "This activity is the only thing that really turns me on"), and the passion criteria (PC; 5 items, e.g., "This activity is important for me"). Participants were asked to think of an activity that was the dearest to their hearts (i.e., corresponded to the criteria of passion of a loved activity which is personally important and on which they spend significant amount of time and energy) and fill out the questionnaire about this activity. This decision ascertained that respondents were indeed passionate for their activities as opposed to being provided with an activity that they might or might not be passionate for. For instance, they were reportedly passionate for sports, being with their family or friends, cooking, or music. Participants reported the same activity at each time-point. Response options ranged on a seven-point scale (1 = not agree at all; 7 = very strongly agree).

  Basic psychological need fulfillment. At Time 1, the Hungarian version (Tóth-Király, Bőthe, Orosz, & Rigó, 2018; Tóth-Király, Morin, et al., 2018) of the 24-item Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015) was used to

measure need fulfillment. This instrument measures a total of six factors (representing need satisfaction and need frustration × autonomy, competence, and relatedness). Due to recent empirical results (see Appendix S5.2 of the supplements), need frustration was reversed and a general need fulfillment factor was used. Given that the educational context was a highly relevant one for the recruited participants, we slightly modified the instruction and the items so that they pertained to need-based experiences at the university. Items were rated on a five-point scale (1 = Not true at all for me; 5 = Very true for me).

Perceived parental styles. Also at Time 1, the Hungarian version (Tóth & Gervai, 1999) of the Parental Bonding Inventory (Parker et al., 1979) was administered which is a 25-item self-report instrument in which one has to recall experiences about parental practices and behaviors during the first 16 years of life. The questionnaire measured three parenting behaviors: care (12 items, e.g., "Spoke to me with a warm and friendly voice"), autonomy (6 items, e.g., "Let me dress in any way I pleased"), and overprotection (7 items, e.g., "Tried to make me dependent on him"). Items were rated on a four-point scale (1 = very like this; 4 = very unlike this).

Statistical Analysis

Data was first analyzed in SPSS 22 for preliminary analyses (e.g., demographics of the participants, estimation of means, standard deviations, internal consistency, and correlations). A particularly important challenge of research is to handle missing data which is inherent to longitudinal designs. To investigate the pattern of data missingness, Little's MCAR (Little, 1988) test was performed in SPSS where a non-significant value would suggest that data is indeed missing completely at random. Results supported the null hypothesis, $\chi^2(512) = 102.274$, p = .337, indicating that missing data is missing completely at random (MCAR). For this reason, full information maximum likelihood (FIML) was used for the handling of missing values for the main analyses. This decision was based on the previous studies showing that FIML outperforms alternative methods (e.g., listwise deletion or multiple imputation) in treating missing data (Enders, 2010; Enders & Bandalos, 2001; Graham, 2009, Jeličič, Phelps, & Lerner, 2009; Larsen, 2011) as missingness is treated as being conditional on all variables included in the analyses, but not on variables that are missing. Put differently, FIML uses all available information to estimate parameters for the model.

Subsequent analyses were conducted in Mplus 8.1 (Muthén & Muthén, 1998-2017) with the robust maximum likelihood estimator (MLR) to account for the potential non-normality of the data. To assess the longitudinal trajectories of passion, latent growth modeling (LGM; Bollen & Curran, 2006) was performed in which two growth factors were estimated: an intercept factor (set to 1 for all time-points as per typical specifications; Geiser, 2012) and a linear slope factor (coded in unit increments of 0-1-2-3 to reflect the monthly interval between the repeated measures)[18]. The intercept reflects the mean initial value, while the slope reflects the change over time. Time-invariant predictors were then incorporated into the models and were allowed to influence the growth factors. Models were estimated for HP, OP, and PC separately and with manifest variable indicators (mean scale scores) to avoid unnecessary model complexity relative to the sample size.

The adequacy of the models was evaluated with commonly used goodness-of-fit indices: the comparative fit index (CFI), the Tucker–Lewis Index (TLI), and the root mean square error of approximation (RMSEA) with its 90% confidence interval. According to typical interpretation guidelines (e.g., Hu & Bentler, 1999; Marsh et al., 2005), values greater than .90 and .95 for the CFI and TLI, respectively, are considered to represent adequate and excellent fit to the data, whereas values smaller than .08 or .06 for the RMSEA, respectively, indicate acceptable and excellent model fit.

Results

Descriptive statistics, internal consistency indices, and inter-factor correlations across the four time-points are reported in Table S5.1 of the supplements. Goodness-of-fit indices for all estimated models are reported in Table 1. These results showed that all LGM models had good fit to the data (CFI and TLI > .950, RMSEA < .080). Parameter estimates for these models are reported in Table 2, and the average trajectories are graphically presented in Figure 1. These results revealed highly similar information across HP, OP, and PC. The mean intercept factors were significant, but the mean linear slope factors were non-significant, suggesting that passion levels remained relatively high and stable for HP and PC as well as moderate and stable for OP. The significant variance parameter of the intercept showed inter-individual variability, suggesting that individual trajectories significantly differed from one another around the estimated mean trajectory.

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[18] Alternative quadratic and cubic models were also tested, but most of these failed to converge or had parameterization issues, suggesting that these growth changes might not be appropriate for the present data.

In addition, time-specific explained variances (R^2) indicated that the growth factors provided a relatively adequate depiction of the repeated passion measures, ranging from 39.1% to 90.8% for HP, 48.0% to 84.3% for OP, and 45.7% to 82.2% for PC.

Table 7.1. Goodness-of-Fit Statistics for the Estimated Models

	χ^2	df	CFI	TLI	RMSEA	90% CI of RMSEA
Latent Growth Models (intercept + slope)						
Harmonious passion	3.484	5	1.000	1.018	.000	.000-.080
Obsessive passion	11.336*	5	.965	.958	.079	.011-.141
Passion criteria	3.275	5	1.000	1.028	.000	.000-.078
Latent Growth Models with Predictors						
Harmonious passion	16.058	13	.978	.961	.037	.000-.089
Obsessive passion	17.850	13	.978	.962	.047	.000-.096
Passion criteria	14.166	13	.988	.980	.023	.000-.088

Note. χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; *$p < .05$.

Table 7.2. Parameter Estimates for the Final Latent Growth Models

	Harmonious passion			
Growth parameters	Intercept factor		Linear slope factor	
Mean	5.559 (.069)**		-.022 (.031)	
Variance	.398 (.111)**		.073 (.029)*	
Standardized correlations	—			
Linear slope factor	-.002 (.247)		—	
Repeated measures	Time 1	Time 2	Time 3	Time 4
Proportion of explained variance (R^2)	.391 (.107)**	.489 (.107)**	.554 (.057)**	.908 (.105)**
	Obsessive passion			
Growth parameters	Intercept factor		Linear slope factor	
Mean	4.039 (.088)**		.020 (.034)	
Variance	.775 (.155)**		.062 (.035)	
Standardized correlations	—			
Linear slope factor	.076 (.266)		—	
Repeated measures	Time 1	Time 2	Time 3	Time 4
Proportion of explained variance (R^2)	.480 (.090)**	.541 (.061)**	.755 (.048)**	.843 (.073)**
	Passion criteria			
Growth parameters	Intercept factor		Linear slope factor	
Mean	5.724 (.073)**		-.024 (.030)	
Variance	.509 (.139)**		.056 (.030)	
Standardized correlations	—			
Linear slope factor	-.022 (.053)		—	
Repeated measures	Time 1	Time 2	Time 3	Time 4
Proportion of explained variance (R^2)	.492 (.117)**	.457 (.058)**	.534 (.064)**	.822 (.127)**

Note. Numbers in parentheses are standard errors.; *$p < .05$; **$p < .01$.

Figure 7.1. Passion trajectories
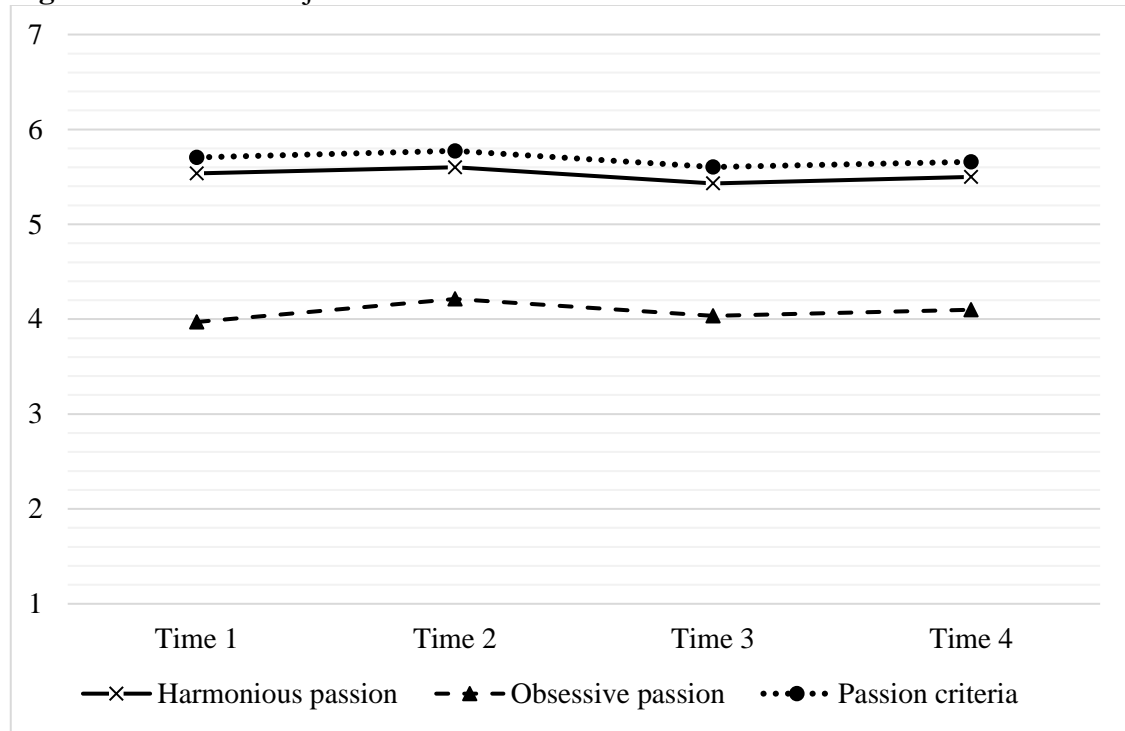
Note. Numbers on the horizontal axis represent time points, while numbers on the vertical axis represent the range of answer options for the Passion Scale. Models were estimated separately, but are depicted in the same figure for the sake of simplicity.

The incorporation of the predictors revealed several effects which mostly pertained to the intercept factor which might be attributed to the fact that predictors were measured in Time 1 (Table 3). The intercept factor of HP was positively predicted by need fulfillment and parental autonomy. While the slope of HP was not significant, parental care still had a small positive effect on it. The intercept of OP was positively predicted by parental autonomy and overprotection, while the slope of OP was negatively predicted by parental autonomy, despite the slope being non-significant. Finally, the intercept of PC was positively predicted by parental autonomy[19].

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[19] Initial auxiliary analyses were also conducted to test whether respondents' gender was related to either the initial passion values or the trajectories in all three models. However, none of the standardized regression coefficients were significant for harmonious passion ($\beta_{intercept}$ = -.038, p = .710; β_{slope} = .056, p = .585), obsessive passion ($\beta_{intercept}$ = -.065, p = .495; β_{slope} = -.256, p = .061), or the passion criteria ($\beta_{intercept}$ = -.086, p = .394; β_{slope} = .083, p = .518).

Table 7.3. Path Coefficients Between the Predictors and the Growth Factors

| Predictors | Harmonious passion | | | |
| | Intercept factor | | Linear slope factor | |
	b (SE)	β (SE)	b (SE)	β (SE)
Need fulfillment	.489 (.150)**	.362 (.108)**	.014 (.075)	.024 (.130)
Parental care	-.149 (.161)	-.099 (.104)	.182 (.087)*	.285 (.142)*
Parental autonomy	.326 (.122)**	.264 (.103)**	-.105 (.063)	-.199 (.102)
Parental overprotection	.121 (.127)	.104 (.107)	.030 (.061)	.061 (.126)

| Predictors | Obsessive passion | | | |
| | Intercept factor | | Linear slope factor | |
	b (SE)	β (SE)	b (SE)	β (SE)
Need fulfillment	-.206 (.196)	-.113 (.107)	-.016 (.095)	-.034 (.190)
Parental care	-.279 (.209)	-.137 (.104)	.110 (.093)	.203 (.189)
Parental autonomy	.655 (.171)**	.395 (.102)**	-.133 (.067)*	-.297 (.179)
Parental overprotection	.359 (.164)*	.230 (.101)*	-.071 (.062)	-.170 (.167)

| Predictors | Passion criteria | | | |
| | Intercept factor | | Linear slope factor | |
	b (SE)	β (SE)	b (SE)	β (SE)
Need fulfillment	.281 (.180)	.192 (.117)	-.028 (.091)	-.061 (.196)
Parental care	-.102 (.175)	-.062 (.108)	.105 (.078)	.205 (.172)
Parental autonomy	.318 (.120)**	.238 (.100)*	-.056 (.056)	-.132 (.139)
Parental overprotection	.222 (.128)	.177 (.099)	-.002 (.053)	-.004 (.133)

Note. b: unstandardized regression coefficient; β: standardized regression coefficient; SE: standard error; Need fulfillment was derived from the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015; Tóth-Király, Morin, et al., 2018); perceived parenting behaviors were derived from the Parental Bonding Inventory (Parker et al., 1979; Tóth & Gervai, 1999); and the passion factors were derived from the Passion Scale (Marsh, Vallerand, et al., 2013; Tóth-Király, Bőthe, Rigó, et al., 2017); *$p < .05$; **$p \leq .01$.

Discussion

Examining the stability of passion developmental processes is essential to better understand how the experiences of being passionate for a self-defining activity fluctuates over a certain period of time. To date, little scientific attention has been paid to the identification of ongoing passion changes despite that these investigations could provide valuable information on understanding developmental trajectories and on how to cultivate and foster passion which is thought to have several positive consequences (see Curran et al., 2015; Vallerand et al., 2015). This study sought to explicitly test the ongoing development of passion across a four-month period and, more importantly, offered to gain insight into the key individual and social determinants of this development. Moreover,

the present study answered prior call for an increased focus on longitudinal passion research (Vallerand, 2015).

