



Examining sexual motivation profiles and their correlates using latent profile analysis



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ABSTRACT

According to self-determination theory, sexual motivations are cardinal in relation to sexual well-being and functioning. Despite that motivations are thought to occur in combination instead of separately, this proposition has not been explicitly tested in relation to sexual motivations. To address this issue, the present two-study investigation examined the simultaneous cooccurrence of multiple sexual motivations on distinct samples of young adults ($N_1 = 679$, $N_2 = 632$) using the novel latent profile analysis. To document the validity of the profiles and the positive and negative aspects of sexuality, theoretically-relevant correlates were also included from inside (sexual passion, sexual satisfaction, positive and negative emotions during sex) and outside (problematic pornography use and life satisfaction) the realm of partnered sexuality. Four highly similar profiles were identified across the two studies: (1) highly self-determined, (2) moderately self-determined, (3) moderately non-self-determined, and (4) highly non-self-determined. These profiles differed from one another on most, but not all, correlates with the more self-determined profiles being associated with more positive correlates. These results contribute to a better understanding of one's underlying sexual motivations by highlighting the importance of simultaneously considering these motivations in regard to sexual well-being.

Sexuality is thought to be an important and integral part of human life (Satcher, 2001). Having sexual activities has been associated with better physiological and psychological health and well-being (Brody, 2010; Drory, 2002; Levin, 2007; Lindau & Gavriloiva, 2010; Persson, 1981). However, despite sexuality having a central importance in life, the psychological study of sexuality mostly focuses on pathologies and the negative characteristics of sex such as hypersexuality and other problematic sexual behaviors (e.g., Bőthe et al., 2018; Bőthe et al., 2019; Grubbs, Perry, Wilt, & Reid, 2018), sexual risks (Kalichman, Simbani, Kaufman, Cain, & Jooste, 2007), diseases (Chen, Gong, Liang, & Zhang, 2000), or other problems (Russell, 2005). While these studies certainly have importance, they paint a rather one-sided picture of human sexuality. This was reinforced by the call of Diamond and Huebner (2012) urging sexual research to investigate the various mechanisms through which sexuality influences well-being and health.

In line with prior studies (e.g., Gravel, Pelletier, & Reissing, 2016; Hill & Preston, 1996; Impett, Peplau, & Gable, 2005; Ingledew & Ferguson, 2007; Leigh, 1989; Meston & Buss, 2007), we posit that motivations and understanding why one engages in sexual relationships

is of crucial relevance as these factors could differentiate between positive and negative sex-related correlates and highlight why some sexual experiences might not be satisfying. The present two-study investigation relied on self-determination theory (SDT; Ryan & Deci, 2017) which provides a well-articulated conceptualization of sexual motivations (i.e., why one has sex). Another important point is that one might endorse more than one sexual motivation whose simultaneous occurrence needs to be accounted for given their complex interactive nature. For this reason, across two distinct adult samples, we relied on the person-centered approach of latent profile analysis (LPA) which is able to reveal how different configurations of sexual motivations are organized within individuals. In addition, to better document the meaningfulness of the sexual motivation profiles and to better understand the positive and negative aspects of sexuality from the perspective of these motivational profiles, we also examined how profile membership predicted theoretically-relevant correlates inside and outside the realm of partnered sexuality.

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1. The perspective of self-determination theory on sexual motivations

Research on motivations (i.e., why people engage in sexual activities) within the framework of SDT posit that sexual behavior is driven by different forms of motivations that one aims to satisfy. These motivations could differ based on the extent to which they are perceived as self-determined or autonomous (i.e., self-governing and in line with one's self-endorsed values; Deci & Ryan, 1985, 2000; Gravel et al., 2016). *Intrinsic motivation* (IMOT) is the most autonomous motivational form and implies that one engages in sex for its own sake (i.e., it is pleasurable and provides enjoyment). *Extrinsic motivation* is present when sex is performed for instrumental reasons, not for its own sake. Four types of extrinsic motivation have been identified along the self-determination continuum (Ryan & Deci, 2017), ranging from the most autonomous to the more controlled ones. In the case of *integrated regulation* (INTE), sex is fully internalized integral part of one's identity and it is a meaningful part of one's life (i.e., sexuality is thought to be an important aspect of life). *Identified regulation* (IDEN) manifests when sex is still significant, but not fully integrated part of one's identity; however, this activity is still performed, because it is perceived as part of the normal and healthy life (i.e., important to have new sexual experiences). With *introjected regulation* (INTR), having sex stems from internal pressures (i.e., engaging in sex to reduce anxiety or enhancing self-esteem). The least autonomous form is *external regulation* (EXTE) and is generated by external rewards or punishment (i.e., having sex to avoid conflict with the partner). Finally, *amotivation* (AMOT) refers to the lack of motivation and thus describes the absence of intention.

Apart from differentiating various motivations on the basis of self-determination, another important tenet of SDT is that these qualitatively different motivations have different consequences. In other areas of life such as work, sport, or education, self-determined motivations (i.e., intrinsic, identified and integrated) have been associated with positive correlates such as job satisfaction and organizational commitment (Gagné & Deci, 2005), persistence in physical activity (Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002), higher vitality during sports (Pelletier, Rocchi, Guertin, Hébert, & Sarrazin, 2017), less academic dropout (Vallerand, Fortier, & Guay, 1997), and better academic performance (Deci, Vallerand, Pelletier, & Ryan, 1991). At the same time, opposing results have been reported in relation to non-self-determined motivations (i.e., introjected, external, or amotivation; see also Ryan & Deci, 2017 for more details). Compared to these fields, relatively little research has been conducted with respect to sexuality. Still, autonomous sexual motivations have reportedly been associated with higher self-reported sexual functioning (Gravel et al., 2016), higher frequency of sex (Wood, Desmarais, Burleigh, & Milhausen, 2018), while controlled sexual motivations have been associated with lower self-esteem and anxiety (Vranganova, 2015) as well as lower need fulfillment and relationship satisfaction (Wood et al., 2018).

All previous sexual motivation studies used variable-centered approaches to examine how sexual motivations relate to various correlates. Despite their importance, variable-centered approaches have their own limitations. More specifically, this approach does not account for the fact that motivations are multidimensional by nature and that people may have multiple reasons at the same time for performing sexual activities. Moreover, one might find it highly problematic to interpret effects when multicollinearity is present as a result of the theoretical closeness of the motivational factors. While these issues can be circumvented by using simplified motivational representations at the cost of information loss (e.g., relative autonomy index; see Grolnick & Ryan, 1987 or Howard, Gagné, Morin, & Forest, 2018), person-centered approaches provide a natural alternative solution by examining the interaction between different motivational factors.

