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Integrace partnerských preferencí do výběru partnera
Mate preferences and their integration to mate choice

Doctoral dissertation

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Mate preferences and their integration to mate choice

Declaration:

I hereby declare that this thesis is the result of my own work and effort. The literature is properly cited. This thesis has not been presented, nor it is being presented, either wholly or in part, for any other degree in this or any other institution.

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Contents

Abstract

Mate choice decisions have long-term effects on both party's well-being as well as reproductive outcomes. Consequently, evolutionary biology and psychology devoted a large body of research on investigating human mate choice. The evolutionary psychology of human partner selection can be perceived as inter-connected processes, such as mating strategy, mate preferences, and mate choice. This dissertation thesis consists of two larger segments. The first segment is an Introduction to my four original research papers in the second segment.

In the Introduction, I discuss heterosexual partner selection in two parts. First, I describe how mating strategies affect mate preferences, what the key mate preference dimensions are – both positive and negative factors of partner evaluations –, how stable they are, and how they change over time within a person. Further, I review the concept of mate value and how mate preference factors are weighing in the overall perception of mate value on the mating market. In the second part, I discuss how partner preferences are integrated into mate choice, also known as the mate choice integration models. The Additive and Threshold models of mate choice, the Euclidean distance model, and Assortative mating will be discussed in detail since they are the most commonly applied models. Afterwards, the predictive validity of mate preferences and its theoretical and methodological implications on mate preference integration will be reviewed. Lastly, I show the most important future directions in the research field of human mate choice.

Subsequently, four original research papers are enclosed in the second segment. These papers are investigating key aspects of mate preferences, their contents, stability, and consequences on mate perception, moreover, how these preferences are integrated to mate choice decisions. The first paper reviews mate preference research and its methodological difficulties. This study also presents an original research testing mate preferences, and how these preference factors are affecting relationship satisfaction and self-perceived mate value. The second paper presents a prospective study showing that initially single individuals change their ideal partner preferences after entering a relationship. Perhaps they do so in order to decrease their cognitive dissonance stemming from mate choice and to accommodate their preferences closer to their actual partner's characteristics. The third study is testing how self-perceived mate value is predicted by proxy variables of objective mate value. The study on a sufficiently large sample found very low predictive validity of demographic variables with a holistic self-perceived mate value measure. These results indicate that conceptual advancements are needed in the theory of mate value. The fourth study focuses on mate preference integration algorithms. The study compares two influential mate choice models, the Additive and Threshold models. The Additive model predicts that the potential partner having the highest overall sum of characteristics is the most desirable, while the Threshold model predicts a potential partner needs to meet every mate preference threshold to be considered. Our results show that individuals preferred the potential partners meeting all thresholds. Participants rated less desirable the ones having a higher overall sum of characteristics but violating one of the thresholds, unless the low-level characteristic was unimportant. Future research would greatly benefit from testing further mate choice integration models and revealing how mate preference factors interact in partner perception.

Abstrakt

Výběr partnera patří mezi nejdůležitější rozhodnutí v životě jedince, a to jak z osobního, tak evolučního hlediska. Výběr partnera má dlouhodobý dopad na well-being a reprodukční úspěch obou partnerů. Proto je v popředí zájmu výzkumu v evoluční biologii a psychologii. Z perspektivy evoluční psychologie lze výběr partnera chápat jako vzájemně propojené procesy párovacích strategií, partnerských preferencí a výběru partnera. Předložená disertační práce sestává ze dvou hlavních částí. První část tvoří úvod ke čtyřem původním pracím, které tvoří část druhou.

V úvodu se zaměřuji na výběr partnera u heterosexuálních jedinců. Nejdříve pojednávám, jak párovací strategie ovlivňují partnerské preference, jaké jsou klíčové dimenze partnerských preferencí (pozitivní i negativní faktory ovlivňující hodnocení partnerů) a jejich interindividuální a intraindividuální variabilitu. Následně se zabývám konceptem *mate value* (tzv. hodnoty na partnerském trhu) a jak její vnímání ovlivňují jednotlivé faktory partnerských preferencí. V druhé části úvodu diskutuji, jak jsou partnerské preference integrovány do skutečného výběru (*integrační modely výběru partnera*). Mezi nejpoužívanější modely patří Aditivní a Prahový model výběru partnera, Model Euklidovské vzdálenosti a Nenáhodné párování. V neposlední řadě diskutuji teoretické a metodologické důsledky prediktivních možností partnerských preferencí a jejich integraci do skutečného výběru. V závěru nastiňuji otázky a směry, jimiž by se mohl ubírat budoucí výzkum výběru partnera.

Druhá část práce je tvořena čtyřmi originálními empirickými publikacemi. Přiložené texty se zaměřují na klíčové aspekty partnerských preferencí, jejich obsah, stabilitu a dopad na vnímání partnera, a to včetně způsobů integrace do skutečného výběru. První studie se zabývá výzkumem partnerských preferencí a jeho metodologickými úskalími. Současně testuje partnerské preference a dopad jejích jednotlivých faktorů na partnerskou spokojenost a vlastní vnímanou *mate value*. Druhá, prospektivní, studie ukazuje, že původně nezadaní jedinci mění po navázání vztahu své ideální partnerské preference. Důvodem by mohla být snaha o snížení kognitivní disonance přizpůsobením partnerských preferencí charakteristikám skutečného partnera. Třetí studie testuje, jak je predikovaná vlastní vnímaná *mate value* prostřednictvím objektivní *mate value*. Studie postavená na dostatečně velkém vzorku respondentů ukázala velmi nízkou prediktivní schopnost demografických charakteristik prostřednictvím celkové vlastní vnímané *mate value*. Tyto výsledky naznačují, že teorie *mate value* vyžaduje významné koncepční přepracování. Čtvrtá studie se zaměřuje na integrační algoritmus partnerských preferencí. Studie porovnává dva v současnosti vlivné modely výběru partnera – Aditivní a Prahový. Podle aditivního modelu je nejžádoucnějším parterem takový jedinec, jehož součet všech charakteristik dosahuje nejvyšších hodnot. Oproti tomu podle Prahového modelu musí potenciální partner dosáhnout v klíčových charakteristikách určitého prahu. Naše výsledky ukazují, že jedinci preferovali potenciální partnery, kteří dosahovali ve všech charakteristikách určitého prahu. Respondenti hodnotili jako méně žádoucí ty jedince, jejichž součet charakteristik byl sice vyšší, ale u jedné charakteristiky nedosahovali prahu, i když daná charakteristika nebyla hodnocena jako důležitá. Budoucí výzkum by se měl zaměřit na testování integračních modelů výběru partnera a vliv partnerských preferencí na vnímání partnera.

Preface

This PhD dissertation consists of two segments. The first segment is an Introduction (Part I and Part II) summarizing the current state of knowledge in mate preferences and their integrating models. The second segment (Part III) consists of four research papers of my original research contributing to the crucial questions in the field.

The introductory part is divided into two parts, Part I focuses on mate preferences. I discuss human heterosexual mate preferences. I review, to my best knowledge, all the research investigating the factors of mate preferences, and discuss the strengths and weaknesses of the diverse approaches in the collected studies (see the original research paper Csajbók & Berkics, 2017 in Part III, section 3.1). It is conspicuous that the methodological variability has led to unequivocal and ambiguous results in determining the most important factors of mate choice. To keep the review sensible, yet comprehensive, I do not discuss the potential differences arising from investigating the question on non-heterosexual samples. Future research would greatly benefit from directly investigating the mate preference factors in same-sex couples. Further, I discuss how stable these preferences are while ageing across retest measurements, and after entering a relationship. The original research paper testing adjustment of partner preferences in coupled individuals is in section 3.2 (Kučerová, Csajbók, & Havlíček, 2018). Subsequently, I discuss mate value at the end of Part I and not in Part II, even though I also discuss that mate value research needs more emphasis on the integration of mate preference factors. My reasons are that current research predominantly focuses on the composing factors of mate value and it is less articulated how these factors are integrated. Mate value is indeed a transitional topic in the structure of my thesis, therefore I place it at the end of Part I, which predominantly discusses mate preferences, however, the future of mate value research should be in Part II at the integration models of mate preferences. The original research paper on testing self-perceived mate value is attached in section 3.3 (Csajbók, Havlíček, Demetrovics, & Berkics, 2019).

In Part II, I discuss mate choice integration models, such as the comparison between the Additive and Threshold Models of mate choice. The manuscript on this comparison (Csajbók, Berkics, & Havlíček, under review) is found in section 3.4. In Part II discussing mate choice models, assortative mating as a mate choice model is a misfit to some extent. Research on homogamy does not explicitly test the integration of preference factors, however, it also shares certain methodological struggles with the integration models. Further, although homogamy is not an integration model, it definitely is a mate choice model that has yet to be rigorously tested against the other mate choice algorithms. Lastly, I end my Introduction with discussing the predictive validity of mate preferences. This topic might be more fitting to Part I, as the research is on testing mate preferences. However, the reason why I put it into Part II is that the conclusions drawn from testing the predictive validity of mate preferences concern, in fact, theories on mate preference integration, and how this integration is affecting the prediction of mate choice. That is, the predictive validity of mate preferences is inseparable from understanding how humans integrate those preference factors and how those factors interact. These theories are crucial in understanding how to improve mate choice research and how to move further with mate preference integration research, thus this part has proved to be more fitting at the end of Part II.

Part III is the collection of my original research contribution. The first paper reviews the available research and various methods employed in mate preferences studies and reports an original research on testing the factors of mate preferences (section 3.1: Csajbók & Berkics, 2017). The second paper presents a prospective study on how people adjust their mate preferences after entering a relationship to accommodate their preferences to their actual partner (section 3.2: Kučerová, Csajbók, & Havlíček, 2018). The third paper is published on self-perceived mate value and finds that people are less sensitive to their objective proximate mate value indicators than how much evolutionary theories suggest (section 3.3: Csajbók, Havlíček, Demetrovics, & Berkics, 2019). Lastly, a manuscript under review is enclosed comparing two influential mate choice models, the Additive and Threshold models of mate choice. The study finds that individuals are sensitive to violations of mate choice thresholds, unless the violated characteristic in unimportant for them (section 3.4: Csajbók, Berkics, & Havlíček, under review).

Part I: Mate Preferences

1.1 Evolutionary theories of human mate preferences

Mate choice is among the most important decisions in a person's life, both from a personal and an evolutionary perspective. To overcome the problem of choosing a partner, humans developed a collection of adaptive behaviours. This set of behaviours is assumed to be a strategic answer to the selection pressure of humans' ancestral conditions. Consequently, human mate preferences are a product of the complex adaptive strategies developed over the course of evolution (Buss & Schmitt, 1993). The strategies employed (as well as mate preferences) are dependent of multiple factors, such as sex, temporal context (i.e., how much time the individual intends to invest in the relationship), individual differences (e.g., mate value, personality), and cultural context (Buss, 1994; Buss & Schmitt, 1993; Buss & Schmitt, 2019; Gangestad & Simpson, 2000; Schmitt, 2015).

Mate preferences are thus assumed to affect mate choice (e.g., Buss & Schmitt, 2019; Fletcher et al., 1999; Li et al., 2013; Thibaut & Kelley, 1959). Further, mate choice decisions are crucial in the survival and reproduction of the offspring, as the heritable traits of both parents affect the genetic quality of their offspring (Betzig, 1998; Plomin et al., 2008). It is thus strategically important to evaluate the partners' heritable traits, which are responsible for their reproductive fitness (e.g., Ridley, 1994; Thornhill & Gangestad, 1996). Certain observable phenotypic cues help to infer these underlying fitness indicator traits of the potential partner (Miller & Todd, 1998). Consequently, humans (and other animals) are selected to choose their partner through observing and integrating these cues signalling the potential partners' overall mating quality (Miller & Todd, 1998). These could be, for example, the invested resources and parental care as direct and the heritable, biological cues, such as fertility and health as indirect cues. Research investigating which cues humans look at covers studies testing mate preference factors and how these factors are integrated to mate choice.

It is a robust finding that men on average (more than women) prefer physically attractive, healthy, and fertile women as partners, while women on average (more than men) prefer cues indicating men's ability to acquire resources (e.g., Buss, 1989; Csajbók & Berkics, 2017; Feingold, 1990, 1992; Fletcher, Simpson, Thomas, & Giles, 1999; Li & Kenrick, 2006). Women's fertility declines by a higher rate while ageing than men's, thus it is strategically reasonable that men are more sensitive to features signalling youth (such as physical attractiveness) than women. Frequently investigated cues of attractiveness with a large body of evidence are facial symmetry, facial averageness, perceived skin condition, and women's waist-to-hip ratio (e.g., Jones et al., 2001; Jones et al., 2004; Little et al., 2001; Singh, 1993). These cues potentially signal health, disease resistance, and developmental stability (Jones et al., 2004; Thornhill & Gangestad, 1994; Thornhill & Møller, 1997). A meta-analysis showed that overall body symmetry was associated with sexual success or sexual attractiveness for both sexes, but men indeed found symmetry more attractive than women (Møller & Thornhill, 1998). Women, as mentioned earlier, are more motivated than men to consider the amount of resources which their partner is able and willing to provide for the family. Women's minimal obligatory investment in the offspring is considerably larger than men's (Trivers, 1974). That is why both men's capacity and commitment to share their resources and social skills are important from women's perspective (e.g., Csajbók & Berkics, 2017; Li et al., 2013; Li & Kenrick, 2006). These resources may be protection, shelter, and food provided to the family while women have restricted access to these valuables due to pregnancy or care

for young infants (Trivers, 1974). Being important for both sexes, other cues show less strong systematic sex differences. Perceived intelligence and personality (such as world knowledge, humour, creativity; as well as kindness, warmth, and trustworthiness, respectively) are good indicators of parenting abilities and capacity for a cooperative relationship (Buss, 1994; Miller & Todd, 1998). Human offspring depends on the cooperative breeding efforts of both parents, therefore, such characteristics signal valuable direct benefits of a potential partner for both sexes. Men and women indeed both show high preference for these partner characteristics (e.g., Buss, 1989; Csajbók & Berkics, 2017).

What else do we know about partner perception and evaluation? Thibaut and Kelley (1959) formulated the interdependence theory, which says the function of ideal standards, i.e., mental representations of the individuals' personal expectations, is to evaluate a scenario and help to regulate it according to whether the experience matches these expectations (see Thibaut & Kelley, 1959). The most prominent and influential model of partner perception, the Ideal Standards Model, is also building on the above assumptions of interdependence theory in the mate choice context (Fletcher et al., 1999; Fletcher & Overall, 2007; Simpson et al., 2001). According to Fletcher and colleagues, mate preferences are persistently accessible to the individuals in a form of cognitive representations. These representations comprise the ideal standards of mate choice, which show significant sex differences stemming from the differential adaptations of men and women. They also suggest that these ideal standards are forming measurable dimensions which have evolutionary importance in mate choice psychology (such as attractiveness and resourcefulness). Ideal standards function as driving forces of relationship satisfaction as a consequence of the discrepancy between the partner ideals and the actual or potential partner (cf. interdependence theory). The core of the Ideal Standards Model is that this discrepancy functions as 1) means of evaluation of the current or potential partner; and as 2) regulation of the relationship through lowering relationship satisfaction and propagating adjustments in the relationship. Individuals overall have two motives in maintaining their ideal standards, 1) punctuality when evaluation and adjustment are needed in the current relationship, or in the actual partner choice, where an unfortunate outcome is especially costly. The opposite motive is 2) overall positivity when evaluating the relationship to maintain the relationship in times when there is no need for disturbing thoughts or seeking problems (as a standby mode).

1.1.1 Dealmakers of mate choice

In the lights of the Ideal Standards Model and the fitness evaluation of potential partners, it is important to investigate which the most prominent factors of the ideal standards are along which people evaluate their partners – may them be potential, past, or current ones (Fletcher et al., 1999; Miller & Todd, 1998). Over the last three decades, a large body of research investigated the factors of mate preferences with inconclusive results (Table 1; section 3.1: Csajbók & Berkics, 2017). Fletcher and colleagues suggested using three factors, the partner's Warmth-Trustworthiness, Vitality-Attractiveness, and Status-Resources, and found them to be theoretically sound and well established (Fletcher et al., 1999). Their strategy was to adopt a bottom-up approach and create a list of important characteristics in ideal preferences based on participants' reports. Subsequently, they conducted factor analysis to identify the principal dimensions of mate preferences and partner evaluation in order to cover a wide variety of the key factors. Interestingly, only

very few independent studies followed a similar strategy, and thus conceptually replicated them (Csajbók & Berkics, 2017).