Overall, all three forms of passion (harmonious passion, obsessive passion, and passion criteria) had elevated initial values, suggesting that participants were highly passionate. None of the slope factors were significant, indicating that passion levels remain high and stable. These findings are in line with prior studies which used ARMs which indirectly measured change (e.g., Carbonneau et al., 2008; Lalande et al., 2017). Interestingly, Mageau et al. (2009) examined the initial development of passion (i.e., respondents who experienced the activity for the first time) and found that 35% of the children developed a moderate level of passion for music after a 5-month period. On the other hand, Schellenberg and Bailis (2015) reported that academic passion changed very little over the course of a semester for most of the first-year students. It is possible that while first-year university students had previous experiences with academics and studying as an activity, they reported about their experiences in a relatively new context that is the university. These seemingly contradictory results might be indicative of an overarching developmental model: it is possible that while the initial development of passion in childhood or in early activity engagement (i.e., from being non-passionate to passionate) occurs more dynamically, the ongoing development among young adults is likely to be a slower process (Schellenberg & Bailis, 2015; Vallerand, 2015). The present study nicely complements those of Mageau et al. (2009) as well as Schellenberg and Bailis (2015) in that the former investigated the initial development of passion (from non-passionate to passionate), while the latter examined how passion for a previously engaged activity manifests in a new context. Adding to them, the present study provides a "snapshot" of the extent to which passion changes in a sample of participants who were thought to have been engaging in their activities for quite some time.

Adopting the theoretical perspectives of SDT (Ryan & Deci, 2017) and attachment theory (Bowlby, 2008), the present study demonstrated that individual and social factors also had independent effects on passion trajectories. Parental autonomy-support predicted HP, and PC. These results are consistent with other research (Bonneville-Roussy et al., 2013; Liu et al., 2011; Mageau et al., 2009) showing that parental autonomy-support provides children with the opportunity to freely engagement in activities and fully experience them, leading to autonomous forms of engagement and, in turn, HP and PC. Somewhat surprisingly, autonomy-support also predicted OP which has not been reported in the above-mentioned previous studies. This discrepancy might

be attributed to the fact that autonomy-support as measured by the PBI is akin to permissive or laissez-faire parenting style which is characterized by a lack of involvement and guidance from the part of the parents. On the other hand, typical SDT research interprets autonomy-support as the provision of constructive, positive feedback, clear rules and goals as well as the possibility of offering guidance and help when necessary (Soenens & Vansteenkiste, 2010). Prior studies have already linked permissive parenting with self-regulatory deficits (Piotrowsky et al., 2013), problematic drinking (Whitney & Froiland, 2015) and other maladaptive behaviors (Mahdavi, Esmaeilpour, & Khajeh, 2013) which are similar to OP. Permissive parenting might provide too much freedom and might lack restrictions that could, in turn, facilitate the initial development of obsessive passion. Overall, from the perspective of parents, it might be important to achieve balance in autonomy-support: while autonomy-support that includes parental involvement might be beneficial for passion, permissive autonomy-support that lacks said involvement might tip this balance in the favor or obsessive passion.

As expected, parental overprotection predicted initial levels of OP which align with the addiction-related literature (e.g., Grant & Kim, 2002) by demonstrating that negative parental practices (e.g., invading the children's privacy or trying to control them) are likely to hinder children in freely exploring the surrounding environment for various activities. In this case, when overprotected children eventually find a self-defining activity, it is more likely that they become over-engaged with it to counter the negative experiences. In addition, this overprotective environment might foster the development of controlled internalization, leading to OP.

At the same time, while not influencing changes in HP, parental care positively predicted the slope of HP. It appears that positive parental practices might be associated with HP by providing a sense of security that might allow the child to immerse in different activities and experience them for their own sake. A possible explanation might be that parental care involves practices (i.e., being affectionate, praising, or making the child feel better) that might satisfy the child's basic psychological needs, allowing for contingency-free activity exploration and engagement. Still, as no actual changes were observed in HP, these findings only provide tentative support for this proposition and the results should only be interpreted with caution.

Finally, basic psychological need fulfillment positively predicted initial HP levels (but not OP), further supporting the relevance of these needs in optimal functioning. Based on the SDT (Ryan & Deci, 2017), the DMP (Vallerand, 2015) posits that the

internalization of an activity becomes complete when needs are fulfilled; that is, when people experience psychological freedom, effectiveness, and reciprocal care with other in a key life context, they are more likely to function in an autonomous way which is conductive of HP. This was contrary to our expectation related to the potential compensatory response of OP to unfulfilled needs (Lalande et al., 2017). It may be that the effect of positive experiences in an important life domain (i.e., fulfilled basic psychological needs) generalize to other aspects of life. Previous studies in the domain of sport have already reported that context-specific need fulfillment was significantly related to HP, but not—or even negatively—to OP (Curran et al., 2013; Verner-Filion & Vallerand, 2018). Interestingly, similar results emerged in the present study in spite that need fulfillment focused on a life domain (i.e., education) that was relevant for the participants, but passion itself was not related to academics. It appears that when basic psychological needs are fulfilled in an important life domain, people do not only engage in the corresponding activity with HP, but they might also engage in another self-defining activity with HP. Overall, it is possible to hypothesize that having satisfactory experiences in a significant life domain might "aid" participants in finding an activity in which they can engage in a harmonious and more optimal way.

This study made two important contributions to the passion literature. First, the data and the analyses provided a more complete picture about the stability and developmental trajectories of passion. Second, the present findings extended prior studies by demonstrating the dual role of parental autonomy-support, and the importance of overprotection and parental care.

Notwithstanding these strengths, there are some limitations that need to be addressed. Participants were recruited from a single university which limits the generalizability of the findings. Sample size in the present study might also be considered moderate. Further studies are needed with more comprehensive samples (including more participants) to ascertain generalizability, possibly recruiting younger samples, given that adolescence might be a more sensible period than adulthood. The synthesis of previous (Mageau et al., 2009; Schellenberg & Bailis, 2015) and present findings suggests that the developmental process of passion is more complex as it appears to be a relatively malleable at a young age, but becomes more stable when one is older. Given that our sample only included university students, it would be equally important to recruit older individuals as they might have less opportunities in finding another self-defining activity compared to students. Future studies might aim to identify the exact point in this process

over which the development slows down and passion becomes more stable. Although attrition did not appear to bias the results, future studies could employ additional strategies to increase participant retention (e.g., conduct research in an online setting, reminder messages). A larger sample size would also allow for the use of latent variables which are naturally corrected for measurement error.

Passion appears to remain stable across a four-month period, suggesting that replications should be made with more spaced intervals between the measurement phases, possibly ranging over a year or even more. It has to be noted that the predictors were mostly related to the initial levels of passion, but not to the growth factors, with the exception of harmonious passion and parental care. However, as no HP changes were observed, these findings should only be cautiously interpreted. Although predictors were only measured at Time 1 which might account for their effects mostly pertaining to the initial passion levels, it remains as a limitation. Apart from the selected predictors, other variables might also influence passion trajectories. These issues represent opportunities for further research. Finally, it might be a fruitful endeavor to more precisely map the frequency of engagement in the passionate activities (e.g., hours per week or years engaging in the activity) as these indicators might be important differentiators with respect to the initial versus ongoing developmental process.

Taken together, this research answers calls for longitudinal studies in understanding the ongoing development of passion and demonstrates that passion remains highly stable across a four-month period. At the same time, parental autonomy-support and overprotection as well as need fulfillment are relevant predictors of the passion trajectories. These findings entail a number of important practical implications: to foster passion (any forms), parents might need to be autonomy-supportive. For taming obsessive passion, parents might need to avoid being overprotective. For nourishing harmonious passion, the basic psychological needs in specific life areas might need to be fulfilled.

Chapter 8: General Discussion

In the last 15 years, scientific interest and research in passion grew greatly with the introduction of the Dualistic Model of Passion (DMP; Vallerand et al., 2003) which was aimed to be a response to the call of Seligman and Csikszentmihalyi (2000) to identify factors that could contribute to optimal functioning and a more fulfilling life. Passion research has been successful in demonstrating the distinctiveness of harmonious (HP) and obsessive passion (OP) and explaining how these two forms of passion lead to different outcomes across various fields (see Curran et al., 2015; Vallerand, 2015). Passion research also provided support for the initial development of passion (Mageau et al., 2009). Still, despite these results, less is known about the temporal dynamics and the ongoing development of passion which has not been explicitly tested. Thus, the aim of this dissertation was to provide a comprehensive examination of the ongoing development of passion. To this end, five empirical studies were conducted using cross-sectional and longitudinal data based on a variety of community and comprehensive adolescent and adult samples. First, the findings of the empirical studies are summarized and then discussed in light of the DMP. Second, the strengths and limitations of the overall research project are discussed, followed by potential future directions that could move this research stream forward. Finally, practical implications are discussed.

Summary of Findings: Studies 1 to 5

Study 1. Study 1 reported the adaptation and validation of the Passion Scale (Marsh, Vallerand, et al., 2013) by comparing alternative CFA and ESEM models on a large combined community sample as well as a comprehensive sample of adults. Simultaneously, the equivalence of the constructs was also tested via measurement invariance, MIMIC models, and a hybrid model across gender and age groups. The results revealed that: (a) the Passion Scale has a two-factor structure that could reliably assess both HP and OP; (b) complete equivalence was achieved across gender groups, and (c) partial equivalence was achieved across age groups as well as the combination of gender and age groups with negligible effects of age.

Study 2. Study 2 examined the representation of need fulfillment to test whether need satisfaction and need frustration are better represented as an underlying bipolar continuum (with each being at the two extremes of the continuum) or rather as two distinct constructs, using a community sample of adults. Additionally, the criterion-related validity of this improved representation was also tested. The results revealed that: (a) the

final representation included a need fulfillment global factor co-existing with the six specific factors (satisfaction and frustration × autonomy, competence, and relatedness); and (b) the global factor substantially predicted positive and negative affect with some of the S-factors having additional minor effects.

Study 3. Study 3, using a community young adult sample, explored the presence of distinct general need fulfillment profiles and tested the importance of having a balanced versus imbalanced profile. In addition, it was also tested whether membership to these profiles was associated with different levels on the profile outcomes of HP/OP and positive/negative affect. Finally, perceived interpersonal behaviors were also included as predictors of profile membership. Results revealed that: (a) four profiles were identified (Satisfied, Relatedness, Average, and Frustrated); (b) it appears to be important whether needs are balanced or imbalanced; (c) profiles differed from one another in OP, but not in HP; (d) profiles also differed from one another in negative affect and, to a smaller extent, positive affect; and (e) profile membership was predicted by the perceived need nurturing global factor and some of the specific factors.

Study 4. Study 4 examined how HP and OP is predicted by perceived parental behaviors (i.e., the social environment) of parental care, overprotection, and autonomy-support. It was also examined how HP and OP predict subjective wellbeing. For this investigation, a sample of adolescents and a comprehensive sample of adults was recruited. The results were partially similar across the two samples and revealed that: (a) parental care predicted HP among adolescents, but not adults; (b) overprotection predicted OP among both adolescents and adults; and (c) subjective wellbeing was associated with HP, but not with OP.

Study 5. Study 5 explored the ongoing developmental trajectories of passion over a four-month period among young adults and also tested whether individual (i.e., need fulfillment) and social (i.e., perceived parental styles) factors influence the temporal changes. The results revealed that: (a) HP, OP and CP had elevated initial levels and remained high and stable across the four-month period; (b) parental autonomy-support predicted all three passion factors; (c) parental overprotection predicted OP; and (d) need fulfillment predicted HP.

Discussion of General Findings

The temporal stability of passion. Arguably, one of the most important aspects of the present dissertation was the explicit examination of the ongoing development of passion.

Passion is thought to be malleable, suggesting that it might change over time as opposed to, for instance, more stable personality traits (e.g., Costa & McCrae, 1994). This temporal change (regardless of being an increase or a decrease) might not only occur during initial development (i.e., when ones becomes passionate from non-passionate), but in later stages of activity engagement as well (i.e., when one becomes non-passionate from being passionate). Despite this assertion, however, the ongoing development of passion in this dissertation was not characterized by a dynamic change, but rather by stability. This is in contrast with Mageau et al. (2009) who focused on the initial development of passion, but agrees with Schellenberg and Bailis (2015b) and Martin (2016) who both focused on the ongoing development. Despite not explicitly examining passion changes, several studies have reported moderate-to-high associations between passion scores measured at two different time points (e.g., Carbonneau et al., 2008; Lavigne et al., 2014) among respondents who were thought to have been passionate for quite some time. It appears that once passion is developed, it remains on the same level, at least over the course of the four-month period of the present dissertation.

The present findings align more closely with those focusing on the ongoing development of passion. First, Schellenberg and Bailis (2015b) investigated how academic passion changed over the course of an academic year (ranging from October to March) for first-year university students. They found that academic passion did not change for the majority of the participants, while there were some changes for a subsample of participants in which OP showed a striking increase. Similar results were reported by Martin (2016) with respect to passion for sports in a sample of high school athletes. Martin's results also show that passion scores remain highly stable across a sporting season (ranging from August to October). A common point of these two studies and the present dissertation is that all three focused on the ongoing development of passion in which respondents have already been engaging in their passionate activities for some time as opposed to the study of Mageau et al. (2009) where they recruited participants without any prior experience to music instruments.

In general, therefore, these various studies provide complementary information to one another with results converging in the same direction regarding an overarching

developmental model of passion (see Figure 8.1 for an illustrative depiction). As suggested by Mageau et al. (2009), initial passion development might be a dynamic process during which people engage in their selected activity for the first time and they go from being non-passionate to being passionate. However, the ongoing development of passion might be a much slower process compared to the initial development as it involves a continued engagement for the maintenance of passion. In other words, during initial development, people start to spend quantitatively more time with their activity; however, during the ongoing development, they spend the same amount of time with the activity. This proposition is supported by the activity involvement models of Bloom (1985, see also Vallerand, 2015) and Côte (1999) describing sustained activity engagement. The findings of the present dissertation provide evidence attesting these models. A closing metaphor might be adequate here: the initial development of passion might be akin to the honeymoon period of marriages as people constantly learn new and exciting things about their passionate activity and they start to value it more and more. Still, after spending some time with the activity and "getting to know it", people might reach a "settlement period" in which they just simply enjoy being involved in it. Figure 8.1 depicts the initial, more dynamic development followed by three distinct potential pathways: (1) passion remains high and stable; (2) passion remains moderate and changes a bit; and (3) passion changes substantially and extinguishes.