2. Motivational profiles

Person-centered approaches provide a uniquely informative and holistic understanding of sexual motivations and complement variable-centered studies by investigating the interaction of the different motivational factors. Importantly, person-centered approaches rest on the assumption that respondents might come from different subpopulations characterized by different levels of motivations. The present investigation used the state-of-the-art latent profile analysis (LPA) to identify homogenous subgroups of participants that are qualitatively and quantitatively different from one another (Marsh, Lüdtke, Trautwein, & Morin, 2009; Morin & Wang, 2016). In particular, LPA is naturally suited to test how different sexual motivations combine among different profiles of participants and the relative consequences of membership into the extracted profiles.

To date, as far as the authors know, no person-centered studies have been conducted with respect to sexual motivations. Nonetheless, there are some studies that serve as foundations for the present investigation from the fields of education (Gillet, Morin, & Reeve, 2017; Hayenga & Corpus, 2010; Ratelle, Guay, Vallerand, Larose, & Sénécal, 2007; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009), sport (Aelterman, Vansteenkiste, Soenens, & Haerens, 2016; Bechter, Dimmock, Howard, Whipp, & Jackson, 2018; Haerens, Kirk, Cardon, De Bourdeaudhuij, & Vansteenkiste, 2010; Wang, Morin, Ryan, & Liu, 2016), and work (Gillet, Fouquereau, Vallerand, Abraham, & Colombat, 2018; Howard, Gagné, Morin, & Van den Broeck, 2016; Moran, Diefendorff, Kim, & Liu, 2012; Van den Broeck, Lens, De Witte, & Van Coillie, 2013). In these studies, given their diverse range of instruments and methodologies, multiple number of profiles have been identified, typically ranging from three to six. Two common “core” profile configurations have emerged in most studies with the first being an autonomous motivational profile (characterized by high scores on the more self-determined as well as low scores on the non-self-determined factors) and the second being a controlled motivational profile (characterized by higher scores on the non-self-determined factors and lower scores on the self-determined factors). Additional “peripheral” profiles have also been identified such as moderately autonomous and moderately controlled profiles, mixed motivational profiles, non-motivated profiles (Aelterman et al., 2016; Bechter et al., 2018; Howard et al., 2016) and even profiles characterized by high levels on both autonomous and controlled motivations (Haerens et al., 2010; Ratelle et al., 2007; Vansteenkiste et al., 2009; Wang et al., 2016).

In line with prior indirect SDT-based results, three-to-six profiles were expected to be identified with one being autonomous and one controlled profile. We also expected some peripheral profiles to emerge, but given their high variety in previous studies, we did not formulate any a priori hypotheses as to which ones would emerge. To support the substantive interpretation and meaningfulness of the extracted profiles, it is not sufficient to only identify profiles, but LPA needs to be complemented with theoretically meaningful key profile correlates as well (Marsh et al., 2009; Morin, Morizot, Boudrias, & Madore, 2011).

2.1. Profile correlates

2.1.1. Sexual passion

Although sexual passion has generally been conceptualized as being single-dimensional, recent research (Philippe, Vallerand, Bernard-Desrosiers, Guilbault, & Rajotte, 2017) rooted in the Dualistic Model of Passion (DMP; Vallerand, 2015; Vallerand et al., 2003) proposed the extension of this concept by identifying two distinct forms, namely harmonious (HSP) and obsessive sexual passion (OSP). The DMP (Vallerand, 2015; Vallerand et al., 2003) identifies passion as an inclination toward a specific activity that one loves and enjoys, values, incorporates into his/her identity, and spends a significant amount of time and energy with it. Such an activity can be sex (see Philippe et al., 2017).

An important proposition of this model is the co-existence of two types of passions that differ from one another based on the process of internalization that takes place during engaging in sex-related activities (Ryan & Deci, 2017). Harmonious sexual passion (HSP) emerges when sex is freely incorporated into one's identity without any contingencies attached to this particular activity, resulting in free and autonomous activity engagement. With HSP, sexual activity is performed the way the individual wants to do so which is not in conflict with other relevant aspects of one's life, leading to potentially adaptive outcomes (e.g., positive emotions or better relationship quality). On the other hand, with obsessive sexual passion (OSP), activity engagement is more controlled when sex-related values, norms, and behaviors are not completely self-endorsed and instead imposed on the individual as inter- or intra-personal contingencies. These contingencies are, in turn, likely to lead to OSP. Finally, although one loves sex, feeling pressured to engage in this activity can even result in potentially maladaptive outcomes such as intrusive sexual thoughts or sexual conflicts (Philippe et al., 2017).

We hypothesized that people engage in sexual activities over the course of their lives due to different reasons or motivations and that these motivations might be associated with sexual passion.¹ A few studies (Lafrenière, Vallerand, Mageau, & Charest, 2014 cited by Vallerand, 2015; Vallerand et al., 2006) have been conducted that directly investigated the associations between the different motivations and harmonious and obsessive passion (HP and OP). These studies investigated whether autonomous and controlled personality orientations (which bear conceptual similarities with autonomous and controlled motivations, respectively) could be related to HP and OP. Based on their results, autonomous personality orientation was positively related to HP, whereas controlled personality orientation was positively related to OP. Other studies from the domain of sports (Curran, Appleton, Hill, & Hall, 2011) and work (Houffort, Philippe, Vallerand, & Ménard, 2013) support these findings. A recent meta-analysis also reported that autonomous motivations were more strongly related to HP, while controlled motivations were more strongly related to OP in general (Curran, Hill, Appleton, Vallerand, & Standage, 2015). We expected similar relations in that belonging to more autonomous profiles would be related to higher levels of HSP and belonging to the more controlled profiles would be associated with higher levels of OSP.

2.1.2. Sexual satisfaction

Besides sexual passion, sexual satisfaction is one of the most cardinal aspects of sexual activities with the majority of people reportedly finding it important to have a happy sexual relationship within a successful marriage (Taylor, Funk, & Clark, 2007). But sexual satisfaction is not only related to more positive intimate relationships (McNulty, Wenner, & Fisher, 2016), it is also associated with higher psychological well-being (Davison, Bell, LaChina, Holden, & Davis, 2009), making it particularly relevant for the present investigation. Some prior evidence is already available with Gravel et al. (2016) as well as Wood et al. (2018) reporting positive associations between autonomous personal and relational motivations and sexual satisfaction. Outside the scope of SDT-based motivations, sexual satisfaction has positively been associated with having sex for intrinsic reasons (e.g., love or commitment),

¹ While there are some conceptual similarities between passion and motives, a closer inspection reveals their unique characteristics (see Curran et al., 2015 or Vallerand, 2015). Passion entails that the activity is part of one's identity, whereas intrinsic motivation does not. For instance, one might be intrinsically motivated for an activity without valuing it or considering it to be part of one's identity. In a similar manner, while SDT suggests that intrinsic motivation is invariably associated with positive outcomes, the DMP suggests that engagement in enjoyable activities might lead to positive or negative outcomes depending on the type of passion for the activity. With respect to extrinsic motivation, the goal is to achieve a goal that is separate from the activity, whereas passion refers to engaging in an inherently enjoyable activity.

but negatively with extrinsic reasons (e.g., improving self-esteem; Stephenson, Ahrold, & Meston, 2011). Similar associations have been reported between approach motivations (i.e., the pursuit of pleasurable experiences; Gable & Impett, 2012) and sexual satisfaction (Impett et al., 2005; Muise, Impett, & Desmarais, 2013).