A distinct approach to investigate the mate preference factors was to theoretically, top-down identify the theoretically probable dimensions of mate evaluation and confirm them on actual data afterwards (Ellis, Simpson, & Campbell, 2002). In some cases, both theoretical and empirical evidence were gathered to enter characteristics into the measurement model, or the items were taken and/or translated from previous research (e.g., Atari & Jamali, 2016; Kučerová, Csajbók, & Havlíček, 2018). Conceptually, the two approaches – and the combination of them – should complement each other, nonetheless, the results show a rather mixed and inconclusive picture of the mate choice factors. Sometimes, unfortunately, the taken procedure or even the factor-analysed items were not specified (Furnham, 2009; Gerdvilyte & Abhyankar, 2010). It is worth mentioning that the empirical collection of the items (i.e., when participants are asked to list the important characteristics in an ideal partner) helps to increase the ecological validity. Using language in the questionnaire that is selected by lay people to describe a potential partner is expected to create a measure that is easier to interpret and relate to by the participants in the study. It also betters the understanding in the current cultural context and helps to avoid artificial-sounding items or professional language, which are difficult to evaluate and interpret (i.e., it may be confusing for the participants to rate their ideal partner's e.g., 'emotional intelligence', Furnham, 2009; 'normality', or 'resilience', Neto, da Conceição Pinto, & Furnham, 2012).

Additionally, the large cultural variation in the research samples potentially amplified the large variance in the number and content of the factors. Presently, it is challenging to differentiate the effects of the differences in the conceptual approach on the resulting dimensions and the effects of the various languages and cultures in which the studies were performed. This is especially conspicuous in studies explicitly using pooled samples of US or UK with Chinese participants (Goodwin & Tang, 1991; Kline & Zhang, 2009). While some cultural effects can be identified and detected with strong confidence, such as the importance of Filial piety in a Chinese sample can be attributed to the collectivist culture in China, the reasons why Intelligence appears as a factor in only some of the studies is unclear, and it evokes concerns about the overall credibility and generalizability of the results in the field. Another related problem stemming from sampling is the inclusion criteria of the participants. Most of the research involved university students, lowering the generalizability of the results to the general population, and sometimes the studies pooled every sexual orientation together without addressing the potential differences in mate preferences and the factors structure of those preferences (e.g., Boxer, 2012).

The other source of the inconclusive results is the analytical and measurement approach employed in past research. Details, such as the context in which the importance of each partner characteristics was measured (e.g., long- or short-term relationship, vs otherwise not specified 'desirability', Furham, 2009), should play an important role, however, they have only rarely been addressed (e.g., Csajbók & Berkics, 2017; Fletcher, Tither, O'Loughlin, Friesen, & Overall, 2004; Jonason, Webster, & Gesselman, 2013). Recent research suggests, in fact, in accordance with the strategic pluralism theory (Gangestad & Simpson, 2000), that several relationship types can be identified (such as, e.g., one night stand, lover, dating without commitment) and should be taken into account in mate

choice research (Semchenko, Evsel, Csajbók, & Havlíček, 2018; Semchenko, Evsel, Csajbók, Kaya-Kurtman, Štěrbová, & Havlíček, 2019). Both theory and data suggest that individuals have differential partner preferences depending on whether short- or long-term relationships are considered (e.g., Csajbók & Berkics, 2017; Li & Kenrick, 2006). Thus, studies not accounting for the contextual sensitivity should be regarded with caution.

Data analysis was another source of great variation in the final factor structures across studies. For explorative purposes, principal components analysis was used or principal axis factoring, but only the latter one is an actual exploratory factor analysis taking into account the residual variances, a potential source of difference in results. The decision whether to use orthogonal or oblique rotation on the factors was often neglected without discussion (e.g., Regan, Levin, Sprecher, Christopher, & Cate, 2000). Orthogonal rotation assumes independent, uncorrelated factors while oblique rotation allows the resulting factors to correlate. However, despite using orthogonal rotation, the resulting factors still tend to correlate. Nonetheless, correlations between the factors are not tested after conducting orthogonal rotation, therefore, unfortunately, they will not be reported and considered. In exploratory studies, the number of factors was identified based on eigenvalues, or by parallel analysis (e.g., Buss & Barnes, 1986; Atari & Jamali, 2016). However, confirmatory factor analysis (CFA) can more reliably determine with model fit indices the actual number of factors the items are loading onto. Identifying the most appropriate number of factors is a common difficulty in factor analysis that can lead to arbitrary results. CFA was used only in 12 papers out of 27 (44%), although in some cases with parcelling. Parcelling is the pooling of items into parcels with averaging to yield better model fit. It is, however, a procedure only recommended in the case of unidimensional items according to methodologists (e.g., such as pooling several reaction-time measures, cf. Little, Cunningham, Shahar, & Widaman, 2002). Interestingly, the labelling of the factors is also a source of confusion, such as the use of bipolar, complicated labels instead of unidimensional one-word expressions to tag each dimension covering the reduced items (e.g., Fletcher, Boyes, Overall, & Kavanagh, 2006; Shackelford et al., 2005a). Further, insufficient sample sizes should account for a great potential for error in the estimations (see Brown, 2006). Lastly, sampling error leads to worse representation of the population as already mentioned above.

Perhaps the most problematic practice in previous research was all the missing details of the performed analyses. For example, some studies did not list the characteristics used in the questionnaire which were further submitted into factor analysis, or did not report the explained variance after the dimension reduction, or did not mention the type of analysis used (Gerdvilyte & Abhyankar, 2010; Kenrick et al., 1990; Parmer, 1998; Regan et al., 2000).

Table 1: Main characteristics of the studies extracting factors of mate preferences in chronological order

	Study	Context	N. and nationality of participants	Number of items & source	Type of used analysis[1]	N. of factors	Labels of fa
1	Buss & Barnes (1986)	ideal long-term	184 (92 couples), (US)[2]	76 (Marital Preference Questionnaire, Gough, 1973)	not specified (+ varimax)	9	kind-conside artistic-intell professional politically co adaptable
2	Kenrick, Sadalla, Groth & Trost (1990)	presumed partner	93 (US)	24 (13 from Buss & Barnes, 1986, and another 11 added by the authors)	PCA (+ varimax)	5	status, attrac and family o
3	Goodwin & Tang (1991)	romantic partner or platonic friend	48 Chinese and 40 British	15 (Goodwin, 1990)	not specified (+ varimax)	3	sensitivity, e kindness/cor
4	Simpson & Gangestad (1992)	romantic partner	473 (US)	15 (Romantic Partner Attributes, e.g. Buss & Barnes, 1986)	PCA (+ varimax)	2	personal/par attractivenes
5	Parmer (1998)	potential marriage partner	166 African American	21 (18 from Hill, 1945, 2 from Allgeier, 1990, 2 by the author, 1 had to be excluded)	not specified	3	social stratifi physical vari
6	Fletcher, Simpson, Thomas, & Giles (1999)	ideal long-term partner and relationship	320 from New-Zealand	49 partner phrases, 30 relationship expressions (empirically selected)	PCA (+ oblique) CFA	3	warmth-trust attractivenes AND intimacy-loy CFA: Warm Intimacy-Lo Trust) and V

7	Regan, Levin, Sprecher, Christopher, & Cate (2000)	long- and short-term (pooled)	561 (US)	23 (from their previous studies)	PCA (+ varimax)	5	social status, desirable, sin and outgoing
8	Rowatt, DeLue, Strickhouser, & Gonzalez (2001)	long- and short-term	168 (US)	42 (from Buss & Barnes, 1986; Simpson & Gangestad, 1992; Kenrick, Sadalla, Broth & Trost, 1990)	PCA (+ oblique)	long: 8 short: 8	fidelity, depe values, creat attractivenes contexts)
9	Ellis, Simpson, & Campbell (2002)	how difficult to find a partner like this	454 US	41(items referring to the Big Five, physical attractiveness and physical prowess)	PCA (+ varimax) CFA	6	agreeable/co potential, ph stability, surg attractivenes
10	Fletcher, Tither, O'Loughlin, Friesen, & Overall (2004)	ideal long-term, ideal long- and short-term	200 and 198 New-Zealand	17 (Ideal Standards Scale, Fletcher et al., 1999)	CFA CFA	long-term: 3 short- and long-term : 3	warmth-trust attractivenes
11	Shackelford, Schmitt, & Buss (2005a)	probable marriage	3168 (from 37 countries)	18 (Hill, 1945)	PCA (+ varimax)	4	love vs. statu dependable/s education/int home/childre religion
12	Overall, Fletcher, & Simpson (2006)	partner, ideals, consistency, regulation	200 + 62 couples (NZ)	17 (shortened from Fletcher et al, 1999)	CFA	3	warmth-trust attractivenes

13	Fletcher, Boyes, Overall, & Kavanagh (2006) (unpublished, see Fletcher & Overall, 2007)	what they can give as partners	200 NZ	60 (empirically selected)	EFA + CFA	6	caring, open, stable
14	Furnham (2009)	not specified (desirability)	250 (mixed from the UK)	14 (not specified from where)	not specified (+ varimax)	5	physical, cog seriousness,
15	Kline & Zhang (2009)	partner preference	102 US and 101 Chinese	59 (38 empirically selected and 21 from Toro-Morn & Sprecher, 2003)	PCA (+ oblique)	US: 4 Chinese:5	warmth-trust status, and pl sample) AND filial piety, s attractiveness authenticity (
16	Gerdvilyte & Abhyankar (2010)	ideal and actual partner	272 Indian women	31 (not specified)	PCA (+ varimax)	ideal: 5	easy-going, c attractiveness recognised in traditional hu
17	Eastwick, Finkel, & Eagly (2011)	romantic partner	502 US	48 (from Fletchet at al., 1999; Gosling, Rentfrow, & Swann, 2003; Wiggins, Trapnell, & Phillips, 1988; Watson et al., 2004)	PAF (+ promax)	7	physically at prospects, w meek, and co
18	Boxer (2012)	future spouse	2522 American	83 (49 from Fletcher et al, 1999, others not specified)	CFA (on the 49 items of ISM) PCA (+	CFA: 3 PCA: 13	warmth-trust attractiveness AND trustworthine

					varimax or oblique, on 83 items)		intelligence, creativity, se attractiveness ‘gender facto
19	Neto, da Conceição Pinto, & Furnham (2012)	potential long-term romantic partner	187 Brazilian and 215 Portuguese	18 (14 from Furnham, 2009)	PAF (+ varimax)	Brazilian: 4 Portuguese: 4	physical attra personality a samples)
20	Schwarz & Hassebrauck (2012)	desired partner (importance of traits)	21245 single Germans	82 (based on a German PhD thesis)	PCA (varimax)	12	kind/underst intellectual, attractive, cu creative/dom
21	Jonason, Webster, & Gesselman (2013)	long- and short-term	401 US	20 (e.g. from Buss, 1989; Jonason, Raulston, & Rotolo, 2012; Li et al., 2002)	PCA (+ oblique) CFA	long: 3 short: 3 CFA: 3 and 3	attractiveness social status AND attractiveness physical trait
22	Fletcher, Kerr, Li, & Valentine (2014)	self, partner, and ideal	100 NZ students	12 (shortened from Fletcher et al, 1999)	EFA + CFA	3	warmth-trust attractiveness
23	Katsena & Dimdins (2015)	self-rating and ideal romantic partner	223 Latvian	53 (from e.g. Fletcher et al., 1999; Buss, 1989; Clark et al., 2005; Cottrell et al., 2007; Furnham, 2009)	PAF (+ promax) CFA	PAF: 5 CFA: 5	warmth/trust intelligence, attractiveness
24	Atari & Jamali (2016)	long-term preferences of women	300 Iranian women for EFA and 100 women for CFA	45 --> 39 --> 26 (empirically selected and both theoretically and statistically supervised characteristics)	PAF (+varimax) CFA	EFA: 5 CFA: 5	kindness/dep attractiveness religiosity/ch education/int

25	Csajbók & Berkics (2017)	partner, self, long- and short-term ideal	60 Hungarians for item selection, 634 for EFA and 1545 for CFA	63 (empirically selected)	PAF (+ promax) CFA	EFA: 7 CFA: 7	warmth, stab status, intelle
26	Gerlach, Arslan, Schultz, Reinhard, & Penke (2017)	ideal and current partner	763 German-speaking	20 (from Fletcher et al., 1999; plus 5 items theoretically supplemented)	PAF (+ oblimin)	4	warmth-trust attractivenes confidence-h
27	Kučerová, Csajbók, & Havlíček (2018)	ideal and current partner	10 Czech for item selection, 204 for EFA and CFA, replicated on 1467 from English speaking countries	42 → 16 (from Ellis et al., 2002; plus 5 empirically selected; later replicated on the statistically selected items)	PCA (+ varimax) CFA	EFA: 4 CFA: 4	warmth/trust vitality, phys

Note. [1]rotation type is presented in brackets; [2](US) = no specification but presented by authors from the US; PCA = p confirmatory factor analysis; EFA = exploratory factor analysis; ISM = Ideal Standards Model; PAF = principal axis of the supplementary material from section 3.1: Csajbók & Berkics, 2017.

1.1.2 Dealbreakers of mate choice

In the previous sections, the positive partner characteristics were overviewed which are desirable in a potential partner. However, the potential partners bear not only positive characteristics, but negative ones as well. As a recent study pointed it out, humans differentiate negative, dealbreaker traits when evaluating a partner, moreover, these characteristics may be even more important than the positive ones (Jonason, Garcia, Webster, Li, & Fisher, 2015).

Initially, Kahneman & Tversky (1974) found that human judgements show measurable systematic errors. For example, they were able to identify typical shortcuts or heuristics in the process of decision making. The underlying driving factor behind these cognitive errors is uncertainty. The aim of these shortcuts is to effectively avoid certain risks humans are inclined to experience, for example, losing money. Interestingly, humans are more sensitive to an expected loss than to an expected gain, causing behavioural asymmetry, as later described in the prospect theory (Kahneman & Tversky, 1979). Therefore, in the context of mate choice, men are prone to approach potential partners with the slightest potential to be sexually receptive, for example, smiling and friendly women. The rationale is that the cost of losing the potential access to a sexual partner, thus reproduce, is higher than a possible rejection from them. Men's interpretation is, therefore, naturally biased in the direction of perceiving women's behaviour as more inviting than how much it might be in fact.

Haselton and Buss (2000) suggested that humans judge the accessibility and suitability of a potential partner based on limited information. The individuals' survival depended in the ancient environment on how well they interpreted these probabilistic cues, leading to adaption and selection bias. Hence, the error management theory was formulated predicting asymmetrical decision-making adaptations according to the differential costs of mate choice decisions. This way the committed errors are predictable as well. For example, in the case of men overestimating women's interest, the potential error is that the partner is not interested, and the cost is the energy invested in courtship in vain. However, if the man is shy, and the woman is available indeed, the potential error is missing the love of his life followed by the loss of the future devoted mother of his children. That is a costly mistake considerably decreasing his fitness.

According to the error management theory, a selection bias was evolved to favour the less costly decisions, for example, men's assertive courtship. It is important to point out that asymmetry in the benefits, not only the costs, is also a driving factor of differential decision-making. When the perceived costs of two outcomes are the same, the asymmetrical benefits will be driving the behaviour instead of the costs. And vice versa, when the perceived benefits are equal, the cost difference will drive the decision. Overall, the adaptation formulated biased rules of decision-making in order to maximize the benefits and minimize the costs of each decision. This strategy is beneficial even if the developed heuristics produce errors more frequently, as those occurring errors may be less costly. In their pioneering research, Haselton and Buss (2000) showed that women are more cautious in evaluating the perceived commitment of men in contrast to men's commitment ratings of female targets. Women underperceived men's intentions to a committed relationship in order to avoid the costs of entering a relationship in which their partner may abandon them. Meanwhile, men showed a more accurate perception of women's commitment. In contrast, men's perception of women's sexual intent showed

inaccuracy towards the overestimation of women's sexual intent. At the same time, women rated men's sexual intent accurately (Haselton & Buss, 2000).

Baumeister and colleagues' (2001) extensive review of the topic suggests that negative information is indeed pervasive in all areas of social psychology from impression formation to development and intimate interactions. It was found that the number of destructive and negative events in a relationship better predicted relationship satisfaction and other relationship outcomes than the number of positive events (Gottman & Krokoff, 1989; Huston, Caughlin, Houts, Smith, & George, 2001; Huston & Vangelisti, 1991; McCarthy, 1999; Pittman & Lloyd, 1988; Rusbult et al., 1986; Wills et al., 1974). It seems that avoiding negative behaviour in a relationship is more powerful in maintaining stability than simply doing positive things (Baumeister et al., 2001). Interestingly, some even reported that couples more readily understand destructive behaviour than positive ones (Acitelli, Douvan, & Veroff, 1993). This underlines the theory suggesting selection to a more sensitive perception of negative versus positive events. In sum, the error management theory had influential supporting evidence of the selection towards avoiding costly mate choice decisions, which was endorsed by the prospect theory predicting people weighting losses as more important than gains. Interestingly, nonetheless, only very few studies focused on investigating the negative, thus potentially more costly traits in a potential partner.