Figure 8.1. A graphical illustration of the developmental model of passion
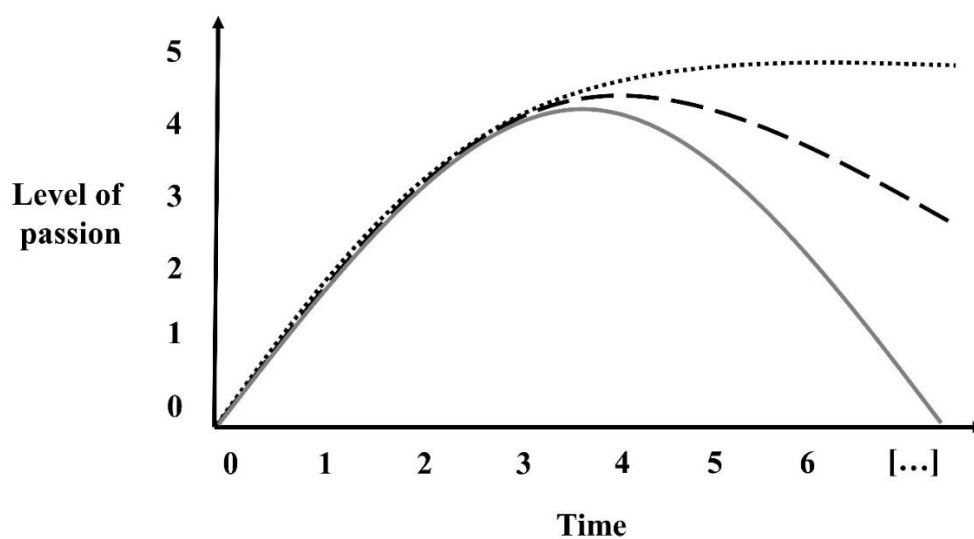
Note. Time and level of passion increments are for illustrative purposes.

General need fulfillment predicts OP. Apart from the longitudinal changes themselves, the DMP also asserts that individual and social factors influence both the initial and the ongoing development of passion (Vallerand, 2015). Chief among the individual factors is need fulfillment as the highly fulfilled needs of autonomy, competence, and relatedness are thought to be conductive of an optimal, autonomous internalization process resulting in HP, while unfulfilled needs are thought to be related to a suboptimal, controlled internalization process, leading to OP. Findings of the present dissertation partially supported this proposition and showed a more nuanced picture about the importance of general versus specific need fulfillment. In the subsequent part, first, the results pertaining to global need fulfillment are discussed (Chapter 5), followed results involving the specific needs (Chapter 7).

Results of the present dissertation showed that general need fulfillment was not associated with HP levels. In other words, having satisfied needs in life in general is not related to being harmoniously passionate for an activity. This finding is consistent with Lalande et al. (2017) as well as Tóth-Király, Bőthe, et al. (under review) who investigated need satisfaction outside the activity (i.e., general need fulfillment). They argue that with HP people engage in a particular activity for its own sake and not for compensatory purposes. This way, HP provides an additional avenue for experiencing various aspects of life instead of becoming fixated with a particular activity.

Another important finding was that membership to the more frustrated profiles was associated with higher levels of OP. This result is consistent with the theoretical work of Vansteenkiste and Ryan (2013) as well as the empirical work of Lalande et al. (2017) and Tóth-Király, Bőthe, et al. (under review). As discussed in Chapter 5, when people experience need frustration (i.e., forced to act or behave in a certain way, feel rejected or isolated, and feel like a failure), they are in a need-deprived state in which they might resort to the use of coping mechanisms that could potentially counter this deficit (Vansteenkiste & Ryan, 2013). One potential way would be engaging in compensatory behaviors in a rigid and persistent manner due to the fact that it can provide a sense of security and structure that is lacking in need frustration. As need frustrated people become more sensitive to environmental cues that have the potential to counter this deficit state (Vansteenkiste, Niemiec, & Soenens, 2010), they could see their passionate activity as a route toward need satisfaction. For this reason, they might start to engage in it in an obsessive manner because they might feel that it could temporarily restore their need satisfaction. However, because need frustrated people are more likely to stick to their

passionate activities and because OP is known to lead to maladaptive outcomes (Curran et al., 2015; Vallerand, 2015), people might become inflexible and might be less likely to find an actual solution and instead begin a vicious circle. Overall, experiencing need satisfaction could be seen as a protective or resilience factor against OP, while general need frustration could be seen as a potential risk factor of OP.

Specific need fulfillment predicts HP. The results of the longitudinal study in Chapter 7 did not align with the results mentioned above. It was hypothesized that similar mechanisms might be at play in the case of specific need fulfillment; that is, when people's needs are frustrated in an important life domain (e.g., work), they were thought to seek out an activity outside this domain with the aim of restoring their sense of need fulfillment. However, based on our results, this was not the case. More specifically, specific need fulfillment predicted HP (but not OP) which is the exact opposite of the above-mentioned findings of Chapter 5. These apparently contradictory findings suggest that when people's needs are fulfilled in an important life domain, they might experience a sense of freedom, effectiveness, and care that allows them to explore other activities in other life domains. For example, one experiences need fulfillment at a need-nurturing work environment, this worker might start to engage in, for instance, sport in a harmonious way.

In a similar manner, when the worker's needs are fulfilled in the workplace, (s)he might not feel the desire to engage in another activity in an obsessive way, because no compensatory behaviors are "needed". Prior studies have reported positive associations between specific need fulfillment and HP, but results pertaining to OP are rather mixed: while some studies reported non-significant relations between OP and specific need fulfillment (Verner-Filion & Vallerand, 2017; 2018), others identified small, but still positive associations (Curran et al., 2013; Forest et al., 2011). Still, in general, it seems that having fulfilled basic psychological needs in an important life domain might mean that people have a domain in which they are able to develop their skills and their self-efficacy which, in turn, might serve as a basis for them to "try themselves out" in other life areas.

Integrating general and specific need fulfillment in the prediction of passion. Considering the results of general and specific need fulfillment together might highlight the rather complex role that need fulfillment might have in relation to passion, particularly in light of a hierarchical need fulfillment model (Milyavskaya et al., 2013; Ryan & Deci, 2017). It appears to be of great importance whether one investigates general or specific

need fulfillment as (1) general need fulfillment might be predictive of OP, suggesting that people are more likely to "overengage" in an activity when they feel that their needs of autonomy, competence, and relatedness are frustrated in general; but (2) specific need fulfillment might be predictive of HP, suggesting that when people having need fulfilling experiences in an important life domain might "find" an activity in another life domain in which they can engage in a harmonious way.

So far, only the multi-study investigation of Lalande et al. (2017) tested a similar proposition by contrasting the effects of need satisfaction outside the passionate activity (i.e., general need fulfillment) and need satisfaction inside the passionate activity (i.e., specific need fulfillment). Their results showed that (1) general need satisfaction negatively predicted OP, but not HP—a result which aligns with the present dissertation. At the same time, (2) specific need satisfaction predicted both HP and OP—a result which is not fully in line with the present dissertation. The slight differences pertaining to OP might be attributed to two factors. First, Lalande et al. (2017) only examined need satisfaction, but not need fulfillment which is joint construct rooted in *both* need satisfaction and need frustration. Second, they examined passion and specific need fulfillment within the same domain (e.g., passion for basketball and need fulfillment while playing basketball). From this perspective, the present dissertation complements the findings of Lalande et al. (2017) by examining the associations between specific need fulfillment in an important life domain and an unrelated passionate activity. As far as the author knows, there is only one preliminary study that aimed to replicate the findings of Lalande et al. (2017) with the simultaneous inclusion of both general and specific need fulfillment (Tóth-Király, Salamon, Bőthe, Rigó, & Orosz, in prep). Results of this preliminary study suggests that, when considered at the same time, general need fulfillment predicts OP (but not HP), while specific need fulfillment predicts HP (but not OP).

Based on these various findings, it can be suggested that the relationship between need fulfillment and passion might be interpreted in a three-fold manner. *First*, when basic psychological needs are interpreted on a general, global level, compensatory mechanisms might be at play that might orient people toward OP. *Second*, having basic psychological needs within the same domain as passion might reveal how one form of passion might turn into the other form and vice versa. *Third*, when basic psychological needs are interpreted within an important life domain that is not related to passion, it might be indicative of a general background experience that might allow people to have

harmonious experiences in other domains of life as well. Arguably, the present dissertation is only able to provide a small step toward understating these complex relationship patterns. Future studies are needed to examine whether these results are country-specific or more generalizable.

   Perceived parental behaviors matter with respect to passion. Finally, besides individual characteristics, the social environment is also thought to play a key role in the development and maintenance of passion. The present dissertation corroborates this proposition by focusing on parents as important agents in one's social environment. Parental *care* positively predicted HP among adolescents, suggesting that parents might be able to provide children with a sense of security and fulfill their needs through positive parenting practices so that children would seek out and engage in activities in a contingency-free manner. Similar results have emerged in the scientific literature with respect to the authoritative parenting style identified in the classification of Baumrind (1966, 1971). Within this theory, authoritative parenting has been described as including warmth, punishment-free disciplining, appropriate demands and guidelines as well as consistency. Several prior studies highlighted the role of authoritative parenting in relation to various outcomes such as wellbeing and ill-being (Milevsky, Schlechter, Netter, & Keehn, 2007), secure attachment (Karavasilis, Doyle, & Markiewicz, 2003), more positive dietary behaviors (Kremers, Brug, de Vries, & Engels, 2003), and higher achievement at school (Spera, 2005). Still, HP and care were not related to one another in the cross-sectional adult and longitudinal adult samples which might suggest that the positive effects of parental care might only manifest when children live with their families. Future longitudinal studies should be conducted to test this proposition.

   Parental *overprotection* predicted OP, providing further evidence for the effects of negative parenting practices. When parents are overprotective, they might not provide children with enough opportunities to explore their environments and become engaged in activities of their choice. Instead, overprotective parents might orient their children toward a particular activity that they think might be suitable. Naturally, children experience this lack of volition or control and, as a result, might seek out activities which might help them restoring their sense of control. Feeling deprived of choice might lead children to engage in an activity in an obsessive manner so that they might experience volition. Overprotection is akin to Baumrind's (1971) authoritarian style which is characterized by low warmth, punishment as a result of discipline, inconsistent and behavior as well as the assertion of power when children make mistake and the provision

of overly strict guidelines. The adverse effects of parental overprotection/authoritarian style are widely reported in the literature as it has been associated with performance orientation (Gonzalez, Holbein, & Quilter, 2002), extrinsic motivation (Ginsburg & Bronstein, 1993), internalizing and externalizing problems (Aunola & Nurmi, 2005), and aggression (Chen, Dong, & Zhou, 1997). While the effects of overprotection were small, it was consistent across studies, suggesting that parental overprotection might be a predictor of OP.

Results pertaining to *autonomy-support* were inconsistent and aligned less with previous studies, potentially shedding new light on the interpretation and conceptualization of autonomy. While prior studies showed that autonomy-support is related to HP (but not to OP; see Vallerand, 2015), the present dissertation painted a somewhat different picture. Both HP and OP were associated with autonomy in the longitudinal study (but not the cross-sectional one). For this reason, these results should only be interpreted cautiously and in a tentative manner. Still, based on the present dissertation, this inconsistency might be related to the interpretation of autonomy. As mentioned in Chapters 6 and 7, autonomy-support might have been understood as permissive or laissez-faire parenting style, again similar to Baumrind's (1971) classification. This style is characterized by low supervision and lax expectations where parents might even be unconcerned of their children's life and, as a result, do not establish rules or guidelines for them. These children might feel that they are free to do whatever they want to without any parental constraints. This permissive style might allow people to freely explore activities that they might become passionate for. However, permissive parenting might allow children to become involved in activities whose management and elaboration might exceeds their regulatory skills. An illustrative example might be when young children spend too much time with video games because their parents do not monitor their behavior enough. In addition, permissive parents might not be involved enough with the activity selection of their children, but their involvement would help the development of children's self-regulation. At the same time, it has to be noted that prior results on permissive parenting appear to be inconsistent (Uji, Sakamoto, Adachi, & Kitamura, 2014) compared to care and overprotection, echoing the present findings.

In general, the classification of parenting styles used in the present investigation (i.e., parental care, autonomy-support, and overprotection; Parker et al., 1979; Tóth & Gervai, 1999; Xu et al., 2018) closely resembles the classification of Baumrind (1971). The results of the present dissertation and those of previous studies suggest that

caring/authoritative parenting is an optimal parenting style that leads to positive experiences mostly for children, overprotection/authoritarian is not optimal at all, where the role of autonomy-support/permissive parenting is unequivocal. On a related note, Durkin (1995) highlighted that the caring/authoritative parenting style is optimal, because it provides (1) emotional security and independence; (2) clear expectations and goals; and (3) bidirectional communication. Overall, this parenting style appears to reflect best on the basic psychological needs of others. At the same time, early parental experiences do not appear to have a substantial role in influencing one's passion.

Strengths of the Present Dissertation

This dissertation provided some theoretical and methodological contributions to passion research which are detailed in the following sections. For completeness, this section focuses on the contributions of the dissertation as a whole rather than restating the strengths of the individual studies that were conducted within its framework. The same approach applies to the subsequent Limitations section.