3. The present investigation

Based on previous theoretical (Vallerand, 1997) and empirical works (e.g., Vansteenkiste et al., 2009), the presence of sexual motivations might be important with respect to sexual and psychological functioning. However, equally important is the co-occurrence of these motivations given that individuals might endorse multiple motivations at the same time which, in turn, might be conducive of different sexual experiences. Thus, for a more detailed understanding, the overarching goal of the present two-study investigation was to examine the simultaneous occurrence of different sexual motivations across two independent adult samples with LPA. On the basis of previous studies, we expected the common core fully autonomous and fully controlled sexual motivation profiles to emerge. At the same time, some uncommon peripheral profiles were also expected to emerge. We also considered how the likelihood of profile membership is associated with key correlates of sexual passion and sexual satisfaction. Should autonomous and controlled profiles emerge, based on previous studies, it was expected that members of the autonomous profiles would have higher levels of HSP and sexual satisfaction, while members of the controlled profiles would have higher levels of OSP and lower sexual satisfaction. Furthermore, in Study 1, other theoretically-relevant correlates were also included from inside sexuality. Study 2 built on this perspective by also including correlates outside the realm of partnered sexuality.

4. Study 1

This study sought to investigate the presence as well as the positive and negative correlates of sexual motivation profiles. To this end—apart from sexual passion and sexual satisfaction that were included in both Study 1 and 2—in Study 1, we also investigated how motivation profiles are related to other variables inside the realm of partnered sexuality. For this purpose, positive and negative emotions experienced during sex were selected given their theoretical relevance. That is, although people engage in sex for various reasons, they might have different experiences during this activity; some might experience positive emotions, while others might experience negative ones. Gravel, Reissing, and Pelletier (2018) have already reported that sexual well-being was positively associated with autonomous sexual motivations and negatively with controlled motivations. Other studies outside sexuality also corroborated these findings (e.g., Gagne, Ryan, & Bargmann, 2003; Weinstein & Ryan, 2010). On the basis of these findings, apart from the general expectations mentioned above in relation to passion and sexual satisfaction, we also expected the more autonomous motivational profiles, relative to the more controlled profiles, to be associated with higher levels of positive sexual emotions and lower levels of negative sexual emotions.

5. Methods

5.1. Ethical considerations

Both studies were conducted in accordance with the Declaration of Helsinki and with the approval of the University Research Ethics Committee. In both studies, the questionnaires were filled out online with the recruitment of Study 1 taking place in March–April 2017 and the recruitment of Study 2 in June–July 2017. Participants were first informed about the general aim and the topic of the study. If they wished to participate, they had to check a box; otherwise, they were excluded.

5.2. Participants

Participants were 679 Hungarian adults (66.6% female), aged between 18 and 62 years ($M = 26.57$ years, $SD = 7.39$ years) recruited in online groups, forums, and mailing lists.² These participants reported their highest level of education as primary (5.0%), secondary (61.0%), and higher (34.0%); their place of residence as the capital city (42.1%), county capitals (14.0%), cities (28.4%), and villages (15.5%); and their relationship status as single (29.2%) and in a relationship (70.8%). The majority of the participants (84.7%) had sex at least on a monthly in the 12 months prior to data gathering.

5.3. Measures

5.3.1. Translation procedures

All non-validated measures used in these studies were translated and back-translated based on the procedure of Beaton, Bombardier, Guillemin, and Ferraz (2000).

5.3.2. Sexual motivations

The 24-item Sex Motivations Scale (SexMS; Gravel et al., 2016) was used to assess six dimensions (four items each) of respondents' motivations toward sexual relationships: intrinsic motivation (e.g., "Because I enjoy sex"; $\alpha = 0.72$); integrated (e.g., "Because sexuality is a meaningful part of my life"; $\alpha = 0.90$); identified (e.g., "Because sexuality is a normal and important aspect of human development"; $\alpha = 0.73$); introjected (e.g., "To prove to myself that I am a good lover"; $\alpha = 0.90$); external (e.g., "To live up to my partner's expectations"; $\alpha = 0.78$); and amotivation (e.g., "I don't know; actually, I find it boring"; $\alpha = 0.84$). Participants were asked to rate items on a seven-point scale (1 = does not correspond at all; 7 = corresponds completely). The Hungarian version is available in Appendix 1 of the online supplements.

5.3.3. Sexual passion

The Passion Scale (Marsh et al., 2013; Tóth-Király, Bóthe, Rigó, & Orosz, 2017; 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 the other activities in my life"; $\alpha = 0.87$) and obsessive passion (six items; e.g., "I have almost an obsessive feeling for my activity"; $\alpha = 0.87$). In the present case, the word "activity" was replaced by the word "sex". Participants indicated their level of agreement on a seven-point scale (1 = not agree at all; 7 = very strongly agree).

5.3.4. Sexual satisfaction

A single item measure was used to assess respondents' sexual satisfaction (Overall, to what extent are you satisfied with your sexual life?) as it has been shown to be satisfactory compared to questionnaires measuring sexual satisfaction including multiple items (Mark, Herbenick, Fortenberry, Sanders, & Reece, 2014; Philippe et al., 2017). The item was rated on a five-point scale (1 = not satisfied at all; 5 = completely satisfied).

5.3.5. Positive and negative emotions

Adapted from Philippe et al. (2017), participants were rated the extent they experience positive (five items; e.g., enthusiastic, happy, in a good mood; $\alpha = 0.88$) and negative (five items; e.g., guilty, anxious, disgusted; $\alpha = 0.62$) emotions during sex. Items were rated on a five-point scale (1 = very slightly, or not at all; 5 = very much).

² Examples of these are Pesten Hallottam [I heard in Budapest] or the student mailing list of the University of Szeged.

5.4. Statistical analyses

All preliminary and main analyses were performed with Mplus 8 (Muthén & Muthén, 1998–2017) and were identical across the two studies.