What are the characteristics to avoid in a potential partner? The strategy to avoid negative characteristics, i.e., relationship dealbreakers, complements the desire to acquire positive characteristics, i.e., dealmakers, in a potential partner as a parallel process (Jonason et al., 2015). In a multi-study paper, American participants listed 49 long- and short-term relationship dealbreakers, which items loaded on a single global factor (Jonason et al., 2015). As expected, women tolerated less and rated higher the likelihood of the items to be dealbreakers in a mate choice context. The items were face-valid sorted into seven categories: Unattractiveness, Unhealthy lifestyle, Undesirable personality traits, Differing religious beliefs, Limited social status, Divergent mating psychologies, and Differing relationship goals. On a nationally representative sample of single individuals, they found that men put more emphasis on estimating the expected return of their investment in the relationship. That is to say, men considered more as dealbreakers than women if a potential partner has kids, lives too far away, and has a low sex drive. In contrast, women considered laziness, neediness, and low self-confidence as dealbreakers more than men. Participants were also more demanding with an increasing age. A subsequent study showed that first learning about five dealbreakers of a person and then about five dealmakers did not increase their interest as much as first learning about five dealmakers of a person and then about five dealbreakers did decrease their interest to form a relationship with them. In plain words, learning negative traits of a candidate outweighed their positive traits, but learning positive traits of a negative candidate did not outweigh their negative traits as expected by the prospect theory. Overall, their results supported that mating mistakes are avoided more strongly than how much quality mate choice is approached (Jonason et al., 2015). In a related research, Zuckerman and Sinicropi (2011) also found supporting evidence that learning negative traits of a potential partner was demonstrated to have a stronger effect on the overall perception than a positive piece of information.

Although Jonason and colleagues (2015) were pioneer investigators of relationship dealbreakers and put considerable efforts into weighing them against the dealmakers, their studies have some space for improvement and some drawbacks. They did not show consistency in the employed dealbreakers across studies and neither provided enough information about the factor analysis to judge its single-factor results. Perhaps, their factoring would have resulted in a more consistent and replicable structure if confirmatory approach were used. Further, their studies had a considerably low extensive validity using convoluted study designs and the enrolment of untested dealbreaker characteristics. To further investigate this, Berkics & Csajbók (2018) aimed to conceptually replicate Jonason and colleagues' research on a Hungarian sample. An initial, qualitative study was conducted to collect a list of 96 negative characteristics that would make the participants reject a potential short- or long-term partner. Subsequently, exploratory factor analysis was employed on one half and confirmatory factor analysis on the second half of the sample to identify the underlying factor structure of the relationship dealbreakers. The exploratory factor analysis yielded a seven-factor model of relationship dealbreakers, which factors were subsequently confirmed on the second sample as a replication. The seven dealbreaker factors were Unambitious, Hostile, Bad hygiene, Arrogant, Unattractive, Overattaching, and Abusive. The factor structure showed acceptable model fit against the data in both short- and long-term contexts for both men and women. For men, in short term, unattractive women with bad hygiene were the strongest dealbreakers, while for a long-term relationship, abusiveness with bad hygiene were the most negative factors. For women, the strongest dealbreakers for both long- and short-term were bad hygiene and abusiveness. For a long-term relationship, both sexes were the most permissive regarding the partner's overattachment, and for short-term, arrogant and loser partners were the least probably rejected by men and loser, arrogant, and overattaching partners by women.

To sum up, individuals are probably conscious about certain relationship dealbreakers which are in line with evolutionary theories (cf. the strongest dealbreaker was Unattractive for men, or Overattaching in a short-term context). Second, the concept of dealbreakers complement that of dealmakers. While Status and Intellect tend to appear among dealmaker factors, Poor and Dull did not emerge in the factor analysis of Berkics and Csajbók (2018), however, Limited social status was among the face-valid sorted factors of Jonason and colleagues (2015). Instead of offering direct opposites across dealmakers and dealbreakers, dealbreakers propose a more comprehensive understanding of the potential partners, which humans had better avoid. Having a detailed representation of what the key cues are which help to predict an unwanted relationship, such as hostility, abusiveness, or arrogance, has helped our ancestors in navigating their mate choice. Consequently, the introduction of error management theory to mate choice research offered valuable new questions to study and allowed a better and more thorough understanding of mate preferences and mate rejection.

1.1.3 General methodological recommendations for future research

Studies investigating the dimensions of mate preferences should above all report the details of the performed analyses. Second, careful decisions should be made and discussed fitting to the context of the study, at least as supplementary material. Finally, replication should be performed when possible, especially when receiving unprecedented results, when performing the study in a sample, context, language, or country where the study has never been conducted before.

More specifically, the context of the study performed should always be considered, i.e., whether the researcher is interested in, for example, the ideal marriage partner or self-evaluation as a partner, or the importance of the characteristic – which is not identical to the ideal level of the characteristic. The researcher must decide whether to measure the importance of each characteristic in an ideal partner or the ideal level of the characteristic (or both). It is important to keep in mind that not every analysis works on the importance measures (that is predominantly employed as default). For example, when one wants to compare the ideal and actual level of a characteristic, the importance of the characteristic will not be useful (cf. section 2.5.2 as well).

Similarly, the language and the content of the factor-analysed items should be discussed as important aspects in the selection of the measures. Such as, 1) the researcher should avoid using professional language or items having ambiguous meaning. Further, 2) in the case of translating the list of characteristics into another language, the secondary layers of meaning of the items potentially cause significant loss in translation (e.g., it is impossible to translate 'easygoing' from the list of Fletcher et al., 1999 into Hungarian without significant loss of meaning). Meanwhile, a questionnaire containing full sentences may have more space to punctuate in the meaning even after the translation into a very distinct cultural and language context. This task can be more difficult in translating only single characteristics as it is predominantly done in mate preference research. Lastly, 3) when comparing cultures, or simply deciding to translate an existing questionnaire, it is important to consider that there is no established universal structure of mate preferences yet and it is yet to be known how to reliably perform such research.

Additionally, it is crucial to carefully consider the contents of the questionnaire. The item selection may be top-down or bottom-up, or a mix of them. Not only positive, but negative characteristics should be considered to include in the measurement model. It cannot be emphasized enough that the resulting factor structure heavily depends on the items submitted into the analysis: items entered into the model will be in the results, items not entered into the study will not be in the final structure, thus cannot be tested in ideal preferences. The lack or presence of a dimension in the final structure does not necessarily mean the factor is or is not important in the specific context, and this is an especially difficult task in cross-cultural studies (cf. the resulting Filial piety factor in a US sample, Kline & Zhang, 2009). Understandably, items can be borrowed from previous research or added based on theoretical considerations, but the rationale should be discussed as well as the quality of the translation of certain items which have subtle cultural meaning (cf. language discussed above).

Further, factor analytical methods should always follow the most novel guidelines reported by methodologists (e.g., Brown, 2006). As a general rule, confirmatory factor analysis should follow the exploratory factor analyses on a sufficient sample size (see the various perspectives on the sample size needed in Brown, 2006). Performing confirmatory factor analysis is the only way to obtain sufficient model fit indices which indicate whether the extracted factors are indeed the best to describe the data. Meanwhile, exploratory factor analysis in practice is much more pliable, and there is only a limited selection of indicators to help choose the best model. Model fit should be carefully investigated, poorly loading, cross-loading items should be omitted from the model. Replication analysis of the model fit of a factor structure on a new sample is always desirable. On a related note, whenever it is possible and the length of the study permits,

having at least 3 items per factor is preferred over using only one item denoting each factor. This way, sufficient error variances and a more robust structure of the factors can be estimated, which is better for the measurement model as well as the subsequent analyses.

Finally, previously established models may be a good starting point for research not primarily focusing on establishing a reliable factor model, especially if no language barrier occurs in the translation of the items. For example, Fletcher and colleagues' three-factor model, i.e., using Warmth, Attractiveness, and Status as a starting point, can be a great solution as its methodology stands out of all the studies performed, and the model has strong theoretical support from the evolutionary theories. Subsequently, it should be investigated whether any, and if yes, what kind of research has been done in the language and context where researchers plan to carry out their study. Sometimes employing factors from similar cultural contexts is acceptable, such as using a seven-factor model containing Warmth, Stability, Attractiveness, Passion, Status, Intellect, and Dominance in Czechia, which was extracted in Hungary – if the translation allows (cf. section 3.1: Csajbók & Berkics, 2017). It is always noteworthy, though, that the study will not cover every important aspect of mate choice in the population which needs to be accounted for.

1.2 Stability of mate preferences

Mate preferences are often measured as a static construct with the underlying assumption that they are constant. However, there are numerous reasons to question whether people indeed do not change their preferences. First, we know only very little about the development of mate preferences, to what extent these preferences are innate (e.g., genetically predisposed), and to what extent they are learned over time (e.g., Boothroyd & Vukovic, 2018; Collins, 2009; Saxton, Caryl, & Roberts, 2006). We may also expect change in mate preferences by maturation and gaining life experience in adults.

Alterovitz and Mendelsohn (2011) found that the older the men are, the younger partners they are looking for, while women, on the contrary, preferred older partners than themselves throughout their lives up until the age of 75. Further, some suggested that while men became more demanding in their preferences with age, women lowered their expectations (de Sousa Campos et al., 2002). In contrast, Jonason and colleagues (2015) reported that although people tend to have stricter dealbreakers by higher age, this association was only in a very weak interaction with sex. Alterovitz and Mendelsohn (2011) did not find such sex differences. An unpublished result on the data from Study 2 in Csajbók, Havlíček, Demetrovics, and Berkics (see in section 3.3; 2019) with sufficient statistical power shows rather mixed additional findings (Table 2). Altogether 17,978 participants aged between 18 and 76 (mean age = 34.01, standard deviation = 11.49) reported about the minimal level of 23 characteristics in a potential partner to consider. The 23 characteristics loaded to seven factors of minimal partner standards. Both men and women had lower expectations of the partner's Warmth, Attractiveness, and Dominance as they were getting older. In contrast, both men and women had slightly higher expectations about the partner's Status and Stability as they were older. Opposite effects were observed in Passion and Intellect between men and women. Overall, however, all of these associations are of very small effect size, statistically significant though, due to the large sample size. It cannot be concluded, on the other hand, that either sex would be more demanding or permissive by ageing.

Table 2: Correlation between participants' age and minimum partner standards

	Age	
	Men	**Women**
Warmth	-.132***	-.111***
Attractiveness	-.130***	-.165***
Status	.054***	.057***
Stability	.033***	.034*
Passion	.036***	-.019
Intellect	-.032***	.060***
Dominance	-.020*	-.068***

Note. N_{male} = 11,206; N_{female} = 4,814.
* p < 0.05. *** p < 0.001.

The above results focus on the stability of mate preferences during the life-course, and they are cross-sectional, thus cannot report actual change in the individuals' expectations by age. Few studies investigated the test-retest stability of mate preferences. Fletcher and colleagues (1999) in their debuting paper on the three-factor model of ideal standards reported that in a three-week period the factors had a retest reliability of r = 0.75 in Warmth-Trustworthiness, r = 0.86 in Vitality-Attractiveness, and r = 0.86 in Status-Resources with mean level of correlation at r = 0.83. Approximately 48% of the total 42 participants were in a relationship. Shackelford, Schmitt, and Buss (2005b) with a 3-year follow-up in 54 newlyweds reported retest correlations on the importance of 18 characteristics. The correlations in wives ranged from as low as r = -0.08 in the importance of mutual attraction and love to as high as r = 0.82 in the importance of chastity and dependable character. Husbands' lowest correlation was observed in the importance of favourable social status (r = 0.21), while the highest was in chastity for them as well (r = 0.79). The mean retest correlation across the 18 characteristics and sex was r = 0.46. Bleske-Rechek and Ryan (2015) employed a sample of 200 college students to measure 10 characteristics' test-retest reliability across a 3-year timespan, and found an average ρ = 0.35 correlation ranging between ρ = 0.15 in emotional stability to ρ = 0.54 in desire for children. However, their relationship status was not reported. Gerlach and colleagues (2019) reported on 763 participants (34% in a relationship at time 2) an average r = 0.65 test-retest reliability in a 5-month timespan across four factors of mate preferences. The correlations ranged between r = 0.56 in the Warmth-Trustworthiness factor to r = 0.73 in the Status-Resources factor. Overall, the stability of preferences largely depended on the length of time that passed between the initial and follow-up measurements and the measures used in the above studies. Further, these differences were not tested against relationship status (this information was not even reported on the college sample). It is conceivable, therefore, that the results suggesting fluctuating preferences with a long follow-up are potentially at least partly due to the change in the participants' relationship status.

1.2.1 Change of mate preferences by entering a relationship

As we saw in the theory of Ideal Standards Model, the discrepancy between the ideal and actual partner has important implications regarding relationship dissolution and

dissatisfaction (Fletcher et al., 1999; Thibaut & Kelley, 1959). A possible consequence of this is that in a long-term relationship, people are motivated to minimize their cognitive dissonance and change the image of their ideal partner to one that is more similar to their actual partner (Morry, 2005). Persisting dissonance between the ideal and actual partner is not sustainable and can lead to unbearable mental suffering to the individuals in the relationship. Thus, when the marital dissolution is not a feasible option (e.g., because of small, dependable children or a shared mortgage), and perhaps the partner has changed too much over the course of their relationship, the individual's expectations may alter to accommodate the changes in the person's life. Even in the earlier phase of the relationship, individuals may be motivated to alter their ideal standards to resemble more the person they are dating. They would do so to decrease their cognitive dissonance after their mate choice. Their motivation could also be to protect their relationship from threatening alternative partners. Hence, they may change the image of their ideal partner to one that is more similar to their current ones in order to exclude others. As a consequence, we can expect to observe differences between single and coupled individuals' preferences.

Some evidence showed, for example, that single women had lower preference for facial masculinity and symmetry in men's faces, but preferred dominant men's body odour more when compared to coupled women (Havlíček, Roberts, & Flegr, 2005; Little, Jones, Burt, & Perrett, 2007; Little, Jones, Penton-Voak, Burt, Perrett, 2002). Single women were also shown to prefer feminine male faces with a direct gaze for a long-term relationship, probably because of inferring a social interest from the men looking directly at them, hence facilitating the allocation of their invested mating efforts (Conway, Jones, DeBruine, & Little, 2010).

The perception of potential partners was also shown to differ between happily and unhappily coupled individuals. Those who were less committed to their partner rated higher the attractiveness of potential alternative partners (Johnson & Rusbult, 1989). In contrast, happily coupled individuals were found to rate attractive people as less attractive than others, as a function of 'blocking' or 'banning' the option of looking for alternative mates who might threat the cohesion of their relationship (Simpson, Ickes, & Blackstone, 1995). This way, by adjusting the perceived attractiveness of potential partners, the individual would feel lower cognitive dissonance when comparing them with their own partner. These results do not directly indicate whether the image of the ideal partner changes, as these only tested how the perception of the potential partner shows individual differences. However, it provides some evidence that individuals are indeed motivated to alter their cognitive structures of mate perception. Probably, these structures of mate evaluation are incorporating both the ideal preferences and the current partner's cognitive representation, which are thus easily altered to be more uniform (cf. Fletcher et al., 1999). Nevertheless, these are only cross-sectional studies, therefore, it is impossible to infer actual change in preferences based on this study design.

To overcome this limitation, Kučerová, Csajbók, and Havlíček (2018) conducted a prospective study (see in section 3.2). Single participants reported about their ideal partner preferences, and concurrently, they were contacted six months later to evaluate their newly found partner if they had one. For a comparison, coupled individuals also rated their ideal and actual partners. Some of the participants remained single, allowing to test their partner ideals to infer a potential effect on their singlehood (e.g., irrationally

high expectations). The overall discrepancy between the ideal and the actual partner was measured in a four-dimensional space with Physical attractiveness, Vitality, Status/Resources and Warmth/Trustworthiness being the dimensions of the measurement. In this measurement space every rated ideal and actual partner has thus four coordinates. The distance in the measurement space was expressed in Manhattan-distance, which is the sum of absolute differences between each of the four factors of the ideal and actual partners. That allows to measure and interpret profile differences between the ideal and actual partner simultaneously along the four factors of the measurement. The study found that the overall difference between the image of the ideal partner and the actual partner was significantly larger in the initially single participants than in the continuously-coupled participants.

This may let us infer that the participants who were already in their relationship at the time of referring about their ideal partner may have altered their preferences in favour of their current partner to minimize the discrepancy. This observed overall discrepancy was probably due to the perceived difference in the Warmth/Trustworthiness and Status/Resources factors. Correlational tests also showed negligible and non-significant associations between the ideal and the actual partner evaluations in the newly-coupled participants, while medium to strong (r coefficients between 0.3 and 0.6) correlations in the continuously-coupled participants along the four factors of the measurement. Interestingly, the length of the continuously-coupled participants' relationship did not correlate with the discrepancy between the ideal and actual partner evaluations, suggesting that the adjustment of the ideal partner preferences was not gradual. As Gerlach, Arslan, Schultze, Reinhard, and Penke (2019) proposed, the relationships which are captured in such studies introduce a 'survival bias', meaning that only relationships which have already transitioned through this dissonant phase could be observed. Naturally, those relationships which are not able to accommodate dissolve hence will not be in the study sample.