Theoretical contributions. So far, only a limited number of studies have been conducted with the explicit aim of examining the temporal changes of passion. The results of the present dissertation complement these prior studies and allowed us to gain insight into the nature of passion and to gain a deeper understanding of its underlying mechanisms. In addition, relying not just on the DMP, but also on the SDT and on the attachment theory made it possible to examine the temporal dynamics of passion through a multidimensional lens rooted in social-, positive- and developmental psychology. With their inclusion as theoretical guides, they provided new perspectives and, in conjunction, provided a more powerful and, at the same time, more detailed understanding of passion. For instance, the present dissertation is among the first ones to directly test the role of parental care and overprotection in relation to passion. Another contribution is the novel examination of the relationship between passion and need fulfillment by (1) including a combination of need satisfaction and need frustration for a more complete representation and by (2) showing the differing effects of global versus specific needs. Yet another contribution of this dissertation is that it extends passion research with a substantial body of Hungarian findings which might help future studies in cross-cultural examinations given the different characteristics of Eastern-European and Western or overseas countries (Hofstede, 2001; Hofstede et al., 2010). A final contribution pertains to the use of diverse samples. While the present dissertation made use of community samples mostly

comprised of young adults, it also included comprehensive and adolescent samples. The latter is particularly important given the paucity of passion studies conducted with children.

Methodological contributions. This dissertation also has some methodological strengths and contributions by using novel statistical methods. The present dissertation includes studies which were the first ones to employ the ESEM (Chapter 3; Marsh et al., 2014) and the bifactor-ESEM (Chapter 4; Morin et al., 2016) frameworks in Hungary (as far as the author knows). This was necessary to achieve a more precise representations of the constructs at hand and to capture the multidimensional and complex nature of passion and need fulfillment. The use of the bifactor-ESEM framework also contributes to the literature of SDT and the ongoing discussion about the dimensionality and representation of need fulfillment. In addition, user friendly input files have also been provided so that others could also embark on using such state-of-the-art methods when appropriate. Apart from these approaches, other powerful and diverse analyses have also been employed such as LPA (Chapter 5), fully latent variables controlled for measurement error (Chapter 6) or LGM (Chapter 7). Another strength is that all constructs were measured by multiple items and the instruments had strong psychometric properties in terms of factor structure and reliability. As a result, the adapted questionnaires could also be used in future Hungarian studies.

Limitations and Future Directions

Despite the strengths of the present dissertation, it is not without limitations which should be addressed. First and foremost, while the DMP is a well-established theory based on empirical data, future studies should aim to elucidate the differences and fine-grained differences between passion, engagement, and addiction. Although some of the recruited samples were diverse and included both adults and adolescents, the generalizability of the present results is still debatable. For this reason, future studies should strive to recruit participants with more diverse background characteristics. In addition, replications in other countries and cultures should also be performed as different economic and cultural characteristics could also influence one's activity selection and passion. While gender was not associated with passion in the above-mentioned studies, attempts should be made in the future to have a more balanced gender ratio. Moreover, it would be highly important to conduct passion research among younger participants as initial activity engagement and activity selection is likely to occur in that age range. Comparing younger and older

individuals might also reveal important information about the generalizability of passion changes.

All studies were self-reported and questionnaire-based which could lead to potential biases (e.g., social desirability bias or recall bias), thus these should be taken into consideration in the interpretation of the results. For this reason, future studies should include more objective indicators of activity engagement (if possible). Given the questionnaire-based design, it is also important to mention that causality cannot be inferred from the present findings. To address this issue, experimental designs are needed. Another future endeavor would be to conduct 360-degree multi-informant assessment involving the relevant social agents (i.e., not just parents, but peers, coaches, teachers, etc.) who might potentially influence one's activity engagement (see Crocetti, Branje, Rubini, Koot, & Meeus, 2017 or Mabbe, Soenens, Vansteenkiste, & Van Leeuwen, 2016 for a similar application). It might also be particularly interesting to conduct a longitudinal study with 360-degree assessment to more clearly delineate the effect of individual and social factors.

The present dissertation (and Chapter 7 in particular) might serve as a basis for future longitudinal passion studies. As mentioned above, the initial development of passion appears to be more dynamic. Diary studies might provide a useful way to explore the more nuanced changes in passion during this period. Additionally, while it was outside the scope of the present dissertation to examine whether substantially important life events (e.g., unemployment or breakup) have an impact on passion trajectories, future longitudinal studies should take the potential role of life events into account. Naturally, an ideal longitudinal study would involve following participants for years. While this design would certainly be costly, it would allow for a more comprehensive examination of passion trajectories, particularly if it involves participants who are at the initial developmental phase. Growth mixture analyses (Muthén, 2002) could also be useful in identifying various subgroups of participants characterized by distinct growth trajectories. It might also be a worthwhile future goal to examine whether the two types of passion can transform (i.e., HP into OP or vice versa). Furthermore, people might be passionate for more than one activity at a time (Schellenberg & Bailis, 2015a), thus future studies might also focus on examining changes in multiple passions.

As for the predictors of the trajectories, a bi-directional relation might be possible between passion and need fulfillment. Future studies should test this assumption either with autoregressive or autoregressive latent trajectory models (Bollen & Curran, 2004,

2006; Pakpahan, Hoffmann, & Kröger, 2017). The assessment of parenting styles focused on the perception by the participants rather than the actual parental behavior. While others' perceptions are thought to influence one's motivations and passion instead of others' behavior per se (Deci, 1975), it is still a limitation that should be addressed in future studies. Future studies should also focus on more deeply understanding the distinction between actual autonomy-support and laissez-faire parenting styles in relation to passion. Although predictors used in the present dissertation were selected on the basis of their theoretical relevance, there are certainly other variables that could influence passion (see the Introduction for more details). Future studies should strive to include these additional variables. For instance, rewards derived from the activities might also be related to passion. There might even be socio-cultural characteristics (i.e., availability and popularity of an activity) that might influence activity selection itself. Passion might also be influenced by the amount of free-time one has in life. All these factors should be considered in future studies so that it became possible to identify which variables are important in the development and maintenance of passion.

Practical Implications

The findings of the present dissertation—that both need fulfillment and perceived parenting behaviors influenced passion—provide more specific suggestions for intervention strategies. As mentioned at the end of Chapter 5, one's subjective need-related experiences are shaped by the surrounding social environment (Ryan & Deci, 2017), focusing on the elements of autonomy-support (reflecting on the need for autonomy) as well as the provision of structure (reflecting on the need for competence), and involvement (reflecting on the need for relatedness). All three of these elements have unique characteristics (Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens, 2014; Jang et al., 2016; Ntoumanis, Quested, Reeve, & Cheon, 2017; Yu et al., 2018): *autonomy-support* refers to the acknowledging the perspective of others, using a non-controlling informational language, offering meaningful choices, giving a meaningful rationale when explaining a decision. *Structure* involves the creation of a predictable and consistent environment, the adequate communication understandable directions, boundaries, expectations and guides as well as the provision of constructive feedback. Finally, *involvement* refers to being dedicated to and being personally interested in other people by investing time, energy, and resources in them as well as interacting with them in a friendly and warm manner.

Chapter 8: General Discussion and Conclusion

Several scholars (e.g., Mageau & Vallerand, 2003; Ryan & Deci, 2017) have underscored the importance of autonomy-supportive behavior. Experimental and intervention studies (Chatzisarantis & Hagger, 2009; Cheon, Reeve, Lee, & Lee, 2018; Cheon & Reeve, 2015; Cheon, Reeve, & Moon, 2012; Cheon, Reeve, & Song, 2016; see Su & Reeve, 2011 for a meta-analysis) represent an increasingly important branch of SDT, supporting the above-mentioned theoretical works with empirical findings that autonomy-supportive behavior can be learned by teachers and that it is effective in increasing students' need satisfaction, autonomous motivations and learning-oriented behavior while, at the same time, decreasing need frustration, amotivation, and even antisocial behavior. This is reasonable as providing autonomy-support could allow for a contingency-free activity selection which is cardinal for the development of HP. Importantly, the effect of these interventions on teachers' behavior appear to be lasting a year later (Cheon & Reeve, 2013) and they also appear to be effective in high-stake situations (Cheon, Reeve, Lee, & Lee, 2015), among people with special needs or disabilities (Haakma, Jansse, & Minnaert, 2017) as well as patients (Williams, Freedman, & Deci, 1998) .

At the same time, although autonomy-support is necessary, it is not a sufficient component for optimal functioning. For instance, the study of Jang, Reeve, and Deci (2010) showed that it is not autonomy-support or structure but autonomy-support *and* structure that contributes the most to students' learning engagement. For this reason, structure and involvement are also essential as they contribute to one's underlying motivations and behaviors differently: autonomy-support influences one's sense of personal causation, structure influences one's control over outcomes, while involvement influences one's perceived emotional support. Some experimental and intervention studies (e.g., Aelterman et al., 2014; Tessier et al., 2010; see Stroet, Opdenakker, & Minnaert, 2013 for a review) have already been conducted with respect to need-supportive behaviors that reflect on either two or all three psychological needs. These studies reported that the interventions were effective and that the behavior of the target groups (e.g., teacher or coaches) changed not just on the basis of self-report from the participants, but from the perspective of students and external observers alike.

Overall, one potential avenue for practical implications would be the incorporation of need nurturing, as opposed to need controlling, experiences into practice. Although the present dissertation only pertained to parents as relevant social agents, these practices could be applied to others who are also of great relevance such as coaches or

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teachers. Interestingly, a recent study has demonstrated that teachers were more likely to implement need nurturing techniques when they believed that these were easy to implement and that these methods would be beneficial for the students (Reeve & Cheon, 2016). For this reason, personally held beliefs could also be targeted with carefully constructed interventions.

Taking a step back from SDT, interventions should also seek to enhance parents' interpersonal behavior so that they would demonstrate more parental care as well as adequate levels of autonomy-support and protection. Interventions should aim to foster parental behaviors which is able to create a caring climate characterized by emotional warmth, responsiveness, and concern for others. While parental protection is important, parents should not strive to be overprotective or overcontrolling, but rather should aim to find a balance.

Of course, one's immediate social environment (i.e., parents) is also embedded in a larger social context that can also exert its influence on parental behaviors. Recently, a study (Stupnisky, BrckaLorenz, Yuhas, & Guay, 2018) was conducted to examine university teachers' and faculty members' motivations and applied practices. They found that experiencing need fulfillment within a faculty was associated with autonomous motivations for teaching which, in turn, was related to the incorporation of effective teaching strategies. This finding suggests that the environment of the parents, for instance, should also be "need nurtured", otherwise it could have detrimental effects on the parents directly and on the children indirectly. Apart from need nurturing, ethnicity/culture, family socioeconomic status and the neighborhood/community context has been reported as influencing parenting practices (Kotchick & Forehand, 2002). Intervention programs have already been developed to minimize the risk factors associated with poor parenting (Webster-Stratton & Herman, 2010). Thus, the characteristics of the larger social environment should be optimized so that one's immediate social environment does not suffer negative consequences. This might be important as the immediate social environment might be able to buffer, for instance, the student against declines in performance, motivation, or even passion.

Conclusion

In conclusion, the present dissertation provided five empirical studies for a more detailed understanding of the ongoing development of passion. One important contribution of this dissertation is that the ongoing development trajectories of passion

are likely to show high stability over the course of a four-month period. In addition, this dissertation also documented the role of need fulfillment as well as perceived parental behavior with respect to passion both in cross-sectional and longitudinal settings. Finally, this dissertation might be used as a foundation in future applied studies in fostering passion which might, in turn, lead to a more satisfactory life.

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Supplementary Materials: Study 1

Table S1.1

Characteristics of the Samples Used in the Present Research

Sample	Activity	Sample size	Females (%)	Age (SD)
Study 1 (N = 7,466)	Facebook use	740	543 (73.4%)	23.40 (6.19)
	series watching	2,325	1,722 (74.1%)	28.38 (10.16)
	learning new things	1,198	879 (73.4%)	24.21 (7.90)
	dancing	207	160 (77.3%)	27.33 (10.03)
	playing Pokémon Go	1,131	566 (50%)	24.41 (6.48)
	smartphone gaming	204	131 (64.2%)	25.34 (7.31)
	online gaming	220	50 (22.7%)	24.94 (6.10)
	sex	1,441	996 (69.1%)	26.32 (7.18)
Study 2 (N = 504)	various, self-written	504	258 (51.2%)	39.59 (12.03)

Table S1.2

Hungarian and original English versions of the Passion Scale

	Hungarian Version	English Version (Vallerand, 2015)
Title	Szenvedély Kérdőív	The Passion Scale
Instructions	Miközben erre az időtöltésre gondolsz jelöld be az alábbi skála használatával, hogy mennyire értessz egyet az egyes állításokkal!	While thinking of your favorite activity and using the scale below, please indicate your level of agreement with each item.
Rating Scale	1 – egyáltalán nem értek egyet 2 – nem értek egyet 3 – inkább nem értek egyet 4 – egyet is értek, meg nem is 5 – inkább egyetértek 6 – egyetértek 7 – teljes mértékben egyetértek	1 – not agree at all 2 – very slightly agree 3 – slightly agree 4 – moderately agree 5 – mostly agree 6 – strongly agree 7 – very strongly agree
Item 1 (Harmonious Passion)	Ez az időtöltés összhangban van az életem egyéb elfoglaltságaival.	This activity is in harmony with the other activities in my life.
Item 2 (Obsessive Passion)	Nehezen tudom kontrollálni az időtöltésre irányuló késztető, sürgető vágyamat.	I have difficulties controlling my urge to do my activity.
Item 3 (Harmonious Passion)	Annak köszönhetően, hogy az időtöltés által új dolgokat fedezek fel, még inkább értékelem azt.	The new things that I discover with this activity allow me to appreciate it even more.
Item 4 (Obsessive Passion)	Szinte megszállott vagyok ezzel az időtöltéssel kapcsolatban.	I have almost an obsessive feeling for this activity.
Item 5 (Harmonious Passion)	Ez az időtöltés kifejezi azokat a tulajdonságokat, amelyeket önmagamban szeretek.	This activity reflects the qualities I like about myself.
Item 6 (Harmonious Passion)	Ez az időtöltés lehetőséget ad arra, hogy sokféle élményt szerezzek.	This activity allows me to live a variety of experiences.
Item 7 (Obsessive Passion)	Ez az időtöltés az egyetlen, ami igazán felpörget.	This activity is the only thing that really turns me on.
Item 8 (Harmonious Passion)	Ez az időtöltés szerves részévé vált az életemnek.	My activity is well integrated in my life.
Item 9 (Obsessive Passion)	Ha tehetném, kizárólag ezzel az időtöltéssel foglalkoznék.	If I could, I would only do my activity.