5.4.1. Preliminary measurement models

Given that using latent variables in mixture models is computer-intensive and often results in convergence problems, the present investigation relied on factor scores (specified with a mean of 0 and a standard deviation of 1) saved from preliminary measurement models and used these factor scores as profile and correlate indicators. Following previous theoretical (Asparouhov & Muthén, 2009; Marsh, Morin, Parker, & Kaur, 2014) and empirical papers (e.g., Marsh et al., 2013; Tóth-Király et al., 2017), sexual motivation and passion were modeled via exploratory structural equation modeling (ESEM), while the remaining variables were modeled via confirmatory factor analysis (CFA). More information is provided in Appendix 2 of the online supplements.

5.4.2. Latent profile analysis (LPA)

Subsequently, LPA—including one to eight profiles—was conducted with the robust maximum-likelihood estimator (MLR) to identify profiles of participants based on their sexual motivations. To avoid converging on suboptimal local maximum, all models were estimated with 5000 random start values, 1000 iterations, and the 200 best solutions were retained (Gillet, Morin, Cougot, & Gagné, 2017; Hipp & Bauer, 2006; Tóth-Király, Bóthe, Orosz, & Rigó, 2018). Means and variances of the profile indicators were freely estimated (Diallo, Morin, & Lu, 2016). Once the final solution was identified, the profiles were compared on the basis of the correlates using Mplus' (e) auxiliary function (Asparouhov & Muthén, 2007) which tests the equality of the means of the correlates across the profiles without assuming directionality between profile membership and the correlates.³

6. Results and brief discussion

6.1. Latent profiles of sexual motivations

The optimal number of profiles was selected on the basis of various fit indices and of the comparison of alternative profile solutions (more details are provided in Appendix 3 of the online supplements). A four-profile solution was retained as a final solution and is displayed on Fig. 1. Profile 1 (including 37.41% of the respondents) was labeled as *highly self-determined* profile following higher than average scores on IMOT, INTE, and IDEN, average scores on INTR, and lower than average scores on EXTE and AMOT. Profile 2 (including 29.16% of the respondents) was a *moderately self-determined* profile characterized by average levels of IMOT and lower than average levels on all other motivational factors. Profile 3 (with 21.94% of the respondents) was a *moderately non-self-determined* profile as apparent by the higher than average INTR and EXTE scores as well as the average scores on the other factors. Finally, Profile 4 (11.49% of the respondents) was a *highly non-self-determined* profile given the higher than average scores on EXTE and AMOT and the lower than average scores on INTR, INTE, and IDEN.

6.2. Correlates of profile membership

Correlates were added to the final 4-profile solution and revealed the differentiated effects of profile membership with some interesting

³ Mplus syntax for the preliminary measurement models and the LPA models are also provided in the online supplementary document in case one wishes to conduct similar future studies.

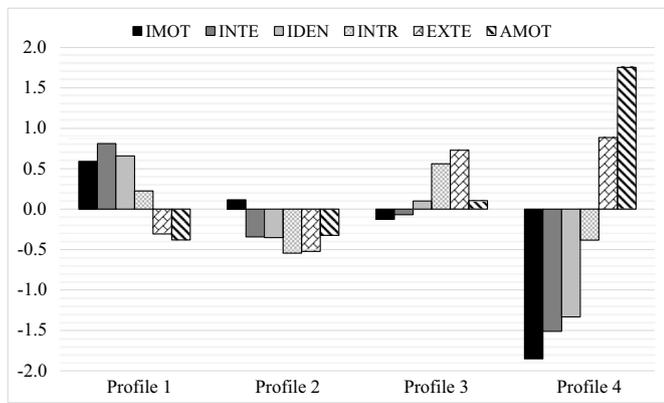


Fig. 1. Characteristics of the sexual motivation profiles (Study 1). Note. Indicators are estimated from factor scores saved from preliminary measurement models with a mean of 0 and a standard deviation of 1; IMOT: intrinsic motivation; INTE: integrated motivation; IDEN: identified motivation; INTR: introjected motivation; EXTE: external motivation; AMOT: amotivation; Profile 1: highly self-determined; Profile 2: moderately self-determined; Profile 3: moderately non-self-determined; Profile 4: highly non-self-determined.

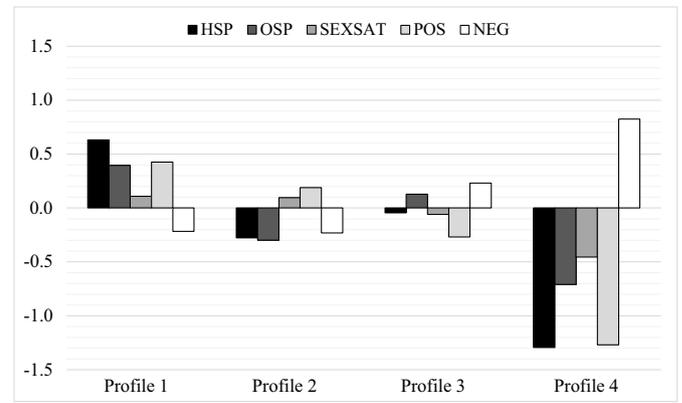


Fig. 2. Levels of correlates in the final four-profile solution in Study 1. Note. All correlates are standardized with a mean of zero and a standard deviation of one.; HSP: harmonious sexual passion; OSP: obsessive sexual passion; POS: positive emotions during sex; NEG: negative emotions during sex; SEXSAT: sexual satisfaction; Profile 1: highly self-determined; Profile 2: moderately self-determined; Profile 3: moderately non-self-determined; Profile 4: highly non-self-determined.

Table 1
Means of correlates and pairwise comparisons between the four sex motivation profiles (Study 1).

Correlates	1. Highly self-determined	2. Moderately self-determined	3. Moderately non-self-determined	4. Highly non-self-determined	Differences between profiles
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	
Harmonious sexual passion	0.632 (0.042)	-0.277 (0.052)	-0.045 (0.061)	-1.294 (0.105)	4 < 2 < 3 < 1
Obsessive sexual passion	0.394 (0.063)	-0.298 (0.055)	0.128 (0.081)	-0.708 (0.073)	4 < 2 < 3 < 1
Sexual satisfaction	0.108 (0.067)	0.096 (0.073)	-0.060 (0.081)	-0.456 (0.112)	4 < 3 = 2 = 1
Positive emotions during sex	0.426 (0.038)	0.188 (0.046)	-0.269 (0.073)	-1.270 (0.154)	4 < 3 < 2 < 1
Negative emotions during sex	-0.216 (0.047)	-0.232 (0.035)	0.232 (0.066)	0.825 (0.165)	2 = 1 < 3 < 4

SE: standard error.; As correlates were estimated from factor scores saved from preliminary measurement models with a mean of 0 and a standard deviation of 1, zero signifies that a correlate is on an average level. Scores substantially higher than zero are considered above average, while scores substantially lower than zero are considered below average.