Some studies propose that individuals may tend to end up with people who are in fact not a perfect match to their stated ideal preferences (see the review of Eastwick et al., 2014). Fluctuations in partner evaluations were found by others as well, however, they were only tested in continuously-coupled participants (Fletcher et al., 2000; Neff & Karney, 2003). Gerlach and colleagues (2019) also found supporting evidence for the downward adjustment of partner preferences in all the four factors they measured after entering a relationship (i.e., Warmth-Trustworthiness, Vitality-Attractiveness, Status-Resources, and Confidence-Humour). They also found that participants who remained single during the follow-up had more stable preferences than those who initiated a relationship when correlating their ideal preference ratings between time 1 and time 2. On the other hand, their participants had stronger correlations between the initially reported ideal preference factors and the partner's characteristics after establishing a relationship than the participants of Kučerová and colleagues (2018). The correlations along the four factors were between $r = 0.14$ and $r = 0.35$ in the study of Gerlach and colleagues, and between $r = -0.05$ and $r = 0.11$ in the study of Kučerová and colleagues. In contrast, the correlations between the ideal preferences reported while already being coupled and the partner assessments were considerably weaker in Gerlach and colleagues' study than in Kučerová and colleagues' study (between $r = 0.23$ and $r = 0.44$; and between $r = 0.33$ and $r = 0.61$ in Gerlach et al., 2019 and Kučerová et al., 2018, respectively). However, in the study of Kučerová and colleagues, the continuously-coupled participants were probably in a

longer relationship than the participants from the newly initiated relationships in the study of Gerlach and colleagues.

The robustness of these findings, however, needs further investigation, such as a closer monitoring of the adjustment in the early phase of the relationship to capture the timing and context of the actual change and thus identify the potential underlying mechanisms, the pace of the adjustment, and individual differences in the level of adjustment. For example, although Gerlach and colleagues (2019) did not find supporting evidence that the level of adjustment was associated with self-perceived mate value, maybe some personality factors or age are better predictors of these adjustments. Further, the two prospective studies testing the adjustment of preferences (i.e., Gerlach et al., 2019 and Kučerová, Csajbók, & Havlíček, 2018) did not measure the ideal and actual partners in the same metric system. That is, Kučerová and colleagues (2018) asked the participants to rate the characteristics according to how much they agreed with the following statement: "I wish my ideal partner was…", whereas Gerlach and colleagues (2019) measured the importance of the characteristics in an ideal partner. Subsequently, both studies measured the level of said characteristics in the actual partners, therefore, the two measures are conceptually different and may be problematic to compare. Currently, we do not know how this methodological difference affected the results. Lastly, associations between relationship satisfaction and the observed change should allow a better understanding of the role and function of such adjustments. Until then, the currently available evidence propagates that such accommodation of preferences may be adaptive through easing relationship strains and conflicts (Campbell, Simpson, Kashy, & Fletcher, 2001).

1.3 Mate value

Mate value may be one of the most important driving forces of mate choice. For example, a recent study using samples from 45 countries indeed found that higher mate value individuals have higher mating standards, higher mate choice power (i.e., higher potential to choose according to their preferences), and consequently, higher mate value partners (Conroy-Beam et al., 2019). Other studies also found evidence that higher self-perceived mate value correlated with higher mating standards (e.g., Csajbók, Havlíček, Demetrovics, & Berkics, 2019; Regan, 1998; Wenzel & Emerson, 2009). However, interestingly, although a lot of evolutionary research operates with the concept of mate value and builds on the idea of the mating market, its conceptualization and operationalization is still rather inconclusive (e.g., Brase & Guy, 2004; Buss, 1989; Buss & Shackelford, 1997; Csajbók, Havlíček, Demetrovics, & Berkics, 2019; Edlund & Sagarin, 2010; Edlund & Sagarin, 2014; Fisher, Cox, Bennett, & Gavric, 2008; Regan, 1998; Singh, 2002; Symons, 1985).

1.3.1 Mating market operations

The operation of actual markets may give us an insight of 'mating transactions' (Noë & Hammerstein, 1995). The economy works as pricing the goods at a certain point of time under certain conditions (such as the available supply and demand). A second-hand car-shop, for example, is in a unique position to price its cars. Each car has specific conditions, both objective and subjective. The brand, model, and age of the car are easily quantified, and maybe more objective than the condition of the interior and the unknown effects of the history of a major car accident. Eventually, the price of the car will be

exactly how much the buyer will pay for it at the time of the transaction. Mating markets are more complicated with less objective measures. The transactions of mate choice, the offers and rejections are even more difficult to trace and map: individuals infer rejection or commence flirting based on minimal information obtained from subtle interactions, even multiple times a day.

Nonetheless, humans are capable of evaluating their potential partners as well as themselves as a potential partner (e.g., Csajbók & Berkics, 2017; Edlund & Sagarin, 2014). According to some scholars, mate value is the fitness of the individuals as a potential partner that predicts their mating success (Kirsner, Figueredo, & Jacobs, 2003; Miller & Todd, 1998). They suggest the actual mate value cannot be measured directly, however, objective predictors can be observed as a proxy. On the other hand, others suggest that mate value – instead of fitness – is conceptualized as how much others desire someone as a potential partner (Fisher et al., 2008; Landolt et al., 1995). This mating desirability is then approximated by mating success and by performance on mate preference factors (Fisher et al., 2008). This assessment should consider factors which are important predictors of reproductive success: both in terms of the provided genetic and parenting quality, increasing the probability of successful survival and reproduction of their offspring (Waynforth, 2001). This evaluation functions on the 'mating market' as a market value, and, according to the assumptions, everybody is aware of the results of these assessments as potential mates. The perception of someone's own and others' mating potential is conceptualized as self-perceived and others-perceived mate value, respectively.

1.3.2 Self-perceived mate value

It is expected that humans' long adolescence period offers the opportunity to practice and learn the principle aspects of mate choice. They can learn, for example, their own mate value through the series of mating offers and rejections one experiences during this time (cf. Connolly et al., 2004; Fletcher et al., 1999; Simao & Todd, 2002; Todd & Miller, 1999). This learning period of puberty is also the stage for the individuals to set their aspiration levels, or ideal expectations based on what is believed achievable for themselves (Todd & Miller, 1999). After the learning period, the individuals can make mating offers to everyone exceeding said aspiration levels or thresholds. As mentioned above (section 1.1), Fletcher and colleagues (1999) theorize that these set ideals are chronically accessible as mental representations to help the judgements of potential and actual partners.

Perhaps the most iconic real-life simulation of the process of individuals learning their self-perceived mate value, as well as the matching phenomenon, was conducted by Ellis and Kelley (1999). The Pairing Game simulates in small scale on actual people 1) how individuals without knowing their own mate value pair up matching in their overall value even if looking for the highest value partner possible; and 2) how they can learn their mate value through this process during this experimental accelerated 'adolescence'. In this study, participants received a randomly assigned number on their forehead and their task was to pair with the highest possible value partner. Their choice had to be mutual. Interestingly, the typical intraclass correlation between the resulting 'couples' was 0.70. What is more important from the perspective of adolescence and the development of mating is that, on average, the participants guessed their own mate value fairly accurately (typical correlation of 0.65). Since their 'mate choice' had to be mutual, people with low

numbers on their forehead got frequently rejected and thus received a by and large accurate sense of their low 'mate value'. Similarly, participants with high numbers could sense their popularity among the participants and thus had the notion of their high 'mate value'. Those who got a high mate value could therefore also set their standards high, while low mate value individuals had to relax their expectations. Some suggest that reviewing around 37% of the potential partners should provide enough insight to reliably set their aspiration level (cf. Ferguson, 1989). This study credibly simulates how interactions during adolescence are important for individuals in learning their own self-perceived mate value, which will later be of crucial importance in (assortative) mating and how high the individuals set their ideal standards (e.g., Conroy-Beam et al., 2019).

Even though there might be a motivation in the researcher to acquire an objective measure of mate value, self-perceived mate value may be a better predictor of the actual human behaviour (Arnocky, 2018). Someone's belief in their own mate value may be more important in whom the person approaches and is successful with than their objective mate value. Although self-esteem and self-perceived mate value are conceptually different, they have similar characteristics. It was shown that self-perceived mate value – similarly to self-esteem – is sensitive to rejections and social comparison. Both self-esteem and self-perceived mate value showed decrease in manipulation studies where participants received mating-related derogatory comments or rejections (Campbell & Wilbur, 2009; Pass, Lindenberg, & Park, 2010; Zhang, Liu, Li, & Ruan, 2015). Nonetheless, while self-esteem is an overall, subjective sense of self-worth, self-perceived mate value has objective domain-specific indicators such as the reproductive fitness. However, both self-esteem and self-perceived mate value have a metacognitive theory of the individual's self-worth, based on how much the person thinks others value them.

Social comparison has a strong effect in how someone perceives their success in relation to others (Festinger, 1954; Leary & Baumeister, 2000). It is no different in the mating context: the relative evaluation of our own and others' mating success, or mate value, depends on who we compare ourselves with and with what goals in sight (cf. Csajbók, Havlíček, Demetrovics, & Berkics, 2019; Li et al., 2013). Li and colleagues showed (2013) that when offering low vs high variation in potential speed-dating partners, the same level of characteristics can have varying functions, relative to the overall pool of potential partners in a scenario. That is, when everybody has an overall high objective level of status in the pool of potential partners, the individual calibrates the assessment of them accordingly, and even very little downward differences in status can jeopardize the overall evaluation of the potential partner. While when actually low-status versus high-status potential partners are shown, the same little variation within the high-status partners does not have the same threat on the overall evaluation of said potential partner, as there are actually low-status people in the pool. Having larger variation in a pool of potential partners results in varying angles of perspective on the overall evaluation of the potential partners. Consequently, the nature and function of mate value may not be objective, by necessity. Rather, mate value is relative and subject to contextual factors (i.e., who, when, and where to compare with ourselves). Thus, perhaps, the idea to measure objective mate value is not realistic.

On the conceptual part, as we have seen it in section 1.1.1, it is still under investigation to identify the important factors of mate preferences. Preferences refer to the most important factors of mate perception and mate evaluation (cf. Csajbók & Berkics, 2017),

as key indicators of mate value (Kirsner et al., 2003; Miller & Todd, 1998). Second, currently there is only very limited knowledge of how these factors are integrated into the overall mate value (Edlund & Sagarin, 2014). Is it a simple sum or is it penalized if one of the factors is exceptionally low? Are mate value evaluations consistent? Can we manipulate them with our interactions and seem better or make somebody look worse than how they are? What affects the difference between self-perceived and others-perceived mate value? How do these two evaluations meet and interact?

Table 3: Methodological approaches to measure mate value

Approach	Study	Measures	Length	Sample items
holistic/overall (self-perceived)	Edlund & Sagarin, 2014	The Mate Value Scale	4 items	e.g., "Overall, how would a partner on the following "Overall, how would mer level of desirability as a pa
	Landolt, Lalumière, & Quinsey, 1995	Self-Perceived Mating Success Scale	8 items	self-perceived evaluation c
	Sela, Mogilski, Shackelford, Zeigler-Hill, & Fink, 2017	self-perceived short-term mate value	1 item for self, 1 for partner	"How desirable are yo relationship (e.g., a one-ni "How desirable is your p relationship (e.g., a one-ni
in-between (self-perceived)	Brase & Guy, 2004	single question of desirability with description of factors	1 item	"Many people look at spe potential marriage partne include: Being socially exc having a good sen financial/professional statu good health, and liking ch your level of desirability (1=Extremely desirable–9=
dimensional/ along factors (self-perceived)	Fisher, Cox, Bennett, & Gavric, 2008	Components of Mate Value Survey	22 items loading on 7 factors	factors: Views of the o Wealth, Looks, Relationsh
	Kirsner, Figueredo, & Jacobs, 2003	Mate Value Inventory	17 items, the ratings are summed up to an overall value	ambitious, attractive face emotionally stable, enthus financially secure, genero independent, intelligent, responsible, and sociable

	e.g., Csajbók & Berkics, 2017; Regan, 1998	using the same factors for ideal partner and self-evaluation	depends on the included N of factors	(cf. Table 1)
by a proxy (objective)	Singh, 2002	waist-to-hip ratio	(short)	
	cf. Fisher, Cox, Bennett, & Gavric, 2008	N of past partners	(short)	
	Feinberg, 2008	Voice and facial features	(can be costly)	
	Pflüger, Oberzaucher, Katina, Holzleitner, & Grammar, 2012	N of children during their lifespan	(short, but can be costly)	
	e.g., Montoya, 2008	physical attractiveness rated by independent raters	(can be costly)	

1.3.3 Measurement of mate value

As the conceptualization of mate value has some difficulties, its measurement will face some obstacles as well (Edlund & Sagarin, 2014). Self-perceived mate value can be measured by separate factors, or holistically, by one overall construct (e.g., Fisher et al., 2008; Edlund & Sagarin, respectively; cf. Table 3). Some use reproductive success as a proxy of objective mate value (Pflüger, Oberzaucher, Katina, Holzleitner, & Grammar, 2012). Others employ independent raters to assess the 'objective' physical attractiveness of the participants. Thus, they are also aiming to receive a proxy of the objective mate value (e.g., Montoya, 2008). Fisher and colleagues (2008) point out that every mate value estimate should account for past mating success as well, although their Components of Mate Value Survey measures it only very superficially. In their questionnaire, the items on the Views of the opposite sex factor (adopted from Landolt et al., 1995) measure the self-perceived attraction of others, but not the actual mating behaviour. Only these two items load onto the Relationship history factor: "After I date someone they often want to date me again" and "Several members of the opposite sex have had crushes on me in the past 6 months". As these questions do not cover the past relationship experience sufficiently, Fisher and colleagues (2008) used a separate measure: the number of past long- and short-term relationships. This is unfortunate because a questionnaire entirely covering the concept of mate value would be more practical. On the one hand, a truly objective mate value can be costly and impractical (e.g., asking a number of independent raters to provide an estimation of one's mate value after a lengthy face-to-face interview; or recording their number of children once their reproductive age is over). Although, as suggested above, it may not be as good an indicator of mating behaviour as the self-perceived mate value (Arnocky, 2018), thus a costly measure of objective mate value may not be worth it from the perspective of the study. Eventually, we do not know what the factors of mate value are exactly, and how these factors are combined (see above). Therefore, any manipulation with them may introduce some bias.

To overcome these problems, Edlund and Sagarin (2014) suggest to simply asking how much the participants are worth in the others' eyes. Their assumption of mate value and mating market operations is that people have a by and large accurate notion of their own worth even if the researchers or they themselves cannot identify its underlying formula or processes (Brase & Guy, 2004; Edlund & Sagarin, 2014). So far, some studies have used holistic, i.e., overall mate value measures (Edlund & Sagarin, 2014; Landolt, Lalumière, & Quinsey, 1995), and some have used multiple factors (e.g., Csajbók & Berkics, 2017; Fisher et al., 2008; Kirsner, Figueredo, & Jacobs, 2003). In the end, researchers themselves have to decide which approach to use based on the aims and scope of the study (Table 3). It should be considered which factors the study focused on and which aspects of mate value are meaningful in the context. For example, if the study is testing how certain manipulations alter the dominance ratings of faces, and how the participant's own mate value moderates this effect, it is reasonable to employ a mate value measure that captures the participant's own dominance as well. Perhaps the most problematic that a researcher can do when employing the mate value concept is to not clarify the reasons in choosing either of the measures.

1.3.4 Correlates of mate value

Evolutionary theories provide some predictions about the correlates of mate value. Physical attractiveness and access to resources are two of the most important sources of

mating quality in women and men, respectively. Thus, objective features predicting status and attractiveness should also correlate with mate value. For example, while ageing may correlate with career progress in the case of men, thus higher status, women are expected to lose their physical attractiveness over time, resulting in opposite directions in the change of mate value by ageing across the sexes (Brase & Guy, 2004). Higher status, regardless of men's age, should also contribute to higher mate value (Mafra & Lopes, 2014). Even relationship status may be an indicator of someone's mate value, signalling the person is worthy to be in a relationship with (Brase & Guy, 2004). However, dissatisfied relationships are associated with decreased self-esteem, and it may be worse to be in a bad relationship than not being in any (Shackelford, 2001). Relationship satisfaction therefore may be a signal of the person's mating success, as a proxy of their mate value.

Some studies using smaller samples, i.e., maximally 200 participants, found associations as expected. Higher self-perceived mate value correlated with higher status and age in men (Brase & Guy; Mafra & Lopes, 2014). Higher self-perceived attractiveness was the strongest predictor of self-perceived mate value when measured as a holistic, overall mate value (cf. the Mate Value Scale of Edlund & Sagarin, 2014) in both men and women in a sample of more than 2,000 participants (section 3.1: Csajbók & Berkics, 2017). Interestingly, although the second most important predictor of men's mate value was their self-perceived status, its effect on their mate value was only about 24% of their appearance's effect. An even larger sample of 21,000 Hungarian participants showed even weaker effects (section 3.3: Csajbók, Havlíček, Demetrovics, & Berkics, 2019). Education, even though frequently considered as a proxy of status, had only very small association with self-perceived mate value in both men ($\rho = 0.088$) and women ($\rho = 0.026$). Age, contrary to the expectations, also had only weak associations with mate value both in men ($r = -0.050$) and women ($r = -0.081$). Socioeconomic status had a more noticeable effect, especially on men's self-perceived mate value ($\rho = 0.282$), but with a similar effect size in women ($\rho = 0.229$). Relationship status had an effect consistent with the expectations, such as, being single with close to zero sexual experience meant the lowest self-perceived mate value, however, divorcees had the same level of mate value as married and dating participants. Additionally, relationship satisfaction had a positive relationship with mate value, as expected, meaning that being single with at least more than 10 past sexual partners was even better than being in a bad relationship.