	Hungarian Version	English Version (Vallerand, 2015)
Item 10 (Harmonious Passion)	Ez az időtöltés jól megfér az életem többi részével.	My activity is in harmony with other things that are part of me.
Item 11 (Obsessive Passion)	Ez az időtöltés annyira izgalmas, hogy néha elvesztem az irányításomat felette.	This activity is so exciting that I sometimes lose control over it.
Item 12 (Obsessive Passion)	Az a benyomásom, hogy az időtöltés irányít engem.	I have the impression that my activity controls me.
Item 13 (Passion Criteria)	Sok időt töltök ezzel a tevékenységgel.	I spend a lot of time doing this activity.
Item 14 (Passion Criteria)	Szeretem ezt az időtöltést.	I like this activity.
Item 15 (Passion Criteria)	Ez az időtöltés fontos nekem.	This activity is important for me.
Item 16 (Passion Criteria)	Ez a időtöltés számomra egy szenvedély.	This activity is a passion for me.
Item 17 (Passion Criteria)	Ez az időtöltés a része annak, aki vagyok.	This activity is part of who I am.

Appendix S1.1
Input for CFA

VARIABLE:
  MISSING ARE ALL (9999);
  NAMES ARE
      sample activity gender age hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12
      cp13 cp14 cp15 cp16 cp17 Zage Zage2;
  USEVARIABLES ARE
      hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12;

ANALYSIS:
  estimator = mlr; ! robust maximum-likelihood estimator

MODEL:
  hp BY hp1 hp3 hp5 hp6 hp8 hp10;
  op BY op2 op4 op7 op9 op11 op12;
! correlated uniquenesses
  op7 WITH op9;
  hp1 WITH hp10;
  op4 WITH op12;

Appendix S1.2
Input for ESEM

VARIABLE:
   MISSING ARE ALL (9999);
   NAMES ARE
      sample activity gender age hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12
      cp13 cp14 cp15 cp16 cp17 Zage Zage2;
   USEVARIABLES ARE
      hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12;

ANALYSIS:
   estimator = mlr; ! robust maximum-likelihood estimator
   rotation = target; ! cross-loadings are "targeted" to be zero with the '(~0)' command.

! ESEM factors are identified with the '(*1)' command.
MODEL:
   hp BY hp1 hp3 hp5 hp6 hp8 hp10
       op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
   op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
       op2 op4 op7 op9 op11 op12 (*1);
! correlated uniquenesses
   op7 WITH op9;
   hp1 WITH hp10;
   op4 WITH op12;

Appendix S1.3
Input for Measurement Invariance Across Gender – Configural

VARIABLE:
  MISSING ARE ALL (9999);
  NAMES ARE
     sample activity gender age hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12
     cp13 cp14 cp15 cp16 cp17 Zage Zage2;
  USEVARIABLES ARE
     hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12;
  GROUPING IS gender (1=male 2=female);

ANALYSIS:
  estimator = mlr;
  rotation = target;

MODEL:
! factor loadings
  hp BY hp1 hp3 hp5 hp6 hp8 hp10
     op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
  op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
     op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
  [hp1-op12];
! item uniqueness
  hp1-op12;
! correlated uniquenesses are fixed to be equal with the arbitrary labels in parentheses
  hp1 WITH hp10 (c1);
  op7 WITH op9   (c2);
  op4 WITH op12 (c3);
! factor means
  [hp@0]; [op@0];

MODEL FEMALE:
! factor loadings
  hp BY hp1 hp3 hp5 hp6 hp8 hp10
     op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
  op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
     op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
  [hp1-op12];
! item uniqueness
  hp1-op12;
! correlated uniquenesses

! factor means
  [hp@0]; [op@0];

Appendix S1.4
Input for Measurement Invariance Across Gender – Weak

! only the relevant and changing parts are presented here

MODEL:
! factor loadings
   hp BY hp1 hp3 hp5 hp6 hp8 hp10
       op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
   op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
       op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
   [hp1-op12];
! item uniqueness
   hp1-op12;
! correlated uniquenesses are fixed to be equal with the arbitrary labels in parentheses
   hp1 WITH hp10 (c1);
   op7 WITH op9   (c2);
   op4 WITH op12 (c3);
! factor means
   [hp@0]; [op@0];

MODEL FEMALE:
! factor loadings are set to be invariant

! item intercepts
   [hp1-op12];
! item uniqueness
   hp1-op12;
! correlated uniquenesses

! factor means
   [hp@0]; [op@0];

Appendix S1.5
Input for Measurement Invariance Across Gender – Strong

! only the relevant and changing parts are presented here

MODEL:
! factor loadings
   hp BY hp1 hp3 hp5 hp6 hp8 hp10
       op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
   op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
       op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
   [hp1-op12];
! item uniqueness
   hp1-op12;
! correlated uniquenesses are fixed to be equal with the arbitrary labels in parentheses
   hp1 WITH hp10 (c1);
   op7 WITH op9   (c2);
   op4 WITH op12 (c3);
! factor means
   [hp@0]; [op@0];

MODEL FEMALE:
! factor loadings are set to be invariant

! item intercepts are set to be invariant

! item uniqueness
   hp1-op12;
! correlated uniquenesses

! factor means are now freely estimated
   [hp*]; [op*];

Appendix S1.6
Input for Measurement Invariance Across Gender – Strict

! only the relevant and changing parts are presented here

MODEL:
! factor loadings
   hp BY hp1 hp3 hp5 hp6 hp8 hp10
       op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
   op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
       op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
   [hp1-op12];
! item uniqueness are now set to be equal with the labels (one per item)
   hp1-op12 (u1-u12);
! correlated uniquenesses are fixed to be equal with the arbitrary labels in parentheses
   hp1 WITH hp10 (c1);
   op7 WITH op9 (c2);
   op4 WITH op12 (c3);
! factor means
   [hp@0]; [op@0];

MODEL FEMALE:
! factor loadings are set to be invariant

! item intercepts are set to be invariant

! item uniqueness

! correlated uniquenesses

! factor means are now freely estimated
   [hp*]; [op*];

Appendix S1.7
Input for Measurement Invariance Across Gender – Variance-Covariance

! only the relevant and changing parts are presented here

MODEL:
! factor loadings
   hp BY hp1 hp3 hp5 hp6 hp8 hp10
      op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
   op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
      op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
   [hp1-op12];
! item uniqueness are now set to be equal with the labels (one per item)
   hp1-op12 (u1-u12);
! correlated uniquenesses are fixed to be equal with the arbitrary labels in parentheses
   hp1 WITH hp10 (c1);
   op7 WITH op9   (c2);
   op4 WITH op12 (c3);
! factor means
   [hp@0]; [op@0];
! factor covariances are invariant due to the arbitrary label
   hp WITH op (1);

MODEL FEMALE:
! factor loadings are set to be invariant

! item intercepts are set to be invariant

! item uniqueness

! correlated uniquenesses

! factor means are now freely estimated
   [hp*]; [op*];
! factor variances constrained to be one (invariant)
   hp@1; op@1;

Appendix S1.8
Input for Measurement Invariance Across Gender – Latent Mean

! only the relevant and changing parts are presented here

MODEL:
! factor loadings
   hp BY hp1 hp3 hp5 hp6 hp8 hp10
        op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
   op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
        op2 op4 op7 op9 op11 op12 (*1);
! item intercepts
   [hp1-op12];
! item uniqueness are now set to be equal with the labels (one per item)
   hp1-op12 (u1-u12);
! correlated uniquenesses are fixed to be equal with the arbitrary labels in parentheses
   hp1 WITH hp10 (c1);
   op7 WITH op9 (c2);
   op4 WITH op12 (c3);
! factor means
   [hp@0]; [op@0];
! factor covariances are invariant due to the arbitrary label
   hp WITH op (1);

MODEL FEMALE:
! factor loadings are set to be invariant

! item intercepts are set to be invariant

! item uniqueness

! correlated uniquenesses

! factor means constrained to be zero (invariant)
   [hp@0]; [op@0];
! factor variances constrained to be one (invariant)
   hp@1; op@1;

Appendix S1.9
Input for Creating Gender × Age Groups

VARIABLE:
  MISSING ARE ALL (9999);
  NAMES ARE
      sample activity gender age hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12
      cp13 cp14 cp15 cp16 cp17 Zage Zage2;
  USEVARIABLES ARE
      hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12;
  GROUPING IS group (1=m33 2=m66 3=m99 4=f33 5=f66 6=f99);
! Frequencies were examined beforehand and age was cut at 33% and 66%.
! The continuous age variable is recoded into three discrete categories with the IF function.
! New groups were then defined by combining the newly created age categories with gender.
! EQ means "equal"; LT means "less than"; GE means "greater than or equal to."
! This way, no overlapping groups are created.
DEFINE:
  IF (gender EQ 1 AND age LT 22) THEN group = 1;
  IF (gender EQ 1 AND age GE 22 AND age LT 26) THEN group = 2;
  IF (gender EQ 1 AND age GE 26) THEN group = 3;
  IF (gender EQ 2 AND age LT 22) THEN group = 4;
  IF (gender EQ 2 AND age GE 22 AND age LT 26) THEN group = 5;
  IF (gender EQ 2 AND age GE 26) THEN group = 6

! The rest of the input file for the invariance models are as above, only more groups need to be specified.

Appendix S1.10
Input for the standard MIMIC model

! For the sake of simplicity, we demonstrate the different MIMIC models on the base ESEM model.
! However, these could easily be integrated into the invariance model.

USEVARIABLES ARE
    hp1 op2 hp3 op4 hp5 hp6 op7 hp8 op9 hp10 op11 op12
    Zage Zage2; ! MIMIC variables to be included in the model.
GROUPING IS gender (1=male 2=female);

ANALYSIS:
  estimator = mlr;
  rotation = target;

MODEL:
  hp BY hp1 hp3 hp5 hp6 hp8 hp10
      op2~0 op4~0 op7~0 op9~0 op11~0 op12~0 (*1);
  op BY hp1~0 hp3~0 hp5~0 hp6~0 hp8~0 hp10~0
      op2 op4 op7 op9 op11 op12 (*1);

  op7 WITH op9;
  hp1 WITH hp10;
  op4 WITH op12;

!MIMIC paths of the linear and quadratic effect of age with the ON command
  hp1-op12 ON Zage@0;
  hp1-op12 ON Zage2@0;
  hp-op ON Zage@0;
  hp-op ON Zage2@0;
! Null model: All paths are constrained to be zero.
! Saturated model: Paths from predictors to items are estimated (without the '@0'), but still zero to the factors (with the '@0').
! Factors-only model: Paths from predictors to factors are estimated (without the '@0'), but still zero to the factors (with the '@0').

Supplementary Materials: Study 2

Appendix S2.1: Model Estimation

In first-order six-factor CFA model (1a), scale items were forced to load on the a priori hypothesized factors and the correlation between the factors were freely estimated, but item-level cross-loadings were explicitly forced to be zero. In the corresponding ESEM model (1b), apart from the same CFA specifications, cross-loadings were freely estimated, but "targeted" to be close to zero following theoretical (Browne, 2001) and applied (Morin, Boudrias, et al., 2016; Tóth-Király, Bőthe, Rigó, et al., 2017) guidelines to achieve a confirmatory setup. In the bifactor-CFA model with one general factor (2a), scale items simultaneously loaded one general factor (i.e., need fulfillment) and one specific factor. Moreover, these specific factors were forced to be orthogonal to the general factor and to each other as well as per standard bifactor specifications so that they were not allowed to correlate with one another (Morin, Arens, et al., 2016a; Reise, 2012). In the bifactor-ESEM model with one general factor (2b), besides the bifactor-CFA specifications, items were allowed to cross-load on the non-target factors, but "targeted" to be close to zero as in the previous models. In the two-bifactor models (3a and 3b), the two general factors were allowed to correlate with each other (need satisfaction and need frustration, respectively), but not with the specific factors (same as in Tóth-Király, Morin, et al., 2018), while the rest of the specifications were the same to their bifactor counterparts (2a and 2b, respectively).

Table S2.1

Standardized Parameter Estimates (with Standard Errors in Parentheses) of the Six-Factor CFA (Model 1a) and ESEM models (Model 1b)