findings (exact means and standard errors are reported in Table 1, graphically represented in Fig. 2, while pairwise comparisons are reported in Table S11 of the online supplements). More specifically, levels of both harmonious and obsessive passion were highest in the highly self-determined profile, followed by the moderately non-self-determined, the moderately self-determined, and the highly non-self-determined profiles. Of additional importance are positive and negative affect during sex which followed the expected patterns in that the more desirable levels were associated with more self-determined profiles relative to more non-self-determined ones. As for sexual satisfaction, respondents having highly non-self-determined motivation had the lowest sexual satisfaction compared to the other profiles, but the other profiles did not differ from one another.⁴

Overall, four sexual motivation profiles have been identified that are theoretically-relevant, demonstrating the importance of person-centered approaches in the case of complex constructs such as motivations. Profiles extracted in the present study also correspond to academic, work, and sport motivation profiles (e.g., Bechter et al., 2018; Gillet et al., 2018; Howard et al., 2016; Wang et al., 2016), giving further support for their validity. At the same time, membership to these profiles was differentially related to various sex-related correlates. Members of the highly self-determined profile reported the highest level of HSP, OSP, positive emotions during sex, while the highly non-

self-determined profile was its reverse. Interestingly, members of the moderately non-self-determined profile reported higher levels of passion than members of the moderately self-determined profile.

7. Study 2

Despite the promising results of Study 1, the replicability of the findings should be further tested in order to minimize capitalizing on chance. Therefore, a second study was carried out with a different sample to assess the generalizability and replicability of our findings. At the same time, similar to Gravel et al. (2016), we wished to examine whether the effects of sexual motivations span beyond the domain of partnered sexuality. For this reason, apart from sexual passion and sexual satisfaction, more general correlates were considered that are outside the realm of partnered sexuality, namely life satisfaction and problematic pornography use with the latter being an individual-based sexual activity (Efrati & Mikulincer, 2018). Still, these variables were not only selected for convenience purposes.

Life satisfaction is one of the most common indicators of one's general well-being. Previous studies have already reported positive associations between more autonomous or self-determined motivations and various indicators of general psychological well-being, suggesting that performing sex for autonomous reasons is not only related to higher sexual satisfaction but higher life satisfaction as well (Brunell & Webster, 2013; Gravel et al., 2018). Therefore, life satisfaction was expected to operate similarly to sexual satisfaction in that more self-determined profiles would be associated with higher life satisfaction

⁴ Auxiliary analyses revealed that profile membership was not associated with either gender (coded as 0 = male and 1 = female) or relationship status (coded as 0 = single and 1 = in a relationship).

compared to more non-self-determined profiles.

There is a small body of literature on sexual motivations and pornography use. Trait sexual motivation (i.e., trait-like individual motivation to be sexually active) has been associated with problematic use of sexually explicit materials on the internet (Stark et al., 2017). Theoretical models have also been proposed that underlie the importance of pleasure seeking (i.e., akin to IMOT) and discomfort avoidance (i.e., akin to INTR) in problematic pornography use (Grubbs, Braden, Kraus, Wilt, & Wright, 2017). While problematic pornography use has not been examined in relation to SDT-based sexual motivations, SDT motivations in other fields had diverse associations with different problematic or risky behaviors in previous studies. More specifically, intrinsic academic motivation had a negative association with current and lifetime drinking behavior, while external regulation had positive association with current drinking behavior among university students (Wormington, Anderson, & Corpus, 2011). In the case of online gaming (Király, Tóth, Urbán, Demetrovics, & Maraz, 2017; Yee, 2006), escapism, advancement, achievement and competition motivations (which might be interpreted as different forms of extrinsic motivation) had positive associations with internet gaming disorder. Regarding sexuality-related constructs, autonomous motivation was negatively related to risky sexual behaviors (i.e., number of casual sexual partners, unprotected sexual intercourse, unprotected sexual intercourse under the influence of alcohol or drugs, having pregnancy and sexually transmitted disease tests), while controlled motivation was unrelated to them (Ingledeu & Ferguson, 2007). The aforementioned results suggest that autonomous motivations may have a protective role in problematic and risky behaviors, while controlled motivations may result in risky or problematic behaviors. Thus, it was hypothesized that more self-determined profiles would be associated with lower levels of problematic pornography use compared to non-self-determined profiles.

8. Methods

8.1. Participants

Participants (all different from those used in Study 1) were 632 Hungarian adults (66.6% female), aged between 18 and 65 years ($M = 26.02$ years, $SD = 6.91$ years) recruited in online groups, forums, and mailing lists.⁵ These participants reported their highest level of education as primary (9.3%), secondary (59.5%), and higher (31.2%); their place of residence as the capital city (44.6%), county capitals (13.9%), towns (27.4%), and villages (14.1%); and their relationship status as single (26%) or in a relationship (74%).

8.2. Measures

8.2.1. Sexual motivations

The same scale (Gravel et al., 2016) was used as in Study 1. Cronbach's alphas were similarly good as in Study 1, ranging from 0.75 (identified) to 0.91 (introjected).

8.2.2. Sexual passion

Similar to Study 1, the Passion Scale (Tóth-Király, Bóthe, et al., 2017; Vallerand et al., 2003) was used, referring to sex. Again, reliability was adequate for both harmonious ($\alpha = 0.81$) and obsessive ($\alpha = 0.85$) passion.

8.2.3. Sexual satisfaction

See Study 1.

⁵ For instance, Youths of Kecskemét [a Hungarian city] or Kérdőív Pont [Questionnaire point].

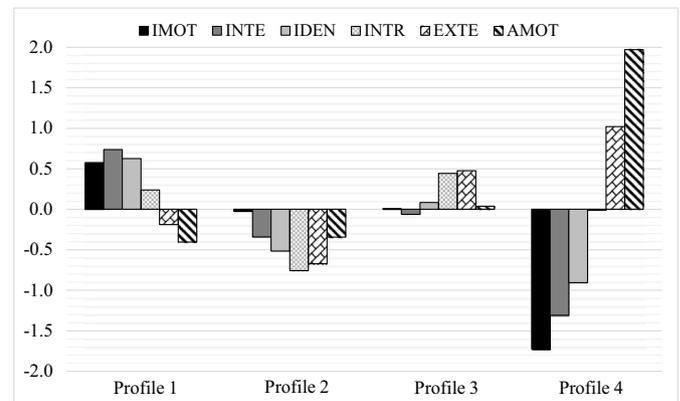


Fig. 3. Characteristics of the sexual motivation profiles (Study 2).