All in all, these results imply that individuals are somewhat sensitive to the objective predictors of their mate value, potentially independently from how we measure mate value (i.e., holistically, or along separate factors). Nonetheless, studies having sufficient statistical power showed that participants are not as sensitive to the objective predictors of their mate value as evolutionary theories would expect them. That is, women in their 40s consider themselves almost as attractive as women in their 20s (cf. Csajbók, Havlíček, Demetrovics, & Berkics, 2019). There is no problem with this; these results highlight how important the distinction between self-perceived and others-perceived mate value is. Moreover, one needs to clarify further contextual factors, such as the overall pool of the potential partners to compare with, which make these evaluations so relative. Results also underscore the importance to consider social comparison and subjective goals when testing mate value (cf. Festinger, 1954; Leary & Baumeister, 2000). The platform of these relative evaluations may be, for example, the individual's personal environment as a 'local mating market'. Therefore, on a general note, research investigating or using mate

value as a measure should emphasize conceptual and contextual clarity in targeting either aspect of mate value. As any other topic, mate value needs thorough and careful considerations when used or studied.

Future research, consequently, should further clarify the nature of this relative evaluation of mate value. For example, a better description would be needed of how it changes over time, not only on absolute levels, but also in terms of the content of self-perceived and others-perceived mate value. That is, we can assume that the most important factors as the source of the 'overall/holistic mate value' depend on the individuals' current relationship goals and life stages. Further, there is only little research yet on how these factors combine into the overall evaluation (cf. the subsequent Part II), neither do we know if an overall, holistic measure is comparable in accuracy to a more dimensional, factorial measure. It can be expected that as research investigating the integration of mate choice factors will be in a more advanced stage, mate value research will see a boost as well. We also know only little of how the sense of self-perceived and others-perceived mate value develops. How do they react in the long run with individual experiences, such as rejection, trauma, or relationship with parents and siblings? We do not know yet how important factors these individual differences are, however, we may infer that they are key in such social comparisons.

Part II: Mate Choice Models

2.1 The integration of mate preferences

The last decades have been fairly productive in identifying the most important dimensions of mate choice, and how these factors are associated with sex, age, socioeconomic status, and other predictors of mate preferences. Nonetheless, knowing the components of such decisions is not enough in making powerful predictions of human mate choice. As Edlund and Sagarin (2014) argued for a holistic approach of mate value, we do not know how an overall evaluation is formed based on such individual factors. The perceived factors of mate preferences interact within the individual bearing them as well as in the eye of the perceiver. Let us take as an example the prediction of relationship satisfaction by the partner's characteristics. A simple regression model predicting relationship satisfaction by seven factors of the partner tells us that both men's and women's satisfaction are predicted the most by their partners' perceived passion and warmth (Csajbók & Berkics, 2017). Two thirds of the variance of relationship satisfaction are explained by this predictive model. We do not know, however, how these factors combine or dominate each other. The seven measured factors all correlate with relationship satisfaction on varying levels and the factors also correlate with each other. Assumedly, a lot of other information was not measured or entered into the prediction, as at least one third of the variance is due to unaccounted variables. Of course, the example here predicts relationship satisfaction, and not directly mate choice. However, the analogy would work similarly in predicting the desirability of the potential partners knowing their characteristics. This type of predictive analysis is an example of the Additive models, i.e., the factors are treated independently, no interaction is truly accounted for, and its underlying assumption is that the higher the evaluation, the better the partner is. We can assume, however, there are other models to conceive.

2.2 Additive versus Threshold models of mate choice

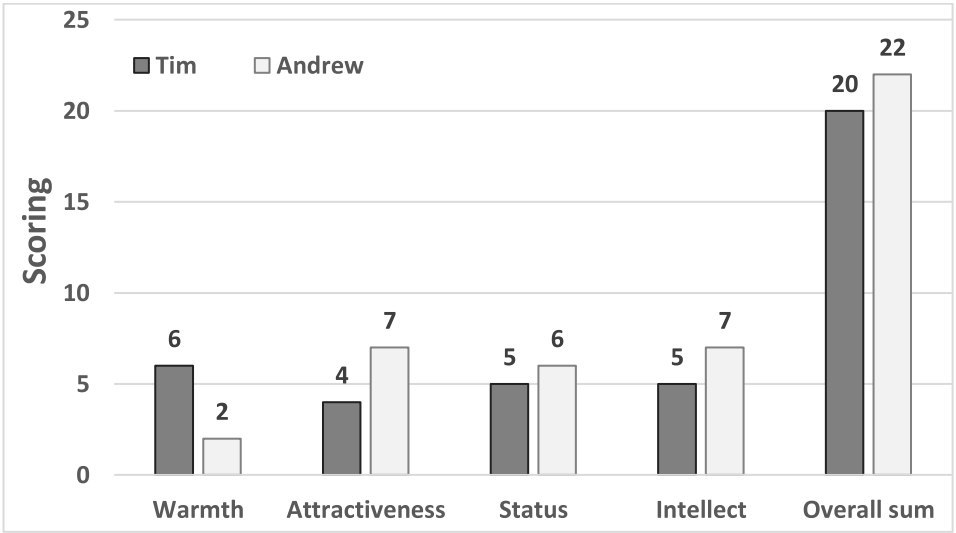

Figure 1. Hypothetical evaluation of two potential partners

The implicit assumption of an underlying Additive model behind mate choice dates back to the beginning of research investigating human partner preferences. The very idea of rating a list of traits infers that each additional trait means additive qualities as a potential partner (e.g., Buss, 1989; Fletcher et al., 1999). Further, the overall sum of the

characteristics is considered as their ‘mate value’, with the highest being the most desirable. As an illustration, Figure 1 shows the ratings of two individuals, Tim and Andrew on four dimensions (Warmth, Attractiveness, Status, and Intellect). According to the Additive model, Andrew is more desirable than Tim as he has a higher overall sum of characteristics.

We may see something conspicuous in the ratings of these two gentlemen. Andrew has a very low evaluation on Warmth, while Tim showed a more balanced assessment. Another model of mate choice predicts that individuals should reach at least a minimum level in each characteristic in order to be even considered as a potential partner. Kenrick, Sadalla, Growth, and Trost (1990), for example, showed that individuals have minimal and maximal levels of acceptance for their partner’s characteristics, such as easygoingness, earnings, or intelligence. These minimal goals in a partner differed between the two sexes as well as between different relationship contexts. Others also showed that participants using dating websites set up searching filters, or aspirational levels of their future partners (Hitsch, Hortaçsu, & Arieli, 2010). In their speed-dating study, Beckage, Todd, Penke, and Asendorpf (2009) also found that using thresholds in the search for a partner functioned as good heuristics. They suggested that these heuristics account for the participants’ own attractiveness, as well as the pool of the available potential partners. This way, the estimation based on the available information allows realistic standards to set up maximizing the outcomes of the partner search (cf. Todd & Miller, 1999). Thus, in our specific example of Andrew and Tim, the Threshold model predicts the opposite of the Additive model. Despite the higher overall score of Andrew, Tim should be more desirable than Andrew, due to his better performance in exceeding all the thresholds of mate choice.

Csajbók, Berkics, and Havlíček (see in section 3.4; under review) developed a method to compare the predictions of these differential models. In a form of manipulated vignettes (similar to Andrew and Tim, Figure 1), they asked participants to rate the desirability of potential partners for a long-term relationship. These short descriptions either had one characteristic which was low among three others which were high or had one high characteristic with three other mediocre ones. For example, the Additive model would predict that the participants prefer the person who is more intelligent, warm, and rich than average, and is less attractive than average. According to the Threshold model, the participants would prefer the descriptions of someone averagely warm, intelligent, and rich, but more attractive than average. Four-four vignettes were allocated to each model. Each of the vignettes was predicted to be desirable only according to one of the models, but not to the other. That is, the vignettes either had a higher overall sum of their characteristics but one low characteristic; or a lower overall sum of the characteristics, but no low characteristic – which may be considered as a violation of the thresholds.

The participants, both men and women, preferred, on average, the descriptions which did not violate any preference threshold. Interestingly, though, the most desirable vignette was an Additive one, which was high in warmth, attractiveness, and intellect, but low in status. Nonetheless, the Threshold vignettes still outperformed the Additive ones. The study was replicated on more than 1700 participants with various levels of the characteristics, denoted with a different number of stars. Four variants of the study used 1-2-3 stars, 1-3-5 stars, 2-3-4 stars, and 3-4-5 stars. The results were comparable to the first study, and the participants on average preferred the vignettes with no violation of

thresholds over those which had a higher overall sum of the characteristics but had one low characteristic.

As already mentioned, the Additive vignette low in Status and high in Warmth, Attractiveness, and Intellect was the most desirable, even though the Threshold vignettes overall were rated higher. Looking at the importance ratings of the characteristics in the participants' ideal partner, Status was the least important characteristic among seven factors of mate choice (cf. items taken from Csajbók & Berkics, 2017: Warmth, Stability, Attractiveness, Passion, Status, Intellect, and Dominance). This suggests that the relative importance of the characteristics plays a crucial role in how the overall assessment is formulated. For example, it clearly suggests that the Additive model is oversimplifying with its underlying assumption that each characteristic should weigh in the final evaluation similarly. A Weighted Additive model might have a better predictive performance than the simple Additive model and should be compared with other models. A recent study indeed found that the Weighted Additive model had the best predictive power of mate choice (Brandner, Brase, & Huxman, in press). Second, as it was shown, the less important characteristics may have thresholds set at different levels than the more important ones. Thus, further research testing the Threshold model could benefit from a more sensitive, perhaps more individualistic approach. Such an approach would be, for example, implementing the raters' own preferences and minimal standards for each trait in a predictive model and testing the characteristics' fulfilment individually.

In general, these results supporting the Threshold model are in line with the aforementioned error management theory (cf. section 1.1.2, Haselton & Buss, 2000). The offered vignettes could bear with any desirable characteristics, the lack of one outweighs them, just like the theory suggests. From this perspective, being low in one characteristic probably functions as a dealbreaker. Nonetheless, there is one important difference between the dealbreakers and the violations of the thresholds in these manipulated vignettes. The vignettes were not necessarily rejected as a dealbreaker, or else 'hard threshold' would indicate it, by definition. The participants rated the desirability of the vignettes on a 0 to 10 Likert-type scale, as well as indicated whether they would consider a long-term relationship with such a person (section 3.4: Csajbók, Berkics, & Havlíček, under review). The desirability ratings allowed us to monitor more closely how the participants perceived these vignettes. Desirability was clearly lower when the threshold of an important characteristic was violated in the vignettes. Similarly, a significantly lower number of participants said 'yes' to such hypothetical partners. However, the average desirability of the vignettes did not reach the lowest possible score. That is, the rejection may not be unequivocal, as the term 'dealbreakers' would indicate. In contrast, the results suggest a non-linear desirability assessment of the vignettes with a more moderate slope before reaching the threshold level. At the threshold level, a break-point is followed by a steeper slope as the association between the level of the characteristic and the desirability rating strengthens (see Figure 2).

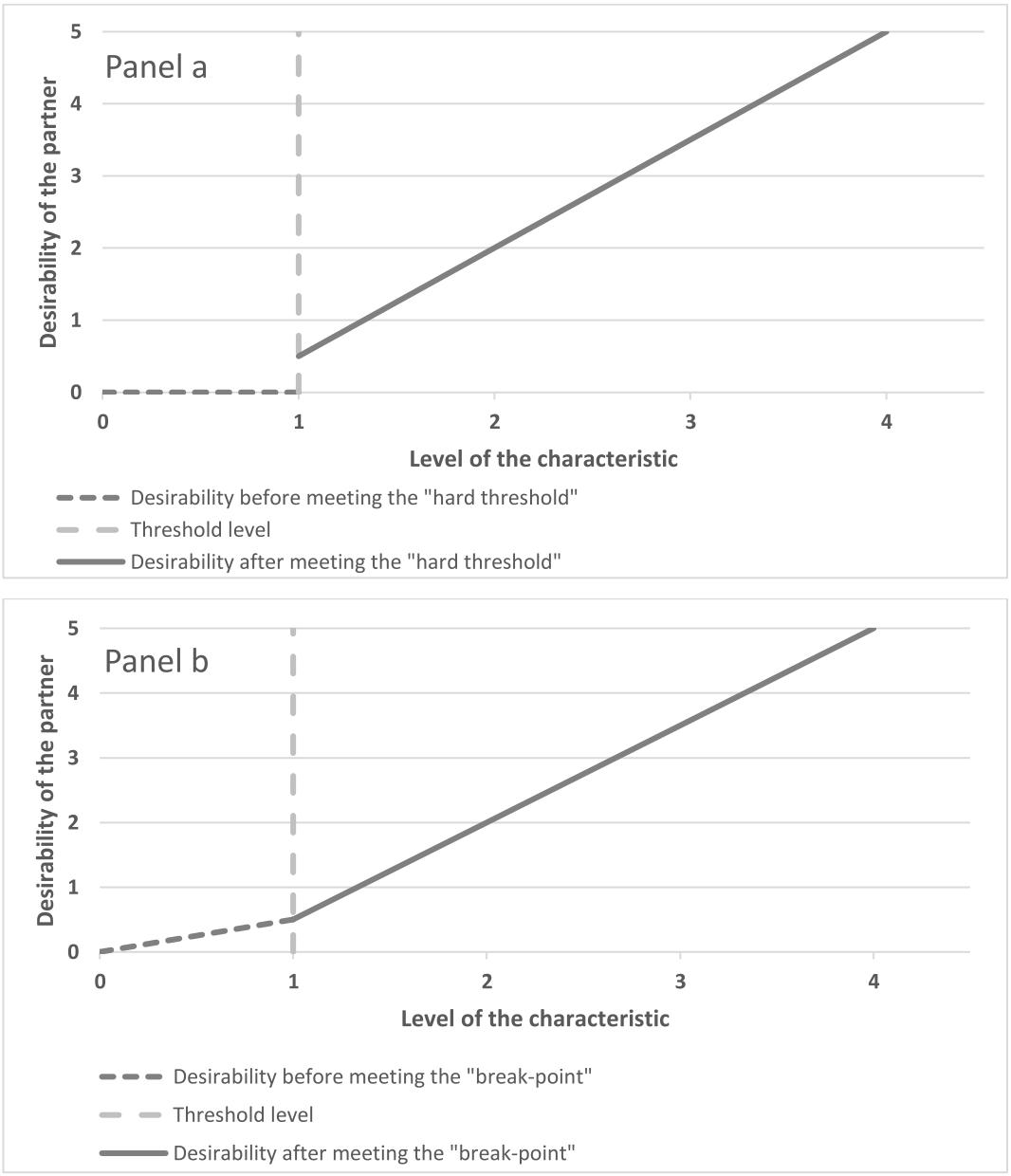

Figure 2. Hypothetical desirability evaluation of a potential partner according to the 'hard threshold' model (panel a) and the 'break-point' model (panel b)

2.3 Further integrational models

Other models were also proposed about how mate preference factors may be integrated. Kučerová, Csajbók, and Havlíček (2018), for example, calculated the Manhattan distance between the ideal and the actual partners (i.e., sum of the absolute differences between their factors) in order to express profile differences between them. Conroy-Beam and Buss (2016) tested altogether seven models of mate choice integration algorithm with simulated agents: Aspiration, Euclidean, Polynomial regression, Random, Simple regression, Threshold Euclidean, and Threshold Regression models. The study allocated a mate choice model to each agent which then reproduced, as their fitness allowed them, after a costly period of mate search. Further, the agents passed forward their mate

preference integration algorithm to their offspring. Each agent started mate search with assigned personal traits and preferences. The Aspiration model allocated an acceptable range to each trait (i.e., the agents got assigned acceptable minimum and maximum levels for each trait). The Euclidean model determined the agents' attraction by the inverse of the straight-line distance in the multidimensional space between the agents' preferences and the potential mates. The Random model allocated random attraction to each of the potential mates. The Simple regression and Polynomial regression models got their preference scores assigned as an intercept and slope for the function of their attraction, also allowing them in the Polynomial regression model to construct a cubic function of preference. The Threshold regression model calculated the attraction score with the simple regression method, only if all the thresholds were met in the potential mate. The Threshold Euclidean model assigned an attraction value to a mate only after each threshold was fulfilled (the attraction value was similarly calculated as in the Euclidean model, i.e., the inverse of the Euclidean distance in the multidimensional space). The agents were run for 200 generations altogether 50 times. Every model run resulted in a population dominated by the agents following the Euclidean algorithm. Moreover, the Random, Regression, Threshold Euclidean, and Threshold regression models went extinct in 100% of the tests. Further, in subsequent studies, actual couples' preference fulfilment was found best described by the Euclidean method (i.e., the straight-line distance of the actual partner from the preferred partner in the multidimensional space).