	CFA		ESEM						
	Factor (λ)	δ	AS (λ)	RS (λ)	CS (λ)	AF (λ)	RF (λ)	CF (λ)	δ
Autonomy satisfaction (A-S)									
Item 1	**.559(.036)****	.312	**.461(.078)****	-.024(.067)	.173(.078)*	-.200(.063)**	.014(.096)	.178(.084)*	.345
Item 7	**.759(.028)****	.577	**.884(.109)****	-.053(.045)	-.045(.069)	.126(.057)*	-.036(.061)	-.007(.057)	.642
Item 13	**.772(.023)****	.596	**.798(.079)****	.065(.045)	-.010(.070)	.086(.051)	.105(.054)	-.097(.053)	.635
Item 19	**.594(.031)****	.353	**.414(.073)****	.050(.089)	.134(.126)	-.284(.070)**	-.025(.113)	.156(.136)	.410
Relatedness satisfaction (R-S)									
Item 3	**.631(.030)****	.398	.091(.061)	**.481(.071)****	-.132(.058)*	-.011(.060)	-.150(.087)	-.084(.067)	.410
Item 9	**.789(.025)****	.622	-.043(.059)	**.852(.075)****	.058(.053)	-.042(.045)	.075(.080)	-.006(.065)	.661
Item 15	**.829(.029)****	.688	.016(.050)	**.855(.079)****	.044(.048)	.079(.040)*	.016(.078)	-.022(.057)	.728
Item 21	**.658(.034)****	.433	.133(.062)*	**.398(.085)****	.107(.071)	-.065(.058)	-.266(.094)**	.195(.079)*	.461
Competence satisfaction (C-S)									
Item 5	**.752(.024)****	.565	.038(.091)	.052(.062)	**.699(.151)****	.042(.059)	.032(.104)	-.128(.143)	.636
Item 11	**.732(.027)****	.536	.177(.055)**	.077(.055)	**.521(.070)****	.063(.045)	.031(.072)	-.128(.064)*	.528
Item 17	**.710(.027)****	.505	.332(.058)**	-.016(.063)	**.408(.081)****	-.020(.055)	-.104(.076)	-.007(.071)	.517
Item 23	**.752(.027)****	.566	.063(.054)	.058(.047)	**.580(.067)****	-.008(.044)	.036(.057)	-.188(.057)**	.570
Autonomy frustration (A-Fr)									
Item 2	**.266(.043)****	.071	-.026(.080)	-.048(.070)	.101(.080)	**.297(.068)****	-.062(.092)	.054(.080)	.089
Item 8	**.717(.027)****	.513	-.156(.071)*	-.008(.053)	.034(.054)	**.630(.081)****	.032(.072)	.045(.067)	.554
Item 14	**.688(.033)****	.473	-.191(.078)*	.052(.071)	.045(.081)	**.461(.080)****	-.024(.098)	.243(.079)**	.443
Item 20	**.675(.029)****	.456	-.109(.056)	-.048(.066)	-.013(.059)	**.552(.066)****	.077(.083)	.040(.077)	.483
Relatedness frustration (R-Fr)									
Item 4	**.649(.033)****	.421	-.067(.069)	.082(.079)	.010(.069)	-.020(.053)	**.645(.135)****	.098(.116)	.454
Item 10	**.725(.028)****	.526	-.024(.064)	-.154(.096)	.077(.070)	.012(.053)	**.551(.140)****	.111(.098)	.511
Item 16	**.763(.028)****	.583	.035(.067)	-.026(.076)	-.029(.052)	.010(.056)	**.771(.108)****	.017(.067)	.630
Item 22	**.684(.028)****	.467	-.001(.061)	-.204(.067)**	.029(.070)	.056(.048)	**.469(.094)****	.065(.084)	.452
Competence frustration (C-Fr)									
Item 6	**.685(.029)****	.469	.126(.075)	.024(.074)	-.365(.088)**	.053(.059)	.155(.096)	**.407(.102)****	.497
Item 12	**.787(.019)****	.619	-.014(.048)	-.044(.053)	-.027(.102)	.071(.068)	.029(.110)	**.732(.145)****	.662
Item 18	**.726(.026)****	.528	-.040(.067)	.092(.066)	-.170(.103)	.041(.066)	.154(.095)	**.508(.106)****	.522
Item 24	**.780(.021)****	.608	.008(.055)	-.081(.052)	-.024(.111)	.169(.061)**	.074(.120)	**.629(.152)****	.623

Note. CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; S: Need satisfaction; Fr: Need frustration; A: Need for autonomy; C: Need for competence; R: Need for relatedness; λ: Factor loading; δ: Item uniqueness; Target factor loadings are in bold; *p < .05; **p < .01.

Table S2.2

Latent Factor Correlations (and Standard Error in Parentheses) from the Six-Factor CFA (1a, below the diagonal) and ESEM (1b, above the diagonal) Models

	A-S	R-S	C-S	A-Fr	R-Fr	C-Fr
Autonomy satisfaction (A-S)	—	.461(.052)	.602(.054)	-.469(.076)	-.459(.070)	-.550(.063)
Relatedness satisfaction (R-S)	.522(.040)	—	.254(.062)	-.257(.052)	-.647(.044)	-.264(.062)
Competence satisfaction (C-S)	.779(.030)	.437(.044)	—	-.241(.069)	-.295(.056)	-.581(.097)
Autonomy frustration (A-Fr)	-.680(.043)	-.401(.049)	-.497(.045)	—	.458(.050)	.329(.095)
Relatedness frustration (R-Fr)	-.492(.043)	-.743(.040)	-.462(.047)	.614(.035)	—	.513(.141)
Competence frustration (C-Fr)	-.632(.038)	-.419(.042)	-.802(.035)	.657(.034)	.682(.032)	—

Note. CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; All correlations are statistically significant ($p \leq .01$).

Table S2.3

Standardized Parameter Estimates (with Standard Errors in Parentheses) of the Bifactor-CFA Model (Model 2a) Including One G-Factor and Six G-Factors

	G-factor (λ)	S-factors	δ
Autonomy satisfaction (A-S)			
Item 1	**.463(.041)****	**.245(.061)****	.274
Item 7	**.608(.029)****	**.579(.073)****	.704
Item 13	**.628(.028)****	**.443(.056)****	.591
Item 19	**.554(.034)****	**.160(.050)****	.332
Relatedness satisfaction (R-S)			
Item 3	**.432(.041)****	**.434(.040)****	.375
Item 9	**.447(.036)****	**.679(.035)****	.661
Item 15	**.472(.034)****	**.708(.044)****	.724
Item 21	**.497(.037)****	**.406(.044)****	.411
Competence satisfaction (C-S)			
Item 5	**.570(.039)****	**.553(.049)****	.632
Item 11	**.587(.035)****	**.435(.048)****	.534
Item 17	**.661(.033)****	**.244(.050)****	.497
Item 23	**.603(.038)****	**.458(.051)****	.573
Autonomy frustration (A-Fr)			
Item 2	**-.132(.041)****	**.297(.054)****	.106
Item 8	**-.524(.031)****	**.536(.053)****	.562
Item 14	**-.528(.031)****	**.413(.052)****	.450
Item 20	**-.538(.033)****	**.383(.047)****	.437
Relatedness frustration (R-Fr)			
Item 4	**-.513(.035)****	**.418(.052)****	.438
Item 10	**-.522(.038)****	**.491(.050)****	.513
Item 16	**-.552(.037)****	**.554(.052)****	.613
Item 22	**-.508(.039)****	**.425(.046)****	.439
Competence frustration (C-Fr)			
Item 6	**-.573(.038)****	**.314(.054)****	.428
Item 12	**-.651(.032)****	**.508(.048)****	.682
Item 18	**-.616(.035)****	**.352(.057)****	.504
Item 24	**-.683(.030)****	**.391(.050)****	.619

Note. CFA: Confirmatory factor analysis; A: Need for autonomy; C: Need for competence; R: Need for relatedness; S: satisfaction; Fr: Frustration; λ: Factor loading; δ: Item uniqueness; Target factor loadings are in bold; *p* < .05; **p* < .01.

Table S2.4

Standardized Parameter Estimates (with Standard Errors in Parentheses) of the Two bifactor-CFA Model (Model 3a) Including Two G-Factors and Six S-Factors

	Satisfaction G-factor (λ)	Frustration G-factor (λ)	S-factors	δ
Autonomy satisfaction (A-S)				
Item 1	**.493(.044)****		**.180(.076)***	.725
Item 7	**.646(.030)****		**.564(.126)****	.265
Item 13	**.670(.029)****		**.368(.086)****	.416
Item 19	**.580(.035)****		.093(.058)	.655
Relatedness satisfaction (R-S)				
Item 3	**.404(.044)****		**.455(.041)****	.630
Item 9	**.433(.037)****		**.689(.035)****	.337
Item 15	**.464(.035)****		**.712(.044)****	.278
Item 21	**.487(.038)****		**.416(.044)****	.589
Competence satisfaction (C-S)				
Item 5	**.595(.041)****		**.538(.057)****	.357
Item 11	**.622(.036)****		**.384(.053)****	.466
Item 17	**.703(.032)****		**.168(.060)****	.477
Item 23	**.623(.040)****		**.424(.061)****	.432
Autonomy frustration (A-Fr)				
Item 2		**.140(.041)****	**.292(.056)****	.895
Item 8		**.530(.033)****	**.532(.058)****	.436
Item 14		**.547(.031)****	**.391(.052)****	.548
Item 20		**.547(.034)****	**.371(.049)****	.564
Relatedness frustration (R-Fr)				
Item 4		**.535(.034)****	**.392(.052)****	.560
Item 10		**.533(.036)****	**.480(.050)****	.486
Item 16		**.566(.035)****	**.540(.053)****	.388
Item 22		**.514(.038)****	**.417(.048)****	.562
Competence frustration (C-Fr)				
Item 6		**.597(.040)****	**.265(.068)****	.573
Item 12		**.682(.032)****	**.475(.059)****	.309
Item 18		**.645(.037)****	**.293(.072)****	.498
Item 24		**.721(.028)****	**.319(.057)****	.378

Note. CFA: Confirmatory factor analysis; A: Need for autonomy; C: Need for competence; R: Need for relatedness; S: Satisfaction; Fr: Frustration; λ: Factor loading; δ: Item uniqueness; Target factor loadings are in bold; *p* < .05; **p* < .01.

Table S2.5

Standardized Parameter Estimates (with Standard Errors in Parentheses) of the Two bifactor-ESEM Model (Model 3b) Including Two G-Factors and Six S-Factors

	Sat-G (λ)	Fr-G (λ)	A-S (λ)	R-S (λ)	C-S (λ)	A-Fr (λ)	R-Fr (λ)	C-Fr (λ)	δ
Autonomy satisfaction (A-S)									
Item 1	**.333(.084)****		**.082(.267)**	.078(.120)	.242(.086)**	-.386(.074)**	-.067(.098)	-.075(.085)	.659
Item 7	**.590(.100)****		**.063(.420)**	.086(.251)	.182(.126)	-.278(.101)**	-.147(.203)	-.313(.159)*	.410
Item 13	**.681(.156)****		**-.039(.413)**	.099(.282)	.205(.129)	-.282(.126)*	-.139(.223)	-.303(.181)	.292
Item 19	**.361(.457)**		**.769(.600)**	.138(.179)	.160(.165)	-.266(.193)	-.105(.059)	-.135(.151)	.134
Relatedness satisfaction (R-S)									
Item 3	**.144(.175)**		.066(.123)	**.508(.090)****	-.011(.050)	-.120(.058)*	-.271(.113)*	-.183(.071)*	.595
Item 9	**.200(.287)**		.041(.077)	**.713(.099)****	.125(.076)	-.068(.063)	-.213(.087)*	-.042(.083)	.382
Item 15	**.231(.339)**		.004(.104)	**.832(.087)****	.094(.099)	-.032(.028)	-.144(.071)*	-.138(.038)**	.204
Item 21	**.273(.127)***		.128(.130)	**.449(.092)****	.192(.080)*	-.090(.096)	-.494(.140)**	.108(.137)	.407
Competence satisfaction (C-S)									
Item 5	**.234(.120)**		-.025(.138)	.102(.048)*	**.693(.087)****	-.108(.052)*	-.015(.074)	-.313(.085)**	.345
Item 11	**.301(.161)**		.140(.210)	.126(.098)	**.529(.069)****	-.060(.059)	-.031(.073)	-.358(.049)**	.461
Item 17	**.341(.127)****		.178(.300)	.122(.102)	**.439(.069)****	-.183(.083)*	-.128(.083)	-.324(.074)**	.489
Item 23	**.248(.109)***		.021(.131)	.081(.053)	**.634(.080)****	-.095(.065)	-.114(.045)*	-.295(.086)**	.420
Autonomy frustration (A-Fr)									
Item 2		**-.123(.176)**	-.063(.070)	-.053(.042)	.027(.053)	**.255(.093)****	.046(.064)	.012(.088)	.910
Item 8		**-.234(.339)**	-.173(.194)	-.122(.054)*	-.129(.056)*	**.617(.132)****	.204(.098)*	.117(.147)	.447
Item 14		**-.278(.343)**	-.043(.188)	-.040(.055)	-.182(.046)**	**.549(.155)****	.167(.090)	.221(.157)	.507
Item 20		**-.250(.273)**	-.245(.188)	-.137(.053)*	-.168(.055)**	**.467(.146)****	.291(.074)**	.079(.152)	.522
Relatedness frustration (R-Fr)									
Item 4		**.080(.291)**	-.080(.106)	-.237(.080)**	-.087(.056)	.210(.091)*	**.430(.154)****	.399(.078)**	.536
Item 10		**.060(.258)**	-.021(.097)	-.416(.081)**	-.034(.055)	.242(.089)**	**.413(.166)***	.368(.059)**	.457
Item 16		**.081(.282)**	-.082(.059)	-.344(.099)**	-.116(.054)*	.180(.066)**	**.601(.154)****	.293(.113)**	.375
Item 22		**-.022(.228)**	-.022(.078)	-.376(.064)**	-.100(.065)	.186(.069)**	**.483(.118)****	.202(.135)	.538
Competence frustration (C-Fr)									
Item 6		**-.123(.205)**	.017(.168)	-.086(.073)	-.475(.062)**	.143(.066)*	.195(.138)	**.440(.120)****	.500
Item 12		**-.357(.245)**	-.061(.151)	-.102(.047)*	-.327(.059)**	.106(.135)	.263(.083)**	**.560(.163)****	.357
Item 18		**-.224(.228)**	-.100(.203)	-.044(.049)	-.351(.060)**	.108(.082)	.218(.087)*	**.543(.129)****	.461
Item 24		**-.451(.220)***	-.083(.146)	-.122(.047)*	-.320(.085)**	.104(.212)	.399(.055)**	**.438(.240)**	.311

Note. Sat-G: Global (G-Factor) representing need satisfaction; Dis-G: Global (G-Factor) representing need dissatisfaction; S-Factors: Specific factors from the bifactor model; S: Need satisfaction; Fr: Need frustration; A: Need for autonomy; C: Need for competence; R: Need for relatedness; λ: Factor loading; δ: Item uniqueness; Target factor loadings are in bold.; *p < .05; **p < .01.