Note. Indicators are estimated from factor scores saved from preliminary measurement models with a mean of 0 and a standard deviation of 1.; IMOT: intrinsic motivation; INTE: integrated motivation; IDEN: identified motivation; INTR: introjected motivation; EXTE: external motivation; AMOT: amotivation; Profile 1: highly self-determined; Profile 2: moderately self-determined; Profile 3: moderately non-self-determined; Profile 4: highly non-self-determined.

8.2.4. Problematic pornography use

The six-item version of the Problematic Pornography Consumption Scale (PPCS; Bóthe et al., 2018) was used to assess problematic use along the six components model of Griffiths (2005), namely salience, tolerance, mood modification, withdrawal, relapse, and conflict (e.g., “I felt that I had to watch more and more porn for satisfaction”; $\alpha = 0.84$). Participants indicated their responses using a seven-point scale (1 = “never”; 7 = “all the time”).

8.2.5. Satisfaction with life

The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) is a five-item scale (e.g., “The conditions of my life are excellent”; $\alpha = 0.89$) assessing the general satisfaction with life on a 7-point Likert scale (1 = not true to me at all; 7 = absolutely true to me).

9. Results and brief discussion

Results pertaining to LPA were remarkably similar to those of Study 1 with a four-profile solution being selected as the most optimal one on the basis of fit indices and profiles comparisons. See Fig. 3 for the graphical representation of the profiles. Once again, Profile 1 included *highly self-determined* respondents (35.44%) with increased autonomous motivations and decreased controlled motivations. Profile 2 included *moderately self-determined* respondents (27.22%) with average autonomous motivations and lower than average controlled motivations. Profile 3 included respondents (26.26%) with *moderately non-self-determined* motivations as apparent by the slightly elevated INTR and EXTE scores. Finally, Profile 4 consisted of respondents (11.08%) who had *highly non-self-determined* sexual motivations given their substantially elevated EXTE and AMOT scores and their substantially decreased scores on autonomous motivations.⁶

Pairwise comparisons were conducted to examine whether the four profiles differed with respect to the correlates (exact means presented in Table 2 and graphically represented in Fig. 4). Findings were similar to

⁶ Compared to Study 1, auxiliary analyses here revealed that being female was associated with lower likelihood of membership into the moderately non-self-determined profile compared to the highly self-determined (odds ratio [OR] = 0.415), the moderately self-determined (OR = 0.584), and the highly non-self-determined (OR = 0.443) profiles. In addition, being in a relationship was associated with lower likelihood of membership into the moderately self-determined profile compared to the moderately non-self-determined (OR = 0.535) and the highly non-self-determined (OR = 0.382) profiles.

Table 2
Means of correlates and pairwise comparisons between the four sex motivation profiles (Study 2).

Correlates	1. Highly self-determined	2. Moderately self-determined	3. Moderately non-self-determined	4. Highly non-self-determined	Differences between profiles
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	
Harmonious sexual passion	0.629 (0.047)	−0.339 (0.066)	−0.032 (0.059)	−1.047 (0.108)	4 < 2 < 3 < 1
Obsessive sexual passion	0.406 (0.065)	−0.356 (0.068)	0.021 (0.072)	−0.452 (0.106)	4 = 2 < 3 < 1
Sexual satisfaction	0.294 (0.067)	0.113 (0.075)	−0.215 (0.079)	−0.647 (0.122)	4 < 3 < 2 = 1
Problematic pornography use	0.016 (0.065)	−0.253 (0.056)	0.084 (0.075)	0.349 (0.159)	2 < 1 = 3 = 4
Satisfaction with life	0.210 (0.062)	0.091 (0.077)	−0.172 (0.077)	−0.442 (0.128)	4 = 3 < 2 = 1

SE: standard error.; As correlates were estimated from factor scores saved from preliminary measurement models with a mean of 0 and a standard deviation of 1, zero signifies that a correlate is on an average level. Scores substantially higher than zero are considered above average, while scores substantially lower than zero are considered below average.

Study 1 in that harmonious and obsessive sexual passion was the highest in the highly self-determined profile, followed by the moderately non-self-determined, the moderately self-determined, and the highly non-self-determined profiles. Problematic pornography use was the lowest in moderately self-determined profile, followed by the highly self-determined, the moderately non-self-determined, and the highly non-self-determined profiles. Somewhat surprisingly, with regards to problematic pornography use, significant differences only pertained to the moderately self-determined profile in relation the other profiles. Regarding sexual satisfaction and satisfaction with life, more desirable levels were once again associated with the more self-determined profiles compared to the more non-self-determined ones.

10. General discussion

The present two-study investigation sought to provide a deeper understanding of the positive and negative aspects of sexuality by identifying profiles of sexual motivations using the person-centered LPA. This approach appeared to be suitable for the assessment of simultaneously present motivational factors that are thought to make up motivational profiles. Interestingly, despite SDT stating that motivations are likely to occur in some combinations (Ryan, Williams, Patrick, & Deci, 2009; Vallerand, 1997), this proposition has not been tested with respect to sexual motivations. The results, across two distinct studies, supported the extraction of four profiles which align well with the proposition of SDT, namely highly self-determined, moderately self-determined, moderately non-self-determined, and highly non-self-determined profiles. These profiles also differed from one another along a

wide range of key correlates (i.e., sexual passion, sexual satisfaction, emotions during sex, problematic pornography use, and life satisfaction). Findings lead to a number of important theoretical and practical implications.

10.1. Sexual motivation profiles

The current research provides an incremental contribution to the literature with the identification of four sexual motivation profiles differing from one another not just in terms of quantity (i.e., overall amount of motivation), but quality (i.e., specific motivational features) as well: (1) highly self-determined profile, (2) moderately self-determined profile, (3) moderately self-determined profile, and (4) highly self-determined profile. These profiles correspond to the results of prior studies with respect to academic (e.g., Gillet, Morin, & Reeve, 2017; Wang et al., 2016) and work motivations (e.g., Howard et al., 2016). The first profile was characterized by high levels of IMOT, INTE, and IDEN (i.e., more self-determined motivations) as well as average levels of INTR and lower than average levels of EXTE and AMOT (i.e., more non-self-determined motivations). Although not measured, members of this profile might have a high sexual desire which might be associated with the high levels of autonomous motivations. As a result of this autonomous sexual integration, members of this profile might engage in sex because they find it enjoyable and personally important. Interestingly, the fourth profile is the mirror image of the first profile (i.e., high levels of non-self-determined motivations and low level of self-determined motivations). These profile members might not engage in sex fully volitionally (as apparent by the high levels of amotivation), but they might do so regardless for the sake avoiding conflicts with others. It is reasonable to assume that members of these profiles may not have sexual desire, though this proposition should be tested in future studies. Both extracted profiles could be interpreted as representing an overall self-determination continuum (Ryan & Deci, 2017) as apparent by the increase and decrease in the level of regulations ranging from the more self-determined to the more non-self-determined ones and both profiles appear to be core profiles as these have been identified in most prior studies (e.g., Haerens et al., 2010; Ratelle et al., 2007; Vansteenkiste et al., 2009).