The above results were replicated in a subsequent paper predicting actual participants' attraction to potential mate profiles (Conroy-Beam & Buss, 2017). Here, the Euclidean model was tested against two other multidimensional space-distance measures, the Manhattan and Chebysev distances (i.e., the maximum absolute difference between the ideal and actual partners' characteristics), as well as against Profile correlations, Profile valence, and Traditional regression approach. The Profile correlations are frequently used techniques in predicting profile similarity between two targets which were measured on several factors (cf. Kenny, 2006). The profile similarity in this approach is expressed by calculating the correlation between the ratings given to the factors for the two targets within a participant. The Profile valence was identical to the Additive model in the study of Csajbók, Berkics, and Havlíček (under review), defining the sum of characteristics as the overall profile value. Lastly, the Traditional regression model regressed the profile attractiveness on the interactions between the ideal partner preference and the profile partner's characteristics (i.e., moderation model). Both in a long- and short-term setting, the Euclidean model had the best predictive power and fit against the data, however, the Manhattan distance measure gave results very close to the Euclidean solution. Subsequently, Conroy-Beam found the Euclidean distance the best fitting model in a multi-study paper in 2018, and across 45 cultures in 2019 (Conroy-Beam, 2018; Conroy-Beam et al., 2019).

Overall, the presented models are computationally complex, such as using assigned intercepts and slopes to formulate the attraction between agents. Further, the agents were programmed for multiple aspects of their life cycles, including fitness loss, population cap (inducing genetic drift), and mate preference integration algorithms. However, from a phenomenological point of view, this computation-heavy approach is not exactly realistic. Several adjusting aspects of childhood and life experiences, natural consequences of life events cannot be implemented in such models. Some might say that this is exactly the advantage of such simulated experiments which are free from the noise

of ecologically more valid observations. Simulations are maybe even clearer of such noise than how much a laboratory-clean environment could achieve. On the other hand, such models rely on the assumption that every aspect of life can be described and quantified. While the preference integration algorithms or mate choice models are highly influential and interpretative segments of mate choice research, such calculations behind real-life mate choice decisions are improbable, therefore, maybe too artificial to entirely capture mate choice.

For research purposes though, these models are incredibly profitable to formulate new theories of mate preference. For example, as mentioned above, a recent study found the best performing the Weighted Additive model (i.e., additive mate value weighted by the importance of the characteristics) when compared with several other models (Brandner, Brase, & Huxman, in press). All in all, this shows that research testing mate choice integration algorithms have a long history ahead. As the presented studies show, a lot depends on the study design and the comparable models in finding either of the models as the best fitting. For example, in comparison to the study of Csajbók, Berkics, and Havlíček (under review), the other mentioned studies may have a somewhat lower ecological validity with a less thorough inspection of the potentially varying threshold levels. Future research should concentrate more on identifying further integration algorithms, such as, for example, the Weighted Euclidean model, which weights the partner characteristics in the multidimensional space by the importance of the characteristics (Conroy-Beam & Buss, 2017). Other models are also plausible, such as expecting the individuals to apply multiple models in a stepwise fashion. A stepwise strategy would be, for example, first expecting the potential partner to pass all thresholds, and subsequently choosing the partner with the highest overall sum of characteristics (cf. 'break-point effect' in Csajbók, Berkics, & Havlíček, under review). Overall, these integrational models suggest that mate choice seems very complex, a lot more than a simple regression model can predict. Research attempting to describe it, however, may bring us closer to understanding mate choice, if only at least partially. In section 2.5, more research will be reviewed on the measurement and phenomenology of the integrational models.

2.4 Assortative mating

Perhaps the most well-studied mate choice model is assortative mating. In contrast to the previously discussed models (e.g., Additive, Aspiration, Euclidean), assortative mating is not a directly computational model (though testing the theory may require computational developments, cf. later in section 2.5.2). Assortative mate choice refers to the active or passive assortment of similar people from the beginning of the relationship. Therefore, it is important to differentiate assortative mate choice from couples' similarity, which implies both the initial similarity between partners and a potential later development of resemblance as the relationship evolves. The term *active* or *passive assortative mating* refers to both intentional (i.e., active preference for similarity) and circumstantial processes (see later) involved in the outcome of couples' similarity. The marriage of similar people is often referred to as homogamy (Luo, 2017).

Luo's 2017 review is an excellent summary of all the areas of couples' similarity. As it is reviewed, the strongest associations are observed in demographics, but medium size correlations can be observed from attitudes to abilities, mental health, lifestyle, physical

characteristics, and personality traits (e.g., Feng & Baker, 1994; George et al., 2015; Luo, 2009; Maes et al., 1998; Mathews & Reus, 2001; Pearson, 1903; Randler & Kretz, 2011; Sakai et al., 2004; Štěrbová et al., 2017; Voracek, Dressler, & Manning, 2007). The most prominent similarities between partners are age, ethnicity, religion, education, and socioeconomic status with correlations ranging between 0.40 to 0.90 (e.g., Frimmel, Halla, & Winter-Ebmer, 2013; George et al., 2015; Hur, 2016; Schwartz & Graf, 2009; Sweeney & Cancian, 2004).

2.4.1 Mechanisms of assortative mating

Interestingly, though, there is no conclusive evidence yet about the exact mechanisms for couples' similarity. Four mechanisms have been hypothesized and tested so far in the literature (Luo, 2017). 1) Active, initial assortment would predict that the individuals prefer mating someone similar to them (e.g., Watson, Beer, & McDade-Montez, 2014). In contrast, a passive assortment could indicate two processes. It could be 2) the consequence of market operations, such as we have seen in section 1.3 the development of self-perceived mate value and mate preferences. The rationale behind is that even if people aim for the best possible partners, they end up with someone similar, as lower or higher mate value partners would be otherwise costly mistakes (see later in this section and cf. section 1.3). The other passive mechanism that may result in partner similarity is 3) social homogamy, referring to the marriage of people coming from a similar background. For example, two people both attending university, or both working in the same business, have higher chance to get to know each other and develop a romantic relationship than two people coming from very diverse backgrounds. Consequently, the shared background will lead to similarity in other characteristics as well, such as in socioeconomic status, health, and intelligence. Lastly, 4) convergence within a relationship can also be a mechanism resulting in the observed similarity between partners in established relationships (e.g., Caspi & Herbener, 1993).

The evidence so far suggests that 1) humans are probably evolved to prefer partners similar to themselves (e.g., Hitsch, Hortascu, Ariely, 2010; Little, Burt, & Perrett, 2006). People also find their relationship more successful, intimate, and understanding when they are more similar to their partners thus allowing the relationship to be more stable (e.g., Bereczkei & Csanaky, 1996; Heaton & Pratt, 1990; Little, Burt & Perrett, 2006).

It has also been demonstrated by mathematical models that 2) some mating market forces other than individual preferences may influence couples towards assortative mating (Fisher et al., 2014; Kalick & Hamilton, 1986; Xie, Cheng, & Zhou, 2015). As shown in section 1.3.2 as well, the pairing game of Ellis and Kelley (1999) simulated the process of assortative mate choice with actual participants. The typical correlation between the numbers of the participants was around 0.70, even though the task was specifically to search for the best possible partner. Second, those having low values will be rejected by those having a sense of higher mate value, as the participants having higher numbers expect to have better options. Those pairing with someone having a higher mate value than themselves might feel anxious in their 'relationship' expecting their partner to leave them for someone better. Interestingly, evidence seems to support this mechanism. People tend to feel higher jealousy if their partners' mate value is higher than their own and more often show mate-retention behaviour (e.g., Sela, Mogilski, Sheckelford, Zeigler-Hill, & Fink, 2017; Sidelinger & Booth-Butterfield, 2007).

As Luo (2017) pointed it out, it is not clear yet how the overall mate value similarity can be translated into similarity along different factors. For example, some authors showed evidence for the potentials-attract hypothesis (e.g., Bereczkei, Voros, Gal, & Bernath, 2010; Buston & Emlen, 2003; He et al., 2013; Todd, Penke, Fasolo, & Lenton, 2007). That suggests pairing up along different characteristics which are exchanged as equal worth offered into the relationship. Such a trade would be the attractiveness offered by women exchanged for the wealth offered by men as a fair bargain (cf. social exchange theory, Kelley & Thibaut, 1978). Second, apart from the classical traits holding a consensually high evolutionary value (such as attractiveness) there are other characteristics which might hold a relative importance for the individual (such as hobbies). According to Luo (2017), the factors holding absolute consensual importance are probably responsible for the market ruling, and the characteristics of relative importance are the assortment factors of active choice. However, further research is needed to clarify this distinction.

Social homogamy as 3) explaining mechanism operates with the availability of similar potential partners around us (cf. Epstein & Guttman, 1984). According to this idea, partners' similarity is coming from social and geographical proximity that is increasing the availability of self-similar potential partners. However, when controlling for the social background, similarity in other factors remain robust (e.g., Botwin, Buss, & Shackelford, 1997; Mascie-Taylor & Vandenberg, 1988; Watson et al., 2004). On the other hand, globalization may offer us some opportunity to gather more evidence. It was found that in more ethnically diverse neighbourhoods and schools, interracial dating was more frequent (e.g., Fujino, 1997; Levin, et al., 2007; Yancey, 2002). Due to the easier and more frequent encounters of different nationalities, more and more intercultural couples emerged (e.g., McFadden & Moore, 2001; Wilczek-Watson, 2017). Nevertheless, online dating studies found that the participants still preferred similar-background partners in race and education, though the prevalence of inter-racial couples increased in the US (Hwang, 2013; Skopek, Schulz, & Blossfeld, 2011). Therefore, the evidence is mixed.

The consequences of social homogamy are in line with the theory suggesting better understanding in more similar couples. For example, intercultural couples have been reported to face specific culture-related stressors in their relationship (Bustamante, Nelson, Henriksen, & Monakes, 2011). Interestingly, though, this drawback is considered as easing on intercultural couples as mixed relationships are becoming more accepted, and the society is relaxing some of their burdensome expectations on the couples' lives. Also, more frequent and positive representations in the media help to empower inter-cultural couples instead of overemphasizing the cultural differences which can have debilitating effects on the couples (Wilczek-Watson, 2017). All in all, there is only limited and inconclusive evidence yet supporting the theory of social homogamy. It is not certain to what extent the observed positive assortative mating is due to social proximity. However, observing the effects of social and global migration suggests that social proximity may indeed have had an impact on assortative mating when migration was less achievable.

Lastly, 4) convergence have been hypothesized as being responsible for finding already established couples to be similar. Couples may have some effect on each other's mood, physical fitness, and other more plastic characteristics over time but the similarity may be coming from the shared living experiences and circumstances as well (Caspi,

Herbener, Ozer, 1992; Luo, 2017). Relationship length has only weak associations with the degree of similarity between partners in IQ, attitudes, and personality (Caspi & Herbener, 1993; Gonzaga, Carter, & Buckwalter, 2010; Mascie-Taylor, 1989; Watson et al., 2004). Physical appearance showed a stronger similarity between partners being together for decades than between newlyweds (Zajonc, Adelmann, Murphy, & Niendenthal, 1987), however, others did not find convergence in physical appearance (Caspi & Herbener, 1993; Griffiths & Kunz, 1973; Hinsz, 1989). Depressive symptoms and physical limitations in the activities of daily living also showed correlated change over time within couples (i.e., the change of husbands' and wives' depressive symptoms happened in tandem; Hoppmann, Gerstorf, & Hibbert, 2011).

A survival effect of the relationships probably introduces a bias in these similarity results, just like it was seen in the change of partner preferences in section 1.2.1 (Schwartz, 2010a, 2010b). Probably, convergence may be more easily observed in characteristics which show some level of plasticity, in contrast to personality, for example (Luo, 2017). Also, study design can be responsible for the lack of observed convergence, considering that a closer monitoring of the initial phase of the relationships would be necessary to accurately capture the survival effect. Cross-sectional studies controlling for relationship length, or longitudinal studies following the couples only once the relationship was established may also introduce the survival bias. This may also be the reason for only limited evidence supporting either complementarity or couples' dissimilarity. Negative assortative mating would indicate independence between the partners' characteristics, while complementarity would be *opposites attract* in complementing characteristics, such as submissiveness and dominance (Štěrbová & Valentová, 2012). Relationships were found to be shorter if the partners complemented each other (Felmlee, 2001). Even those individuals who believed they are attracted to opposite characteristics ended up choosing someone similar to them (Dijkstra & Barelds, 2008). Thus, it is very likely that the study of solely established relationships introduces bias in the research of assortative mating, and henceforth relationships which are not homogamous are not well documented.

2.4.2 Consequences of assortative mating

The genetic consequence of assortative mating is that the offspring is more similar to the parents. That is, according to Thiessen and Gregg (1980), assortative mate choice is advantageous because it ensures to pass on more than 50% of the parent's genome as the parents share some of the characteristics. This can be advantageous in a stable environment where it is beneficial to inherit the genetic adaptations to the current circumstances (Figueredo & Wolf, 2009). On a social level, assortment in socioeconomic characteristics, such as education and resources, increases the gap between different social classes (Blossfeld, 2009). From the perspective of the relationship's psychological health, homogamy in the main demographic characteristics has a relationship stabilizing effect (e.g., Blackwell & Lichter, 2004; Frimmel, Halla, & Winter-Ebmer, 2013; Goldstein & Harknett, 2006). Although the mere level of similarity in demographic variables is not linked with relationship satisfaction, similarity in personality and attitudes was in moderate positive association with relationship satisfaction (e.g., Keizer & Komter, 2015; Luo & Klohnen, 2005). Overall, though, these results strongly vary by the applied analytical approach (see Edwards, 2001; Luo, 2017; e.g., Dyrenforth, Kashy, Donnellan, & Lucas, 2010; Furler, Gomez, & Grob, 2013). This question will be discussed more in depth in section 2.5.2.

As a mate choice model, homogamy is incredibly powerful and robust, and assortative mating is a suitable pivotal principle in making predictions of mate choice. From the individual's perspective, it is an easy to follow rule of thumb and intuitively simple to conceptualize. As it seems, the relationships benefit from the partners' similarity and it lowers the risk of marital dissolution. All in all, homogamy very parsimoniously describes mate choice, it is well-replicated and very useful in theorizing about relationship initiation, maintenance, and satisfaction. Learning which ones of the proposed mechanisms lead to assortative mate choice (or to what extent they do) will be influential in understanding relationship formation.

2.5 Synthesis of preferences: Lessons learned from the predictive validity of mate preferences

After the careful investigation of which are the important characteristics of mate choice and theorizing about those characteristics' association and overall integration, it is important to examine the robustness and predictive validity of such measures. Consequently, we will explore how the integration processes and the interaction of these preferences and preference fulfilment in a potential partner can alter the predictive validity of mate preferences.

As Feingold's meta-analysis reported (1990, 1992), sex differences in the ideal partner's physical attractiveness and earning prospects are as high as $d = 0.5$-0.7, as theories suggested (e.g., Buss & Schmitt, 1993). A more recent study conducted in 45 countries also confirmed these sex differences (Walter et al., 2020). A common hypothesis is to expect these sex differences to decrease by closing the gap in gender inequality, providing equal opportunities for men and women to acquire resources. While the age gap between the couples was found to be decreasing in the case of higher gender equality, they did not find any robust association between gender equality and sex differences either in other preferences, or in pathogen exposure in contrast to previous studies (Eagly & Wood, 1999; Zentner & Mitura, 2012). Surprisingly, Eastwick and colleagues' meta-analysis did not find a significant sex difference in the association between the partner's romantic evaluation (e.g., desirability) and physical attractiveness or earning prospects (Eastwick, Luchies, Finkel, & Hunt, 2014). Men's and women's romantic evaluations correlated at 0.53 and 0.50 with physical attractiveness, and at 0.27 and 0.28 with earning prospects, respectively. The relationship stage was found to be a moderator. Overall, the predictive power of preferences was stronger in the initial attraction phase of the relationship than in the courtship phase, but they increased again in the established relationships.

Perhaps, the two sexes have different abstract pictures of attractiveness and status in their minds when building a cognitive representation of the ideal opposite sex partner (cf. Buss et al., 2020). For example, for women, an attractive man might be muscular, while for men, an attractive woman might be curvy. It is plausible that in the context of rating an ideal man versus ideal woman, status also has a different overall cognitive constellation leading to the equal correlations with romantic evaluation across men and women. Second, as the social exchange theory implies, the most important characteristics can be traded (or exchanged) in mating not necessitating to 'have it all' in a partner (Kelley & Thibaut, 1978). Meta-analyses even suggest that some characteristics, such as physical attractiveness, correlate very high with successfulness in life. The individual may extrapolate from knowing only one characteristic (e.g., attractiveness) to imply further

positive future prospects of the potential partner (cf. Langlois et al., 2000). Perhaps this is the way, how Eastwick and colleagues (2014) received the unexpected equal correlations of men and women between the romantic evaluations of both attractiveness and status (i.e., desirability as a partner with the partner's attractiveness at r = 0.53 and 0.50 in men and women, respectively; and at r = 0.27 and 0.28 with status, in men and women, respectively).

2.5.1 Differential evaluations of abstract versus gut feelings

The lower predictive validity of mate preferences in the initial dating phase (e.g., courtship) of a relationship is a more complex question that have been heavily debated over the last years (e.g., Campbell & Stanton, 2014; Conroy-Beam & Buss, 2017; Li et al., 2013). Levinger and Snoek's (1972) intersection model of the stages of romantic relationships offers an overview of the qualitatively distinct periods of pair relatedness. The first stage, awareness, covers the phase of hypothetical evaluation of each other as impression formation. The surface contact phase involves the first shared interactions and potential attraction. The mutual phase shares closeness, information of each other, and a declared relationship. These three phases may be investigated with different methodologies, for example the impression formation phase is usually tested with an abstract rating task, the surface contact phase with speed dating, or first dates, chatting, and the mutuality phase with testing established relationships. Eastwick and colleagues (2014) found that mate preferences had a stronger predictive validity in the awareness and mutuality phases than the surface phase.