Supplementary Materials: Study 3

Table S3.0. Hungarian and original English version of the Basic Psychological Need Satisfaction and Frustration Scale – General Measure

	Hungarian Version	English Version (Chen et al., 2015)
Title	Alapvető pszichológiai szükségletek kielégítettsége és frusztrációja	Basic Psychological Need Satisfaction and Frustration Scale – General Measure
Instructions	Az alábbiakban olyan állításokat olvashatsz, amelyek az általános tapasztalataidra és érzéseidre vonatkoznak.	Below, we are going to ask about your actual experiences of certain feelings in your life.
	Olvasd el ezeket a mondatokat alaposan és az 1-től 5-ig terjedő skálán jelöld be, hogy mennyire igazak rád abban az életszakaszban, amelyben vagy.	Please read each of the following items carefully. You can choose from 1 to 5 to indicate the
	Válaszolj a lehető legőszintébben!	degree to which the statement is true for you at this point in your life.
Rating Scale	1 – egyáltalán nem igaz rám 2 – 3 – 4 – 5 – teljesen igaz rám	1 – not true at all 2 – 3 – 4 – 5 – completely true
Item 1 (Autonomy Satisfaction)	A döntésem szabadságát érzem azokban a dolgokban, amelyeket elvállalok.	I feel a sense of choice and freedom in the things I undertake.
Item 2 (Autonomy Frustration)	A legtöbb dolgot azért csinálom, mert úgy érzem, hogy ezt „kell" tennem.	Most of the things I do feel like "I have to".
Item 3 (Relatedness Satisfaction)	Úgy érzem, hogy azok az emberek, akikkel törődök, viszonozzák a törődést.	I feel that the people I care about also care about me.
Item 4 (Relatedness Frustration)	Úgy érzem, hogy nem fogad be az a csoport, ahova tartozni szeretnék.	I feel excluded from the group I want to belong to.
Item 5 (Competence Satisfaction)	Biztos vagyok benne, hogy jól meg tudom csinálni a dolgaim.	I feel confident that I can do things well.
Item 6 (Competence Frustration)	Komoly kétségeim vannak azzal kapcsolatban, hogy jól el tudom látni a teendőim.	I have serious doubts about whether I can do things well.
Item 7 (Autonomy Satisfaction)	Úgy érzem, hogy a döntéseim tükrözik azt, amit igazából akarok.	I feel that my decisions reflect what I really want.
Item 8 (Autonomy Frustration)	Úgy érzem, hogy sok olyan dolgot vagyok kénytelen megcsinálni, amit amúgy magamtól nem választanék.	I feel forced to do many things I wouldn't choose to do.

	Hungarian Version	English Version (Chen et al., 2015)
Item 9 (Relatedness Satisfaction)	Közel állok azokhoz az emberekhez, akik törődnek velem, és akikkel én törődöm.	I feel connected with people who care for me, and for whom I care.
Item 10 (Relatedness Frustration)	Úgy érzem, hogy a számomra fontos emberek távolságtartóak velem.	I feel that people who are important to me are cold and distant towards me.
Item 11 (Competence Satisfaction)	Úgy érzem, hogy értek ahhoz, amit csinálok.	I feel capable at what I do.
Item 12 (Competence Frustration)	Csalódott vagyok a legtöbb teljesítményemmel kapcsolatban.	I feel disappointed with many of my performance.
Item 13 (Autonomy Satisfaction)	Úgy érzem, hogy a döntéseim azt fejezik ki, aki igazán vagyok.	I feel my choices express who I really am.
Item 14 (Autonomy Frustration)	Túl sok dolognál érzem azt a nyomást, hogy meg kell csinálnom.	I feel pressured to do too many things.
Item 15 (Relatedness Satisfaction)	Szoros kapcsolatban vagyok azokkal az emberekkel, akik fontosak nekem.	I feel close and connected with other people who are important to me.
Item 16 (Relatedness Frustration)	Az a benyomásom, hogy nem kedvelnek azok az emberek, akikkel sok időt töltök.	I have the impression that people I spend time with dislike me.
Item 17 (Competence Satisfaction)	Úgy érzem, hogy tudom hogyan érhetem el a céljaim.	I feel competent to achieve my goals.
Item 18 (Competence Frustration)	Bizonytalan vagyok a képességeimmel kapcsolatban.	I feel insecure about my abilities.
Item 19 (Autonomy Satisfaction)	Úgy érzem, hogy azt csinálom, ami tényleg érdekel engem.	I feel I have been doing what really interests me.
Item 20 (Autonomy Frustration)	Miközben végzem a mindennapi teendőim, úgy érzem meg van kötve a kezem.	My daily activities feel like a chain of obligations.
Item 21 (Relatedness Satisfaction)	Kellemesen érzem magam azokkal az emberekkel, akikkel sok időt töltök.	I experience a warm feeling with the people I spend time with.
Item 22 (Relatedness Frustration)	Úgy érzem, hogy a kapcsolataim felszínesek.	I feel the relationships I have are just superficial.
Item 23 (Competence Satisfaction)	Úgy érzem, hogy a nehéz feladatokkal is sikeresen meg tudok birkózni.	I feel I can successfully complete difficult tasks.
Item 24 (Competence Frustration)	Sikertelennek érzem magam a korábbi hibáim miatt.	I feel like a failure because of the mistakes I make.

Appendix S3.1. 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, et al., 2016) and reviews (Asparouhov et al., 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 et al., 2014; Sánchez-Oliva et al., 2017; Tóth-Király, Morin, 2018) and passion (Marsh, Vallerand, et al., 2013; Schellenberg et al., 2014; Tóth-Király, Bőthe, Rigó, et al., 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, et al., 2016; Morin, Boudrias, et al., 2016). 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 et al., 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 et al., 2016).

Appendix S3.2: 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 S3.3: 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 ($\omega_{\text{autonomy support}}$ = .272; $\omega_{\text{competence support}}$ = .129; $\omega_{\text{relatedness support}}$ = .252; $\omega_{\text{autonomy thwarting}}$ = .607; $\omega_{\text{competence thwarting}}$ = .403; $\omega_{\text{relatedness thwarting}}$ = .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 ($\omega_{\text{positive affect}}$ = .746; $\omega_{\text{negative affect}}$ = .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 et al. (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, Bőthe, Rigó, 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 S3.4. Selecting the Optimal Number of Profiles

Fit indices for the alternative solutions can be seen in Table S3.1. 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 S3.1) 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.
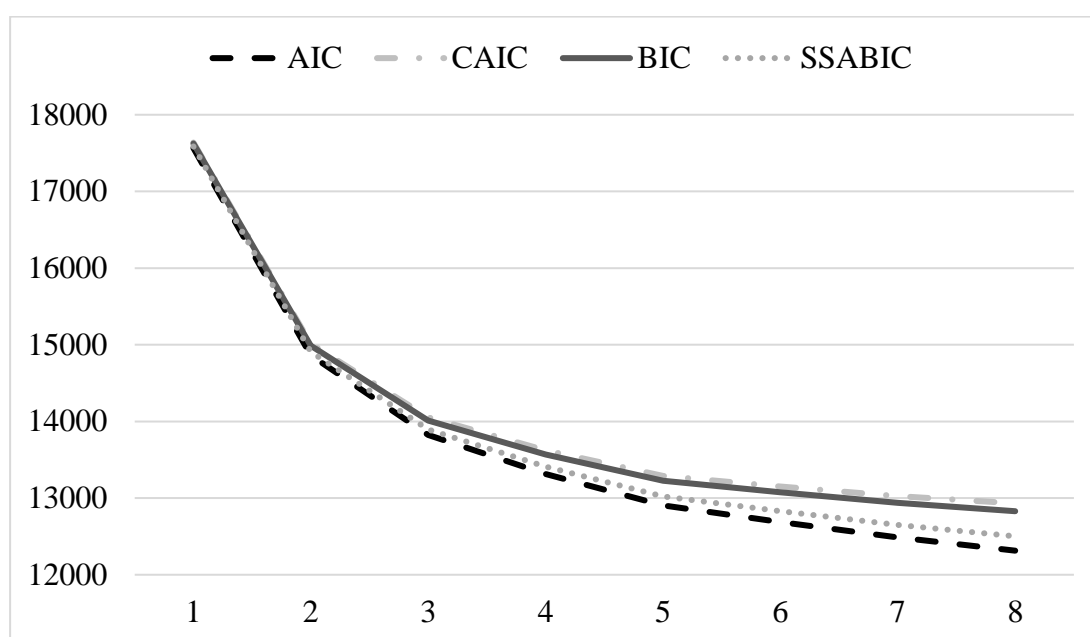
Figure S3.1
Elbow plot for the information criteria used in class enumeration

Table S3.1

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.

Table S3.2

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.

Supplementary Materials: Study 4

Appendix S4.1. Estimation of Preliminary Measurement Models

Before investigating the associations between the variables of interest, it is important to verify, in the form of preliminary measurement models, whether the hypothesized structure of the variables fit the data well and whether the constructs are well-defined. This step was done for each for the instruments to avoid potential measurement biases.

On the basis of previous recommendations (e.g., Tóth-Király, Bőthe, Rigó, et al., 2017; Xu et al., 2018), the Passion Scale and the Parental Bonding Instrument were modelled with an Exploratory Structural Equation Modeling (ESEM; Marsh et al., 2014) model. Compared to confirmatory factor analysis (CFA) which forces each of the items to be associated with one factor only (i.e., cross-loadings are set to be zero), ESEM allows the explicit expression of these cross-loadings to non-target factors, making it possible to take into account one source of construct-relevant psychometric multidimensionality referring to the assessment of conceptually-relevant constructs (Morin, Arens, et al., 2016; Morin, Arens, Tran et al., 2016). This approach stems from the fact that scale items are seldom pure indicators of their respective factors and the presence of at least some degree of construct-relevant association can be expected between items and non-target, yet conceptually similar constructs such as harmonious and obsessive passion. Recent applications (e.g., Fadda et al., 2017; Litalien, Guay, & Morin, 2015; Marsh et al., 2011; McKay, Perry, & Harvey, 2016; Neff et al., 2018; Perera & Ganguly, 2016; Sánchez-Oliva et al., 2017; Tóth-Király, Bőthe, Rigó, et al., 2017) and reviews (Asparouhov et al., 2015; Marsh et al., 2014) have demonstrated that even small cross-loadings need to be taken into account, otherwise parameter estimates (e.g., factor loadings and correlations) can be biased, leading to misleading findings.

Preliminary measurement models were estimated with Mplus 8.1 (Muthén & Muthén, 1998-2017) and the robust maximum-likelihood (MLR) estimator which is able to provide fit statistics and standard errors that are robust to the non-normality of the data. ESEM models were specified in a confirmatory manner using the orthogonal target rotation (Browne, 2001) which allows the expression of cross-loadings, but targets them to be as close to zero as possible. The same fit indices (CFI, TLI, and RMSEA) with the same guidelines were used for model evaluation as in the main study. As no analyses should solely be based on fit indices (e.g., Hu & Bentler, 1998; Marsh et al., 2004; Morin, Boudrias, et al., 2016), parameter

estimates (e.g., factor loadings, cross-loadings, and inter-factor correlations) as well as the theoretical conformity of the models were also evaluated. Finally, two reliability indices were also calculated: Cronbach's alpha (α; Nunnally, 1978) and model-based omega coefficient of composite reliability (ω; McDonald, 1970) with the latter being particularly relevant given the fact that Cronbach's alpha is less reliable (Sijtsma, 2009; Rodriguez et al., 2016) and that omega takes into account the strength of association between the items and latent factors as well as the item-specific measurement errors.

Appendix S4.2: Results Related to the Passion Scale (PS)

In the present investigation, based on Tóth-Király, Bőthe, Rigó, et al. (2017), a two-factor ESEM model was specified with correlated uniquenesses between items 7-9, 1-10, and 4-12. This hypothesized model had satisfactory fit for the adolescent sample (χ^2 = 133.373, df = 40, CFI = .950, TLI = .917, RMSEA = .067 [90% CI .055-.080]). Parameter estimates are reported in the left-hand column of Table S4.1 below. Both factors were well-defined by the target loadings (HP: $|\lambda|$ = .592-.774, M = .694; OP: $|\lambda|$ = .423-.897, M = .645). Although cross-loadings were present in the model ($|\lambda|$ = .018-.262, M = .120), these were reasonable in size and did not undermine the definition of the factors. The same measurement model was estimated for the adult sample, showing adequate fit to the data (χ^2 = 68.561, df = 40, CFI = .984, TLI = .973, RMSEA = .038 [90% CI .022-.052]). Once again, factors were well-defined (HP: $|\lambda|$ = .539-.720, M = .642; OP: $|\lambda|$ = .500-.904, M = .678) and cross-loadings were small in magnitude ($|\lambda|$ = .003-.232, M = .119). For the exact parameter estimates, see the right-hand side of Table S4.1.

Table S4.1

Standardized parameter estimates for the two-factor ESEM models of the Passion Scale

	Sample 1 (adolescents)			Sample 2 (adults)		
	HP	OP	Uniqueness	HP	OP	Uniqueness
HP1	**.702****	-.021	.521	**.613****	-.062	.647
HP3	**.774****	-.040	.431	**.712****	.021	.482
HP5	**.700****	.108**	.418	**.539****	.232**	.566
HP6	**.768****	.018	.394	**.720****	-.003	.483
HP8	**.628****	.179**	.455	**.568****	.172**	.578
HP10	**.592****	-.084	.694	**.700****	-.223**	.571
OP2	-.061	**.539****	.741	-.027	**.605****	.645
OP4	.262**	**.624****	.371	.177**	**.753****	.307
OP7	.205**	**.423****	.688	.100*	**.561****	.635
OP9	.143**	**.610****	.517	.175**	**.500****	.657
OP11	-.057	**.774****	.443	-.029	**.744****	.460
OP12	-.259**	**.897****	.372	-.210**	**.904****	.274
HP-OP	.523**			.355**		
OP7-OP9	.329**			.445**		
HP1-HP10	.219**			.394**		
OP4-OP12	-.261**			-.460**		

Note. ESEM = exploratory structural equation modeling; HP = harmonious passion; OP = obsessive passion; *$p < .05$; **p < .01.

Appendix S4.3: Results Related to the Parental Bonding Instrument (PBI)

The examination of the Parental Bonding Instrument was particularly relevant, given that only exploratory factor analysis was used in the original Hungarian adaptation (Tóth & Gervai, 1999), while ESEM was used in a more recent investigation (Xu et al., 2018), suggesting that it is necessary to incorporate freely estimated cross-loadings in the measurement models. Based on the recent study of Xu et al. (2018), the PBI was modelled through a three-factor ESEM solution representing factors of parental care, autonomy-support, and overprotection. Additionally, an a priori correlated uniqueness was incorporated between items 21 and 22.