Two other profiles were also identified with the first being a moderately self-determined profile characterized by average levels of IMOT and lower than average levels on the other motivational factors. Members of this profile are intrinsically motivated for sex on an average level and they might not engage in unwanted sexual behavior if they are not intrinsically motivated to do so (i.e., low non-self-determined motivations). The final profile was a moderately non-self-determined one characterized by higher than average levels of INTR and EXTE and average levels on all other factors. Members of this profile might engage in sex to meet either self- or other-related expectations, thus complying with internal or external demands. Profiles similar to the latter two have also been identified in some prior studies (e.g., Gustafsson, Carlin,

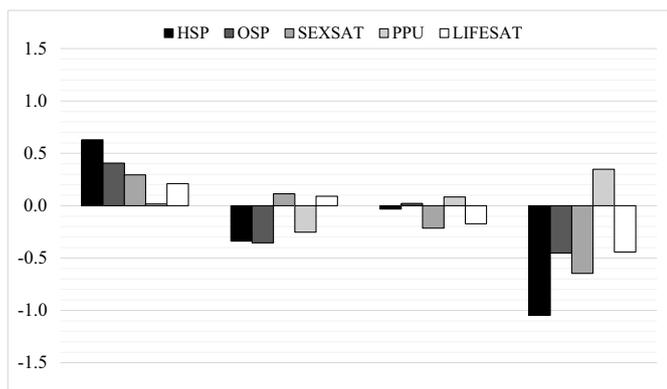


Fig. 4. Levels of correlates in the final four-profile solution in Study 2. Note. All correlates are standardized with a mean of zero and a standard deviation of one.; HSP: harmonious sexual passion; OSP: obsessive sexual passion; SEXSAT: sexual satisfaction; PPU: problematic pornography use; LIFESAT: life satisfaction; Profile 1: highly self-determined; Profile 2: moderately self-determined; Profile 3: moderately non-self-determined; Profile 4: highly non-self-determined.

Podlog, Stenling, & Lindwall, 2018; Howard et al., 2016), though these configurations appear to be less common. Together, the four profiles might also be interpreted as representing a transition between self-determined and non-self-determined sexual motivations. Overall, our results support prior studies (e.g., Howard et al., 2016) in highlighting the importance of relying on a complete range of behavioral regulations in the estimation of motivational profiles.

At the same time, it appears to be equally important to rely on adequate person-centered approaches that are able to provide a more fine-grained representation of sexual motivations. LPA provides such an approach and assumes that a sample is made up of a mixture of various subpopulations (instead of assuming that all respondents belong to the same group). Compared to cluster analysis, LPA also assumes that the variances of the profile indicators are not the same across profiles, that profile indicators are unrelated to one another conditional on the latent profiles, and that respondents have a probability of membership in all profiles instead of exclusively “forcing” them into one or the other. For more discussion on LPA, see Meyer and Morin (2016) or Morin (2016).

10.2. Correlates of sexual motivation profiles

As suggested by Granvold (2001), having a passionate love life is an important aspect of life. The recent delineation of harmonious and obsessive sexual passion (HSP and OSP, respectively; Philippe et al., 2017) provided us with the opportunity to examine how different sexual motivation configurations are associated with HSP and OSP. It was expected that the more self-determined profiles would be associated with higher levels of HSP, while the more non-self-determined profiles would be associated with OSP. Strictly speaking, this was not the case in the present investigation. HSP and OSP had similar associations with profile membership: HSP and OSP were the highest in the highly self-determined profile, followed by the moderately non-self-determined profile, the moderately self-determined profile, and the highly non-self-determined profile.

This result may be explained by the elevated levels of intrinsic motivation. Compared to SDT which focuses on extrinsic elements, the DMP describes that intrinsically interesting elements can further be internalized into one's identity in an autonomous or controlled manner, leading to the development of HP or OP for an activity, respectively (Diefendorff, Houliort, Vallerand, & Krantz, 2018). The observed high levels of intrinsic motivation might be driving this effect. Future studies are needed to better understand such an effect and the variables that might be important for the internalization process. The highly non-self-determined profile (Profile 4), given that it was a mirror opposite of Profile 1, had substantially low levels of IMOT, INTE, and IDEN. One might interpret this as members of this group not engaging in sex volitionally at all and it might equally be possible that they do not have a high desire for sex. For this reason, they reported the lowest levels of HSP and OSP.

The comparison of the two intermediate profiles reveals more nuanced differences. Members of the moderately self-determined profile (Profile 2) had average levels of IMOT, but slightly lower than average levels of INTE and IDEN as well as lower than average INTR, EXTE, and AMOT. Thus, these individuals might find sex pleasurable, but they do not appear to fully endorse other reasons for sex as in the case of the other three profiles. These individuals thus might not become highly passionate for sex (neither harmoniously, nor obsessively), only moderately. Members of Profile 3 (moderately non-self-determined) also had average levels of IMOT, and they also reported average levels of INTE and IDEN. Endorsing all three autonomous factors, instead of just one, appears to be important from the perspective of passion: people might more likely be harmoniously passionate for sex if they engage in it because it is pleasurable, because it is integrated into their self and because it is personally significant. As for obsessive sexual passion, the elevated levels of INTR and EXTE might be attributed to the higher OSP levels which are in line with Vallerand

et al. (2006) who reported that a controlled personality orientation (constructed from the external and introjected regulation subscales) was associated with OP. Predominantly endorsing controlled motivations might lead to suboptimal internalization and, as a consequence, OSP. The consistent ordering of the profiles (i.e., Profile 1, Profile 3, Profile 2, and Profile 4) give support for the validity of the passion-related results.

Sexual satisfaction was also identified as a theoretically-relevant correlate of profile membership. Although there are some minor between-sample differences with respect to the ordering of the profiles, results of Study 1 partially support the a priori expectations, while Study 2 fully supports them. Namely, endorsing self-determined forms of motivations was associated with higher levels of sexual satisfaction which is congruent with previous variable-centered findings (Gravel et al., 2016; Wood et al., 2018). The present investigation suggests that engaging in sex for more self-determined reasons (e.g., enjoyment and personal importance) might be related to higher levels of well-being within the activity. However, it has to be noted that the profiles failed to clearly discriminate differences in sexual satisfaction which might be attributed to its assessment. The present investigation only focused on a narrower understanding of sexual satisfaction which could have also biased our findings. Future studies should also incorporate, similar to Gravel et al. (2016), a wider understanding of sexual satisfaction that includes, for instance, satisfaction with frequency and types of sexual activities as well as with the functioning of one's body (Štulhofer, Buško, & Brouillard, 2010).