The reasons as Eastwick and colleagues explain (2014) might be the following. The construal-level theory offers a perspective on the cognitive representation of these evaluated objects in Levinger and Snoek's three phases of relatedness (Trope & Lieberman, 2010). The theory holds that the psychologically distant, hypothetical events or objects are abstract construals, while the psychologically near events in the 'here and now' are concrete construals. These are also referred to as high- and low-level construals. That is, when testing the ideal romantic partners, the participants use their high-level mindset to rate the abstract picture of their ideal partner schemas. The ideal partner representations often include traits and stable characteristics which typically need high-level judgements. In contrast to these hypothetical partners, an actual date heavily involves attributions, behavioural observation, concrete, observable characteristics. A different mindset is employed to these events, the low-level construals, which are able to contextualize live behaviour. Therefore, in the case of Levinger and Snoek's relatedness stages, the hypothetical awareness phase accesses high-level construals to evaluate a potential partner, or even a picture of someone on a dating app. The first dates usually strongly emphasize low-level procedures with strong attention to details and gut feelings. Interestingly, in established relationships it would be too exhausting and costly to constantly maintain such efforts. Thus, the low-level construals are employed only in pivotal relationship events such as during the evaluation of a moving-in or before engagement and marriage. Otherwise, an established relationship returns to the high-level construals, and the evaluation of the partner is performed only on the abstract level, maintaining only an abstract picture of the partner and the relationship with them.

Further, Asch's research (1946) on impression formation proved to be incredibly profitable as an interpreting framework for partner evaluation. He demonstrated that traits have different meanings according to the context in which they are shown to the

participants. That is, an individual hypothetical trait of a potential partner in a survey can be reinterpreted in a real person either negatively or positively, depending on all the available contextual information. Contextual information refers here to the intraindividual interaction of the person's traits. For example, the live constellation of a blind-date's ambition will be worrisome if the person is a cold-hearted hangman but heart-warming if the date is a humorous paediatrician. Additionally, the change-of-meaning hypothesis (Hamilton & Zanna, 1974) predicts that connotative meanings will be adjusted according to the overall negative or positive evaluation of said person (e.g., conforming may mean cooperative or weak; persistent may mean diligent or uncompromising, depending on the intraindividual context of the other traits of said person, e.g., happy and intelligent, versus boring and rude). Thus, referring back to the different stages of relatedness (Levinger & Snoek, 1972), the abstract construal personal theories will be adjusted according to the impression that the individual forms during the first date (Eastwick, Finkel, & Eagly, 2011). It is not expected, therefore, that the ideal partner preferences will be strongly associated with the evaluation of a surface contact person during speed-dating. The different construal levels employed in a date are not in line with the abstraction level of rating an ideal partner schema for a questionnaire.

To rigorously test the predictive validity of mate preferences in the speed-dating context as well, Li and colleagues (2013) raised some concerns about the lack of variance in status and attractiveness in the typical speed-dating events. The general attendance of such events is rather homogenous with middle to high level professionals, especially if organised among college students or based on other themes that enhance homogeneity. Overly unattractive and highly attractive people are also less likely to attend such events either because of the fear of rejection, or because they need it less (Li et al., 2013; Montoya, 2008). Further, numerous group perception processes may introduce bias in the perception of a date. Among college students, people tend to perceive the variation within their group higher than they would among the average population (cf. heterogeneity and homogeneity bias, Mullen & Hu, 1989 and Simon, 1992, respectively). Introducing a broader demographic context into the speed-dating event could help to decrease this intergroup bias (Messick & Mackie, 1989). Li and colleagues (2013) provided evidence successfully supporting these concerns with introducing their participants truly low-level versus moderate-level status or attractiveness. Not surprisingly, the participants rejected those potential partners who did not reach their thresholds (cf. Csajbók, Berkics, & Havlíček, under review).

It is also possible that Western cultures are more biased by gut-level feelings or low-level construals about a potential partner than individuals from Eastern populations (e.g., Eastwick et al., 2014; Li et al., 2013; Simpson, Campbell, & Berscheid, 1986). That would explain why the evidence from Eastern cultures suggested a stronger predictive validity of preferences in relationship satisfaction and potential partner desirability than in Western cultures (e.g., Eastwick et al., 2014; Eastwick, Finkel, & Eagly, 2011; Li et al., 2013; Todd, Penke, Fasolo, & Lenton, 2007). The speed-dating context also introduces considerable ambiguity about the expected mating duration. Whether the event is held in a bar or a classroom, the participants may feel more inspired to pursue a short- or long-term relationship, respectively (Kurzban & Weeden, 2007; Li et al., 2013). It was indeed found that in the speed-dating study conducted in a bar, both sexes highly appreciated physical attractiveness that is more associated with the short-term than long-term mating context (Kurzban & Weeden, 2005). Maybe that is the reason why there was

no sex difference found in the predictive validity of physical attractiveness in the speed-dating context. Anyhow, the available time is also very short to deeply get to know each other in such events, which perhaps drifts the participants' judgements toward the more salient stimuli, e.g., physical attractiveness (Kurzban & Weeden, 2007). Participants were also shown to be more afraid to hurt the feelings of a potential partner when they thought the scenario was real as opposed to when they thought the scenario was hypothetical, thus leading to a lower predictive validity in the courtship phase (Joel, Teper, & McDonald, 2014). They may also adhere to existing relationships to avoid hurting the other's feelings, potentially even if their preferences changed (Gunaydin et al., 2017). The halo effect can also change the rating of even unobservable traits because of one salient, appealing trait, thus conspicuous traits may also shift the desirability ratings (Li et al., 2013; Nisbett & Wilson, 1977). It was also shown that the individuals adjust their ideals closer to their partner in order to decrease their dissonance, thus it is not suspicious that at the very moment of the speed-dating, the preferences have a lower predictive validity than afterwards (cf. section 1.2.1; Gerlach et al., 2019; Kučerová, Csajbók, & Havlíček, 2018).

2.5.2 Methodological approaches in predicting desirability

2.5.2.1 Explicit difference measures

As mentioned in the discussion of homogamy measures, calculating the correspondence between ideal and actual partner (just like as between the self and actual partner) is a complicated problem with various solutions. Perhaps the most straightforward approach is to explicitly ask the participants to indicate the difference between the two targets (i.e., how much their partner differs from their ideal partner). It has the advantage that the participant directly estimates the relative difference between the two targets. That is an easier task than accurately assessing the actual level of the two targets separately in an artificial metric, such as rating somebody's attractiveness on a scale from 1 to 7 (Eastwick et al., 2014). However, the approach is not recommended by statisticians because these items combine the ratings of two separate targets into one score and hence are double-barrelled (Edwards, 2001). It is also probable that the explicit difference items measure a distinct concept, which is only partially in overlap with the two items' difference score (cf. Edwards, 2001; Rice et al., 1989). Studies using the approach found strong association concerning the directly estimated discrepancy between the ideal and actual partners and relationship outcomes (e.g., Campbell et al., 2001; Fletcher, Kerr, Li, & Valentine, 2014; Lackenbauer & Campbell, 2012; Overall et al., 2006).

2.5.2.2 Profile correlations

The other procedures operate with the calculation of the discrepancy of the preference fulfilment between the ideal and the actual partner (or the self and the actual partner in the case of testing homogamy) and some form of evaluation of the relationship. The profile correlation, or pattern metric is the correlation between the items rated of the two targets (e.g., how much the partner's warmth, attractiveness, and status correlate with the ideal partner's warmth, attractiveness, and status, within the participants' ratings). This way, every dyad (ideal vs actual partner; husband vs wife) will have one single (profile) correlation score for the overall correlation between their characteristics instead of multiple difference scores for each characteristic. Similarly to the directly estimated discrepancy, this approach is also beneficial in the sense that the participants' ratings are related within the participant, which is an easier task than to interpret the ratings in absolute measures (e.g., how rich is someone 6 out of 10 in reality?). In general, this pattern metric gives a good prediction of relationship satisfaction (e.g., Eastwick & Neff,

2012; Fletcher et al., 1999, Fletcher, Simpson, & Thomas, 2000; Murray et al., 1996; Zentner, 2005). The corrected pattern metric is similarly performed, but only after the ratings are corrected for the stereotype accuracy, or consensual desirability (e.g., Lam et al., 2016). That is, if something is rated highly only because of high consensus in its desirability (e.g., nobody likes a liver taste ice-cream), then similarity between couples in this regard does not predict much of their overall similarity (cf. Kenny et al., 2006).

2.5.2.3 Moderation analysis

The moderation model expects that the relationship outcome (e.g., relationship satisfaction) is significantly predicted by the interaction between the ideal partner preference and the partner's rating (also controlled for the main effects of both the partner and the ideal partner ratings). In case of multiple factors rated, grand mean centering of each partner and ideal partner factor is necessary to avoid very high multicollinearity when all terms are entered into the model simultaneously. The revealed preference model is similar to the moderation model, except that in this procedure, the association between the partner and the satisfaction is saved (e.g., the regression coefficient), and further associated with the ideal partner preference (e.g., correlated). Both of these methods tend to give mixed results of the predictive validity of mate preferences (e.g., Eastwick, Finkel, & Eagly, 2011; Flegr et al., 2018; Li et al., 2013; Wood & Brumbaugh, 2009). Perhaps the evidence is inconclusive because these equations are not able to reliably capture the effect of congruence of the two predictors on the outcome (Edwards, 2001, cf. section 2.5.2.7).

2.5.2.4 Distance measures

A newly introduced, highly influential analytical strategy which proved to be exceptionally effective among the mate preference integration models is the Euclidean (straight-line) distance, or in general the distance measures in the multidimensional space (cf. section 2.3; and Conroy-Beam, 2018; Conroy-Beam et al., 2019; Kučerová, Csajbók, & Havlíček, 2018). The benefit of this approach is that it combines the advantages of multiple methods. It gives a holistic outcome, but employs all the measured traits, and provides the possibility to integrate the weight of the individual traits as well. It is believed that the interactions between the traits act in the overall model in a way that the Euclidean model penalizes the decrease in one trait by a consequential decrease in all the traits by mere geometric necessity (Conroy-Beam, 2018). That may depict well the process of how a less advantageous trait affects the overall evaluation. However, the Euclidean distance has not been tested yet in mate choice research against actual congruence analysis (i.e., response surface analysis), which would be needed to confirm that there is no information loss using the Euclidean integration algorithm (cf. Edwards, 2001). The most commonly applied analysis using Euclidean distance measures is to express the distance between the ideal and the actual partner, or the actual partner and the average ideal partner in the overall sample (Conroy-Beam, 2018; Conroy-Beam et al., 2019). The purpose of comparing the actual partner with the average overall sample preferences is to calculate this way a mate value of the partner in relation to the population ideal (cf. others-perceived mate value).

However, it is also possible to define the overall mate value as the distance from the origin (i.e., 0,0 coordinate). It has the benefit that it does not rely on the sample average, which is especially advantageous if the sample size, thus the generalizability, is low. Supposing the researcher chooses to define mate value as the distance from the origin, the Manhattan

distance (sum of the coordinates' absolute differences) performs better, because it gives identical results to two targets which have (5,5) and (7,3) coordinates (both of their distances are 10). Meanwhile, the Euclidean distance does not (i.e., their distances from the origin are 7.07 and 7.62, respectively). This may seem illogical in certain cases, especially if the additive model is more adequate to the study design (cf. the varying mate value assumptions, section 1.3). Further, the Manhattan distance does not penalize the decrease in one trait with decrease in other traits, which may be beneficial if the change in one trait is expected to be independent from the change in another trait (e.g., in case of orthogonal personality factors). Overall, the distance measures are incredibly intuitive and useful if the researcher wants to orient in a multidimensional space, however, one has to confirm the distance measure reliably tests the congruence effect (see section 2.5.2.7 below).

2.5.2.5 Implicit measures

Implicit measures unavoidably emerge in the researcher's mind when discussing the potentially poor predictive validity of mate preferences. The implicit measures assess the implicit association between the partner and the measurable traits. The implicit association can be measured, for example, by go/no go test (Nosek & Banaji, 2001). The test measures by reaction time how strong the implicit importance of physical attractiveness is for the participants. For example, if the participants move faster to compatible blocks (e.g., attractive ice cream) than incompatible blocks (e.g., attractive dumpster), it is implied that the participant has stronger unconscious associations between physical attractiveness and positive objects (ice cream) than negative objects (dumpster). Meanwhile, the participants also have to refrain from reacting to other traits than the synonyms of physical attractiveness. The associations measured implicitly are usually only weakly associated with explicit measures and their use needs careful planning and precision (Greenwald et al., 2009; Williams & Kaufman, 2012). Thus, these results are not unambiguous and need thorough consideration. Research found that while the explicit measures predicted only the abstract scenario of interest in photographs, the implicit measures did predict the interest in speed-dating partners (Eastwick, Eagly, et al., 2011). Another approach we may rightfully categorize as implicit is to take neuroimaging measures, e.g., fMRI, combined with implicit and explicit measures in assessing the preference for attractive faces (e.g., Aharon et al., 2001). Other physiological measures, such as electrodermal activity, blood pressure, pulse, or respiration can also be considered when choosing unconscious measures.

2.5.2.6 Difference scores

Difference scores seem an obvious interest when testing how relationship satisfaction is associated with the difference between the ideal and actual partners (or the difference between the male and female scores if testing the effect of homogamy on relationship satisfaction). While the mere subtraction of the ideal and the actual partners' scores may give an intuitively straightforward picture of the discrepancy between the two constructs, in fact, the difference does not necessarily tell everything about their congruence (Edwards, 2001). For example, the difference score does not control for the original levels of the components. Using difference score functions as only expecting an effect of the absolute difference. Meanwhile, in reality, small discrepancy might have different implications if both have high original scores versus if both have low original scores. That is, for example, if both partners have low status versus both of them have high status, both of these scenarios result in low discrepancy scores not accounting for the level differences

between these two couples. Meanwhile, our intuition would suggest these two couples have differential relationship outcomes. Hence, using difference scores without establishing evidence that it does not constrain the model into a shape that is not confirmed (e.g., linear) is advised against (Edwards, 2001, cf. section 2.5.2.7).

2.5.2.7 Response surface analysis

Finally, response surface analysis is an alternative method of simple difference scores (cf. Humberg, Nestler, & Back, 2019). Response surface analysis controls for the problems of difference scores and offers an easy to interpret analytical approach to investigate whether a similarity effect can be observed. That is, the relationship outcome is the highest if, and only if, there is perfect similarity between the couples (or between the ideal and actual partner ratings). Neither of the other options suggests a congruence effect. Thus, one first needs to investigate whether the calculation of simple discrepancy (or Euclidean distance) does not lead to information loss with first conducting response surface analysis (Edwards, 2001). In practice, response surface analysis is the prediction of a relationship outcome with at least two components (e.g., ideal and actual partner; or male and female partner in a couple) whose congruence effect we are interested in. An interaction term is also included in the equation together with the components' polynomials (e.g., squared, but could also be cubic). The equation will thus be: relationship satisfaction = intercept + b1*ideal partner + b2*actual partner + b3*ideal*actual partner + b4*ideal*ideal partner + b5*actual*actual partner. With visual illustration and statistical assessment of the regression coefficients, it is possible to infer the congruence effect. That is, when there is congruence, the relationship outcome increases if the ideal and actual partner ratings are closer to each other (i.e., similarity effect). For a detailed guide of the interpretation of the various kinds of response surfaces possible to receive, see Humberg, Nestler, and Back (2019). See as an example Lee and colleagues (2014) predicting the perceived attractiveness of manipulated online dating profiles by facial attractiveness, facial masculinity/femininity, and perceived intelligence using response surface analysis.

A special marriage of response surface analysis and actor-partner interdependence model is dyadic response surface analysis (Schönbrodt, Humberg, & Nestler, 2018). With this improvement, while testing the congruence effect, it is possible to simultaneously predict differential outcomes for the two members of the dyad (e.g., positive effect of couples' similarity on women's satisfaction as opposed to null effect on men's satisfaction). Overall, the response surface analysis has numerous advantages over any of the previous methods, however, when testing more than two predictors' congruence, the equation tends to become complex with the inclusion of the multiple terms in the equation. This may cause problems of low statistical power (Edwards, 1993).

Lastly, as mentioned in section 1.1.3, during the planning of the study, one has to make sure to measure the desired constructs to be able to perform certain analyses. For example, to compare the ideal and the actual partner in the multidimensional space, the ideal level of the characteristic should be recorded instead of the importance of the characteristic in an ideal partner. The importance measure, however, could be used for the interaction studies, or the Weighted (e.g., Additive or Euclidean) models. Perhaps the most conservative strategy is to measure the ideal level, as it can be used for both purposes. On a general note, it is important to conclude here that all the above listed approaches have their advantages and disadvantages. It is not possible in every study to perform all these

tests. For example, the approach will differ if there is only one comparable characteristic as opposed to when there is a complete profile to compare the ideal and actual partners or couples to test couples' similarity. It is crucial, though, to be aware of the options before conducting the study, as well as their potential flaws. When possible, it is desirable to report results with multiple approaches for transparency. Further, as is it presented, there is a large variation in the approaches, both in predicting relationship satisfaction by mate preference fulfilment and by couples' similarity. This is one of the sources of the inconclusive results. Researchers need to discuss and keep in mind the drawbacks of each approach as statistical analyses evolve. The future of psychological science is to conduct rigorous meta-analyses, learn from previous research, and synthetize the growing amount of knowledge that scientists gather.