This measurement model showed remarkably good fit to the data in the adolescent sample ($\chi^2 = 407.568$, df = 227, CFI = .956, TLI = .942, RMSEA = .039 [90% CI .033-.045]). See the left-hand side of Table S4.2 for the exact estimates for this sample. All three factors were well-defined by their target loadings (care: $|\lambda| = .466$-.782, M = .675; autonomy: $|\lambda| = .379$-.652, M = .553; overprotection: $|\lambda| = .231$-.585, M = .482). While there were statistically significant cross-loadings ($|\lambda| = .005$-.391, M = .122), these pertained to opposite associations between care and overprotection. These results were supported by the findings pertaining to Sample 2: adults' responses to the items were also satisfactorily modelled with a three-factor ESEM model ($\chi^2 = 511.170$, df = 227, CFI = .953, TLI = .939, RMSEA = .050 [90% CI .044-.056]). Parameter estimates also corroborated the adequacy of this solution by strong target loadings (care: $|\lambda| = .550$-.855, M = .733; autonomy: $|\lambda| = .608$-.741, M = .682; overprotection: $|\lambda| = .558$-.653, M = .612) and small cross-loadings ($|\lambda| = .004$-.328, M = .142). For exact estimates for this sample, see the right-hand side of Table S4.2.

Table S4.2

Standardized parameter estimates for the three-factor ESEM models of the Parental Bonding Inventory

	Sample 1 (adolescents)				Sample 2 (adults)			
	Care	Auto.	Over.	Uniq.	Care	Auto.	Over.	Uniq.
CA1	**.770****	.179**	.178**	.384	**.772****	.196**	.140**	.308
CA2	**-.512****	.144*	.194**	.673	**-.691****	.172**	.172**	.493
CA4	**-.696****	.056	.036	.519	**-.837****	.184**	.167**	.283
CA5	**.776****	.021	-.010	.379	**.735****	.193**	.135**	.367
CA6	**.657****	.243**	.232**	.513	**.828****	.186**	.216**	.256
CA11	**.682****	.058	.156*	.574	**.671****	.115*	.185**	.540
CA12	**.782****	.088*	.158**	.419	**.855****	.152**	.195**	.237
CA14	**-.466****	-.014	.391**	.471	**-.550****	.009	.328**	.454
CA16	**-.612****	.113	.237**	.509	**-.643****	.159**	.288**	.449
CA17	**.721****	.033	.015	.472	**.731****	.149**	.183**	.431
CA18	**-.704****	.096	.005	.541	**-.724****	.240**	.129**	.502
CA24	**-.720****	.186**	.190**	.422	**-.757****	.140**	.184**	.373
AU3	.085*	**.621****	-.033	.549	.103**	**.709****	-.052	.394
AU7	.210**	**.538****	-.121*	.498	.111*	**.685****	-.070	.414
AU15	.155**	**.604****	-.173**	.409	.115**	**.659****	-.249**	.313
AU21	-.103**	**.652****	-.137**	.533	.009	**.741****	-.146**	.366
AU22	-.127**	**.524****	-.104	.713	-.008	**.692****	-.063	.500
AU25	-.015	**.379****	-.045	.845	-.009	**.608****	-.102*	.593
OV8	-.050	.018	**.541****	.691	-.126**	.011	**.647****	.507
OV9	-.147**	-.321**	**.427****	.497	-.137**	-.242**	**.575****	.428
OV10	.134**	-.217**	**.500****	.673	.028	-.211**	**.611****	.533
OV13	-.065	-.147**	**.585****	.524	.051	-.109*	**.632****	.581
OV19	-.148**	.048**	**.231****	.908	-.264**	-.004	**.558****	.500
OV20	-.241**	-.015	**.508****	.574	-.134**	-.109**	**.653****	.426
OV23	.072	-.137**	**.583****	.612	.252**	-.146**	**.611****	.650
AUTO-CARE	.354**				.454**			
OVER-CARE	-.410**				-.393**			
OVER-AUTO	-.404**				-.260**			
AU21-AU22	.494**				.553**			

Note. CA = care; AU/Auto. = autonomy; OV/Over. = overprotection; Uniq. = item uniquenesses; *p < .05; **p < .01.

Appendix S4.4: Results Related to the Satisfaction with Life Scale (SWLS)

In contrast to the previous two cases, due to having a unidimensional structure, subjective wellbeing (as measured by the SWLS) was estimated with the classical CFA approach where all five items loaded on a single factor. Model fit was adequate both in the adolescent (χ^2 = 21.817, df = 5, CFI = .977, TLI = .955, RMSEA = .081 [90% CI .048-.117]) and in the adult (χ^2 = 9.720, df = 5, CFI = .995, TLI = .989, RMSEA = .043 [90% CI .000-.084]) sample. The latent factor was well-defined by strong target loadings in both samples (Sample 1: $|\lambda|$ = .672-.867, M = .754; Sample 2: $|\lambda|$ = .709-.895, M = .824). For the exact estimates, see Table S4.3.

Table S4.3

Standardized parameter estimates for the three-factor ESEM models of the Parental Bonding Inventory

	Sample 1 (adolescents)		Sample 2 (adults)	
	Life satisfaction	Uniqueness	Life satisfaction	Uniqueness
SWLS1	**0.749****	0.440	**0.859****	0.263
SWLS2	**0.702****	0.508	**0.816****	0.334
SWLS3	**0.867****	0.249	**0.895****	0.199
SWLS4	**0.781****	0.390	**0.841****	0.292
SWLS5	**0.672****	0.549	**0.709****	0.497

Note. SWLS = Satisfaction with Life Scale; *p* < .05; **p* < .01.

Supplementary Materials: Study 5

Appendix S5.1: Autoregressive and Latent Growth Models

There have been several methods throughout research that have been used to analyze the stability of developmental processes such as correlational analysis, repeated measures analysis of variance, multivariate analysis of variance, and other methods (Curran et al., 2010; Morin, Maïano, Marsh, Janosz, & Nagengast, 2011). Two approaches that received considerable attention over the years have been the autoregressive modeling (ARM; Guttman, 1954; Jöreskog, 1979) and latent growth modeling (LGM; McArdle & Epstein, 1987; Meredith & Tisak, 1990). Both of these approaches have been widely used in psychological research (e.g., Arens et al., 2016; King, 2015; Morin et al., 2011; Morin et al., 2017; Putwain et al., 2018; Turner et al., 2014). However, there are fundamental differences between the two when one wishes to examine growth trajectories and change over time (see Figure S5.1 for a schematic representation of basic ARM and LGM models).

The main characteristic of ARM is that they assume that one's current behavior is best predicted by one's previous behavior (Geiser, 2012). For this reason, scores measured at Time 2 are regressed on scores measured at Time 1, scores measured at Time 3 are regressed on scores measured at Time 2, and so on. The strength of these autoregressive effect (i.e., regression coefficients) informs us about the stability of the construct at hand. In addition, residual variances are also to be examined to draw conclusions about temporal stability. High autoregressive effects in conjunction with low residual variances would suggest high temporal stability. Conversely, moderate-to-low autoregressive effects and high residual variances would suggest that the construct of interest changes over time. One can see that with ARM, growth is not directly assess, but *indirectly* and inferred from the magnitude of autoregressive and the time-specific residual variances. It is also important to note that, generally, ARM models are not used to investigate change over time, but rather to investigate the effect of other variables on the variable of interest (i.e., cross-lagged effects) over and above its previous score.

LGMs function differently as they produce latent trajectories or growth curves over time for the repeated measures (Bollen & Curran, 2004). The basic research question for LGMs is also distinct from that of the ARMs. Instead of examining the dependence of current passion levels on past passion level across all participants, LGMs assess an underlying developmental trajectory across the time points for all individuals (Bollen & Curran, 2006). These trajectories are assessed by estimating a latent intercept factor (i.e., mean initial value) and a latent growth factor (i.e., actual change rate over time). In other

words, LGMs *explicitly and directly* focus on change over time. A strength of LGMs is that different types of growth factors (i.e., linear growth, quadratic growth, cubic growth, etc.) can be estimated when theory supports their potential presence (Bollen & Curran, 2006). Another important distinction between ARMs and LGMs is that the latter does not assume that all respondents have the same effect and allows individual variability and individual trajectories to be present. On the other hand, ARMs assume that change over time is the exact same for all individuals in the sample. Put differently, ARMs focus on group changes, while LGMs focus on individual changes (Voelkle, 2008). Given that our research question pertained to the temporal dynamics of passion, LGMs were deemed to be well-suited for the present investigation.

Appendix S5.2: On the Issue of Need Fulfillment vs. Need Satisfaction and Need Frustration

There is currently an ongoing discussion within the field of Self-Determination Theory (SDT; Ryan & Deci, 2000; 2017) as to whether basic psychological need satisfaction and the later proposed need frustration are indeed empirically distinct, yet moderately associated factors, or rather these two dimensions are parts of the same underlying need fulfillment continuum with both taking up one extreme of said continuum. There have been some studies which provided support for the former proposition by demonstrating the distinctness of need satisfaction and frustration (e.g., Bartholomew et al., 2011; Chen et al., 2015; Longo, Gunz, Curtis, & Farsides, 2016; Nishimura & Suzuki, 2016). On the other hand, other studies not just only suggested that need satisfaction and frustration are two endpoints of the same underlying continuum (Tóth-Király, Bőthe, Orosz, & Rigó, 2018; Tóth-Király, Morin, Bőthe, Orosz, & Rigó, 2018), but it was also demonstrated that need satisfaction and frustration show completely opposite pattern of associations with various correlates (Brenning, Soenens, Mabbe, & Vansteenkiste, 2018; Costa et al., 2016; Landry et al., 2016; Schultz et al., 2015). In addition, a daily diary study reported that changes in need satisfaction and need frustration mirrored one another over the period of 8 days (Bidee et al., 2016), supporting the continuum hypothesis. For these reasons, similar to previous studies (e.g., Campbell et al., 2016), we reversed the need frustration items and added them to the need satisfaction items to create a composite score of need fulfillment.

Table S5.1

Descriptive statistics, internal consistency indices, and inter-factor correlations

Variables	Range	M	SD	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. HP (T1)	1-7	5.55	1.01	.78	—														
2. HP (T2)	1-7	5.61	0.97	.79	.38**	—													
3. HP (T3)	1-7	5.50	1.10	.84	.32**	.50**	—												
4. HP (T4)	1-7	5.53	1.05	.84	.33**	.51**	.65**	—											
5. OP (T1)	1-7	3.95	1.26	.78	.35**	.19*	.07	-.01	—										
6. OP (T2)	1-7	4.22	1.25	.81	.13	.38**	-.13	.01	.45**	—									
7. OP (T3)	1-7	3.99	1.27	.82	.18	.24*	.16	.16	.55**	.70**	—								
8. OP (T4)	1-7	4.08	1.28	.82	.12	.23*	.01	.25*	.49**	.62**	.80**	—							
9. CP (T1)	1-7	5.74	1.02	.78	.62**	.28**	.18	.27**	.57**	.23**	.20*	.19*	—						
10. CP (T2)	1-7	5.82	1.02	.82	.34**	.70**	.30**	.35**	.25**	.42**	.32**	.21*	.43**	—					
11. CP (T3)	1-7	5.68	1.04	.83	.37**	.45**	.76**	.47**	.20*	.04	.37**	.27**	.32**	.38**	—				
12. CP (T4)	1-7	5.68	1.02	.80	.43**	.48**	.49**	.80**	.17	.11	.30**	.40**	.42**	.44**	.56**	—			
13. NE (T1)	1-5	3.90	0.47	.87	.22**	.24**	.15	.23*	-.13	-.08	-.13	-.13	.05	.22**	.08	.06	—		
14. CA (T1)	1-4	3.58	0.42	.86	-.07	.17*	.14	.14	-.14	.01	.09	-.07	-.05	.06	.17	.05	.19	—	
15. AU (T1)	1-4	2.83	0.52	.73	.11	.15	.23*	.04	.18*	.20*	.19*	.09	.11	.14	.19*	.09	.05	.24**	—
16. OV (T1)	1-4	1.88	0.55	.73	-.03	.04	-.01	.04	.19*	.06	.00	.11	.08	.06	-.02	.06	-.19*	-.29**	-.22**

Note. HP: harmonious passion; OP: obsessive passion; CP: passion criteria; NE: need fulfillment; CA: parental care; AU: parental autonomy-support; OV: parental overprotection; T1: Time 1; T2: Time 2; T3: Time 3; T4: Time 4; M: mean; SD: standard deviation; α: Cronbach's alpha; *p<.05; **p<.01.

Figure S5.1

Schematic illustration of autoregressive and latent growth models
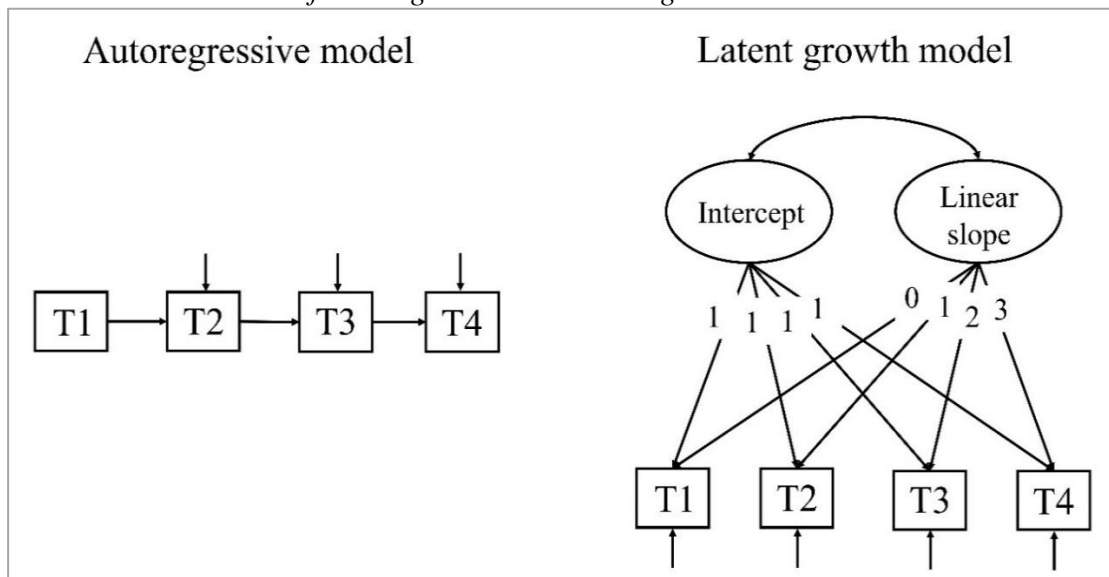
Note. T1: Time 1 scores; T2: Time 2 scores; T3: Time 3 scores; T4: Time 4 scores.

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