The two studies included other well-being correlates that were inside (Study 1) and outside (Study 2) the realm of partnered sexuality (i.e., positive-negative emotions during sex and life satisfaction, respectively). Results pertaining to these correlates align well with the general expectations; membership to the more self-determined profiles was associated with higher levels of positive emotions and life satisfaction as well as lower levels of negative emotions during sex. Endorsing a combination of self-determined sexual motivations (e.g., IMOT and INTE) appears to allow people to experience joy and positive emotions associated with the activity of sex and, at the same time, also experiencing positive emotions in life in general. On the other hand, when they endorse multiple controlled motives (or when they lack the intention for sex), people are more likely to experience negative emotions and have fewer positive emotions as well as lower life satisfaction, partly because they do not necessarily find this activity enjoyable and because they do not engage in sex completely volitionally.

Results appear to be more complex with respect to problematic pornography use as members of the moderately self-determined profile reported the lowest levels of problematic pornography use, while the other three profiles had equal levels to one another. Individuals in the highly non-self-determined profile reported the highest level of problematic pornography use. Individuals in this profile might experience being forced to engage in real-life sexual behaviors in which they do not necessarily want to, thus, they might feel losing their autonomy regarding their sexual behaviors. As pornography is easily accessible, affordable (or in the most cases free) and anonym, it might provide them a wide variety of pornographic materials, autonomous decision-making and a way to escape from real-life experiences, which in turn, may result in the engagement of pornography use in a problematic manner (Cooper, 1998; Young, Griffin-Shelley, Cooper, O'mara, & Buchanan, 2000).

Individuals in the highly self-determined profile were expected to have the lowest level of problematic pornography use. However, individuals in the moderately self-determined profile reported the lowest level of problematic pornography use. These results might be explained by the fact that individuals in the highly self-determined profile might experience higher sexual drive or desire than individuals in the moderately self-determined profile, resulting in more frequent pornography use as a way to alleviate high sexual desire that might not necessarily be fulfilled in real-life. These results are in line with previous studies

indicating that using pornography to experience sexual activities that may not be experienced in real-life situations may result in higher levels of problematic pornography use (Bóthe, Tóth-Király, Demetrovics, & Orosz, 2018). Future studies are needed to test these hypotheses.

10.3. Limitations, future research, and practical implications

The present investigation made some significant contributions to the scientific literature. This research examined different specific sexual motivations configurations instead of relying on more global, simplified dimensions by relying on the state-of-the-art LPA. This investigation showed the added value of a person-centered approach by identifying distinct subgroups of participants who have quantitatively and qualitatively different motivations, something which would not have been possible via variable-centered approaches. Another contribution of this approach is that it becomes visible that people endorse multiple motivations at the same time. The highly similar results across the two studies revealed a more nuanced picture about the relationship between sexual motivations and sexual passion as well as other profiles correlates.

However, there are also some limitations of the present investigation that need to be noted. First, the two studies employed a cross-sectional design that does not allow for causal inferences. An important next step in this research would be the application of experimental designs to examine the causal relations between sexual motivations in HSP and OSP. Additionally, longitudinal studies would also be essential to test the temporal stability of the profiles and to test the directionality between the examined constructs. Longitudinal studies would also be fruitful in examining within-person and between-person changes in sexual motivation profiles. Second, the studies were questionnaire-based which could lead to distorted results due to potential biases (e.g., social desirability). The results should be replicated with other, more comprehensive or even representative samples in order to have even more generalizable conclusions. LPA itself also has limitations that should be kept in mind. Absolute fit indicators (e.g., CFI or RMSEA) are not available for mixture models, only relative fit indicators (e.g., SSABIC or CAIC) which might make the class enumeration process difficult in case these relative indicators do not converge on the same solutions. Another limitation is that fully latent variables—which are completely corrected for measurement error—are difficult to include into mixture models. Although the present research relied on factor scores saved from fully latent measurement models that are partially corrected for measurement error, it still represents a limitation. While diverse correlates were included in the present investigation, other ones (e.g., sexual functioning and dysfunctioning, self-esteem, psychological distress, previous sexual experiences, sexual desire) could also be used in future studies to more fully grasp the potential differences between the different motivational profiles. It might also be important to identify potential profile predictors such as need satisfaction and need frustration (Tóth-Király, Morin, Bóthe, Orosz, & Rigó, 2018; Vansteenkiste & Ryan, 2013). As mentioned above, future studies should measure sexual satisfaction in more details. Finally, future research should also verify whether the present results generalize to other cultures that are different from the Hungarian one and to other life areas (e.g., academic motivations and academic passion or sport motivations and sport passion).

As for practical implications, from the perspective of problematic pornography use, belonging to the highly non-self-determined profile may be considered a risk factor of developing problematic pornography use. Individuals being amotivated or externally motivated toward sexual activities might have a higher risk of engaging in pornography use in a problematic manner. If individuals do not feel like having partnered sex, pornography may provide them an easy, anonymous, and affordable way to satisfy their sexual needs, which in turn may lead to problematic pornography use (Young et al., 2000). Therefore, in targeted interventions, the reduction of amotivation and external

motivation as well as the promotion of intrinsic, integrated, and identified motivations toward sex may help individuals to reduce their problematic pornography use. From the perspective of romantic relationships, having highly self-determined motivations toward sex may result in higher levels of sexual satisfaction, which in turn is strongly associated with relationship satisfaction (e.g., Bóthe, Tóth-Király, Demetrovics, & Orosz, 2017). Thus, when individuals attend couple therapy because of relationship problems, developing autonomous motivations toward sex may also improve their relationship. From the perspective of sexual education for adolescents, it would be useful to explain to them that people can have different motivations for having sex. Having sexual motivations are natural parts of human development and it is normal that they are interested in sexuality-related activities. However, it would be important to emphasize the potential positive effects of highly self-determined sex motivations (e.g., higher levels of sexual satisfaction and well-being) and the potential negative effects of external motivations or amotivation toward sexual activities (e.g., negative emotions during sex).

11. Conclusion

In sum, across two samples of young adults, four sexual motivation profiles were identified, representing a transition from the more self-determined to the more non-self-determined motivations. Furthermore, the present results showed that the endorsing multiple self-determined motivations was related to the highest levels on most desirable correlates (e.g., sexual passion, sexual satisfaction, life satisfaction, and positive emotions during sex), while endorsing several non-self-determined motivations was associated with non-desirable correlates (e.g., low passion as well as sexual and life satisfaction, negative emotions during sex). Differences between the two moderate profiles were more fine-grained. These results highlight the importance of taking the interplay of one's sexual motives into account for better understanding the positive and negative aspects of sexuality.

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Conflict of interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.paid.2019.04.002>.

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