Future directions

The above reviewed research offers numerous important questions in studying human mate choice which have remained open. The first part of the above introduction mainly focused on the mate preference factors while the second part concentrated on the synthesis of these factors into mate choice. Human mating is one great success story of evolutionary psychology (Goetz, Pillsworth, Buss, & Conroy-Beam, 2019; Miller & Todd, 1998). Interestingly, though, while evolutionary scientists have studied it since the 1980s, we still cannot predict mate choice with certainty. Future research solving some of the following knowledge gaps will help us closer to understand human mating.

A pivotal part of mate choice research is the measurement of mate preferences. Without proper measures and a well-considered approach, researchers may never be sure how to interpret their findings. Unfortunately, there are a lot of ambiguous measures of mate preferences which were developed by various methods and approaches (Csajbók & Berkics, 2017). The field needs new scales which are more generalizable, especially across cultures. Some results suggest that individuals in the Eastern cultures have a different approach to mate choice than Western individuals, however, as we have seen, there are many non-universal factors in mate choice which are very difficult to compare (e.g., 'Filial piety'). I suggest that more efforts should be made to develop a reliable factor structure that could function as an international standard – analogous to Big Five.

Perhaps this would be of help to measure mate value more adequately as well. Mate choice research desperately needs a reliable understanding of mate value. So far even a true insight into its components is missing, in addition, other conceptual ambiguities even complicate its usage. Researchers should be aware of the differential approaches to mate value measurement, such as holistic versus dimensional, as well as self-perceived versus others-perceived. This conceptual clarity would make great advancement in research using mate value; however, theoretical development is also much needed in better defining and structuring the concept of mate value.

Further, the ontogeny of mate preferences offers various potentials for future research. Currently, we know only little about which preferences emerge when during human maturation. Neither do we have evidence yet about the development of self-perceived mate value, even though many theories suggest it develops during adolescence. Testing more of the underlying theories might help us relate and predict adult mate choice. For example, some imprinting-like effects were shown in humans, too, which indicate parent-

similar mate preferences (see Štěrbová & Valentová, 2012). Another mechanism involved might be the heritability of mate preferences as an adaptive strategy (e.g., Zietsch, Verweij, & Burri, 2012). Meanwhile, parental influence, long time studied in Eastern cultures but less understood in Western societies, should complement future research (e.g., Apostolou, 2010). Surprisingly, though, these effects received only little attention yet.

Perhaps one of the most mysterious topics of human mating is the actual act of mate choice, the decision itself emerging in the human mind. Speed-dating studies aim to capture this moment, however, they may perhaps be too artificial and have somewhat low success rates (e.g., 4-7% in Asendorpf, Penke, & Back, 2011). To overcome this, Sparks and colleagues online measured the participants' unique, actual ideals a week before the date, but this situation probably did not call yet the 'gut feeling', low-construal level process of the dating procedure, hence they did not find sufficient predictive validity of the pre-recorded preferences (Sparks et al., in press). As Eastwick and colleagues suggested (2014), the ideal partner rating beforehand is produced on the abstract level, but the individuals probably switch to a different work mode during the date. Thus, data collected in this mental state would give incredibly valuable insight into this mental process. I propose that intensive longitudinal methods should be applied to complement speed dating studies. For example, regular logging of the various aspects of the mate choice decision before, during, and after the speed dating until the decision is made should help to identify the actual partner characteristics which were considered in the decision. The initial phase of the relationship would also need closer monitoring. As it was shown, individuals seem to change their mate preferences in the early phase of the relationship, but we are yet to know more about this mechanism. At least the first month would be crucial in such an intensive follow-up, preferably from both parties of the emerging relationship.

Further, advancements in implicit measurements should improve our knowledge on human mate choice. Neuroimaging studies have yet to be directly included in mate preference theories, however, there are multiple studies already published to consider. The neurological background of the perception of attractiveness and trustworthiness offers a promising opportunity to formulate new hypotheses. Future research could investigate, for example, why certain brain areas are active or overlapping during these tests, and how we can translate these into our findings with traditional questionnaire techniques (e.g., Aharon et al., 2001; Anders et al., 2016; Bzdok et al., 2011).

Additionally, testing mate choice models has become the new focus of mate choice research. One of the most well-studied mate choice models is assortative mate choice and it still has multiple open questions. Perhaps its most important question is no longer whether there is homogamy, instead, which mechanisms are leading to it. Probably more than one process is involved and soon we will see an integrative model that incorporates how the chain of multiple effects results in couples' similarity. I find especially interesting Luo's (2017) suggestions about the absolute value factors in similarity which are traded between the partners. If there are indeed absolute values in the mate choice process, such as 'my status for your attractiveness', it would be of great importance for other fields as well, such as mate value research. There are yet to be more studies directly addressing this question, such as the 'potentials-attract' effect, or the 'sugar relationships', i.e., transactional relationship (see Birkás et al., 2020; Buston & Emlen, 2003, He et al., 2013).

Lastly, mate choice integration models are perhaps the most prolific advances in mate choice research. Still, a lot is unknown. Multiple integration algorithms are imaginable and yet to be tested, as well as further replication studies and ecologically valid, prospective study designs are very much needed. Apart from the mathematical models, theoretical advancements explaining the underlying mental procedure of the overall partner perception and evaluation are also missing from the field. While the phenomenological approach and Gestalt psychology are well-established perspectives, mate choice psychology have not yet incorporated these theoretical angles. Currently, only few attempts have been published which directly theorize on how the mental synthesis of the overall partner perception is performed (e.g., Ledgerwood et al., 2018). It can be suspected that mate choice integration algorithms will need a theoretical background of the mental processes involved. Once, this may well be the most complex and awaited result of mate choice research.

Conclusions

In summary, the evolutionary perspective on human mate choice offers an incredibly profitable approach for scientists. Theories on the sex differences in parental investment and sexual strategies ever since their publication are still applicable guidelines of mate choice research. Studies investigating mate preferences give supporting evidence of the above theories. When studying the most important negative and positive traits of the potential partners, humans have adaptive preferences to guide their mate choice. However, there is still surprisingly a lot of ambiguity around the most important factors of mate preferences and how they are affected by cultural and methodological variation (see our published research paper in section 3.1: Csajbók & Berkics, 2017). Moreover, the dealbreakers, i.e., the avoidable traits of mate preferences, are an especially understudied field in mate choice research. We do not know much either about how the positive and negative traits complement each other in the mate choice context. Although some experience from social psychology suggests that negative traits weigh disproportionally stronger when compared to the positive ones. Stability of mate preferences across different age groups and retest measurements was also considered. Evidence suggests some stability of preferences over time but conducting more prospective studies is much needed to have a more detailed and accurate picture. Most importantly, however, preferences seem to be adjusted after the individuals enter a relationship. They do so, according to the Ideal Standards Model, to decrease cognitive dissonance stemming from the mate choice decision (see our published research paper in section 3.2: Kučerová, Csajbók, & Havlíček, 2018).

Theories on differentiating self-perceived and others-perceived mate value were also discussed. Most importantly, the experiences during adolescence are hypothesized to be essential in learning the relative mate value. Mating offers and rejections teach the individuals their own desirability while helping to set achievable ideal standards. Research showed evidence that this self-perception of their own mate value does not entirely reflect the objective value on the mating market, it rather depends on social comparison and self-esteem. Interestingly, though, there is still only little known about the concept of mate value or how to measure it. Future research would greatly benefit from a structured mate value concept, but until then, researchers should attentively plan the use and measurement of mate value. Most importantly, self-perceived and others-

perceived mate value should be clearly differentiated, and the decision to use either holistic or distinct dimensional measures should also be discussed before applying them (see our published research paper in section 3.3: Csajbók, Havlíček, Demetrovics, & Berkics, 2019).

The second part of the above introduction reviews how the integration of mate preferences is expected by recent studies. Perhaps the most influential approach currently is the Euclidean distance measure, which has several times been shown to be the best model describing mate choice. However, studies also showed that humans prefer to avoid partners not reaching certain minimal thresholds of their preferences, which is not incorporated in the Euclidean model (see our research paper under review in section 3.4: Csajbók, Berkics, & Havlíček, under review). Further mate choice models need to be tested to have unambiguous results. Perhaps the most well-studied mate choice model is assortative mate choice, which, interestingly, has multiple open questions about the most plausible explanatory mechanisms. For example, it is unknown, whether and how much social proximity plays a role in couples' similarity, or how much the couples converge to similarity over time. Unequivocal results would also be needed in understanding how exactly couples' similarity improves their relationship quality. Lastly, research investigating the predictive validity of mate preferences proposed that the differential relationship stages need differential study approach. That is, during mate preference studies, predominantly abstract, conceptual personal theories are measured, however, these are difficult to translate into the gut level, emotionally intensive actual mate choice decisions. Nevertheless, this field also showed considerable variation in the testing approach, similarly to studies testing assortative mating. It is imaginable that this large methodological diversity leads to ambiguous results, thus researchers should be more aware of the benefits and disadvantages of each approach.

Finally, mate choice integration algorithms received a lot of attention recently, and it can be expected that due to this, multiple advances will be introduced to mate choice research. We can hope that this innovative approach will revolutionize mate choice research, and it will better the study designs which are currently used in the field. Apart from the introduction of new mathematical integration methods, however, some theoretical advancements are also needed to understand the mental synthesis of mate preferences. We still know very little about how mate preferences, together with all the individual experiences and gut feelings, are translated in the human mind into the actual mate choice. Understanding this procedure will be the most prosperous advancement in the psychological research of human mate choice.

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Part III: Published studies

3.1 Csajbók & Berkics, 2017

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Factor, factor, on the whole, who's the best fitting of all?☆,☆☆ Factors of mate preferences in a large sample

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ABSTRACT

The goal of the studies reported here was first to explore and confirm a factor structure of evaluations of actual and ideal partners as well as oneself, then validate the factors by testing classic hypotheses from evolutionary psychology on the factor means, and finally, to use the factors to predict self-perceived mate value and relationship satisfaction. Partner characteristics were empirically collected with open-ended questions and then rated by two large samples for actual and ideal partners as well as the self. Participants also filled in measures of self-perceived mate value and relationship satisfaction. A structure of seven correlated, first-order factors was confirmed by CFA. Factor means across sex and context were in line with evolutionary theories and previous findings about sex and context differences. Self-perceived mate value and relationship satisfaction were both predicted by factors of ratings in the respective context. However, different models emerged for mate value and satisfaction, respectively. While people evaluate actual and ideal partners as well as themselves as partners along the same factors, between-sex differences can be observed, and self-perception of mate value and relationship satisfaction seem to depend on different factors. Methodological and theoretical implications are elaborated.

1. Introduction

Replication might be a bad idea for broken-up intimate relationships but a good one for scientific research. Especially for a topic like along what factors people evaluate actual and ideal partners, on which various studies have been done with inconsistent methods and results. The current 'replication crisis' in psychology (e.g., Open Science Collaboration, 2015) may serve as a caveat to previous research, particularly when it was done in a different cultural and linguistic context than yours.

A systematic and critical overview of 23 studies on the factors of mate preferences (see below and in the Supplementary material) reveals considerable variability concerning the results and the methods, including instruments as well as data analysis. Work by Garth O. Fletcher and his colleagues (e.g., Fletcher, Simpson, Thomas, & Giles, 1999) stands out of this literature because of its methodology (empirically generated items and confirmatory factor analysis) and because it was replicated several times. However, most of these replications used Anglo-Saxon samples (from New Zealand and the USA, respectively), and one must also consider that several other studies exist on this topic with different approaches.

While evolutionary psychology suggests that there are some universals as to what traits, characteristics, and dimensions people consider when they evaluate potential, actual, and ideal partners (Buss, 1998; Buss & Schmitt, 1993), there may be cultural and linguistic differences pertaining not only to the importance of these dimensions but their content as well (cf., Confer et al., 2010). This paper reports studies of mate preferences in a cultural and linguistic context, Hungary, from where such research has never been published before.

1.1. (Mis)measuring mate preferences

For three decades researchers have been trying to reveal the main dimensions of mating decisions by reducing mating-relevant characteristics with factor analysis. By asking participants to score the importance of partner traits, a decision making pattern can emerge that gives information about the ideals of mating. Although there are a large number of studies that deal with the underlying structure of mating decisions, the results as well as the methodological solutions are somewhat inconsistent, thus it is difficult to agree on the number of factors (e.g., Jonason, Webster, & Gesselman, 2013; Penke, Todd, Lenton, & Fasolo, 2007).

Different researchers used diverse contexts of measurement, e.g., some asked about long-term ideals (e.g., Buss & Barnes, 1986; Fletcher

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et al., 1999), some asked about otherwise unspecified 'romantic partners' (Simpson & Gangestad, 1992), others specifically about potential/probable marriage partners (Parmer, 1998; Shackelford, Schmitt, & Buss, 2005) or future spouses (Boxer, 2012), while some asked about the desirability of various characteristics (Furnham, 2009; Schwarz & Hassebrauck, 2012). Only a few articles did explicitly measure short-term preferences besides long-term ideals (Fletcher, Tither, O'Loughlin, Friesen, & Overall, 2004; Jonason et al., 2013; Regan, Levin, Sprecher, Christopher, & Cate, 2000; Rowatt, DeLue, Strickhouser, & Gonzalez, 2001), although it is widely accepted that short-term ideals differ from long-term preferences (Buss & Schmitt, 1993).

Another inconsistency concerns the construction of measurement instruments and the inclusion of items therein. Trait items were sometimes empirically developed (e.g., Fletcher et al., 1999), sometimes taken from previous research by others (e.g., Shackelford et al., 2005, took their 18 traits from a study done 60 years before by Hill, 1945). In some cases, the list was completed or developed based on theoretical considerations (e.g., Ellis, Simpson, & Campbell, 2002; Katsena & Dimdins, 2015). Sometimes the source or the process of item generation was not specified (e.g., Furnham, 2009), but there is also a case when even the rated items were not published (Gerdvilyte & Abhyankar, 2010). Instead of using items based on theory or taken from previous studies, empirically collected trait-lists may be more ecologically valid. Such items are easier for the participants to evaluate, since they are generated in the same cultural and temporal context, do not sound artificial (e.g., 'emotional intelligence', Furnham, 2009; 'normality', Neto, da Conceição Pinto, & Furnham, 2012), and do not contain professional language (e.g., 'resilience', Neto et al., 2012).

In some cases, sample sizes and the inclusion criteria of participants were also problematic. Some studies, especially the earlier ones had small samples either in absolute terms (e.g., Goodwin & Tang, 1991; Kenrick, Sadalla, Groth, & Trost, 1990) or relative to the number of items submitted to factor analysis (Buss & Barnes, 1986). Most of the samples consisted of university students, moreover, some of the studies did not consider or mention sexual orientation (e.g., Boxer, 2012), and thus their samples may contain non-heterosexual participants, although it is unclear how sexual orientation relates to the factor structure. In some studies, responses from cultures as different as the UK/US and China were pooled for analysis (Goodwin & Tang, 1991; Kline & Zhang, 2009).

Data analytical methods ranged from principal component analysis (PCA) with varimax rotation (especially in earlier studies, e.g., Kenrick et al., 1990, but even as late as Schwarz & Hassebrauck, 2012) to exploratory factor analysis (EFA) with either orthogonal or oblique rotations to confirmatory factor analysis (CFA; since Fletcher et al., 1999; see also Fletcher, Kerr, Li, & Valentine, 2014; Overall, Fletcher, & Simpson, 2006). For example, Katsena and Dimdins (2015) used principal axis factoring (PAF) with oblique rotation before proceeding to CFA; while Neto et al., 2012 used PAF with varimax rotation and no CFA. The number of the underlying factors was identified in various ways: sometimes based on the eigenvalues (e.g., Buss & Barnes, 1986), sometimes by parallel analysis (e.g., Atari & Jamali, 2016), and in less than half of the papers by CFA (e.g., Katsena & Dimdins, 2015). Some of the studies used parcelling on the items while performing CFA (e.g., Fletcher et al., 1999; Katsena & Dimdins, 2015), although parcelling is only reasonable in exceptional cases when the parcelled traits are a unidimensional phenomenon (cf., Little, Cunningham, Shahar, & Widaman, 2002). Factor labels were equivocal and diverse, varying from unidimensional one-word expressions to bipolar and complicated labels (e.g., Fletcher, Boyes, Overall, & Kavanagh, 2006; Shackelford et al., 2005).

Perhaps the most serious problem with some of the reported articles was the lack of essential details concerning the analysis or the investigation, e.g., the variance explained by PCA or exploratory factor analysis (EFA; e.g., Kenrick et al., 1990; Regan et al., 2000); the type of analysis or rotation (e.g., Parmer, 1998); or the extracted traits (Gerdvilyte & Abhyankar, 2010). Besides, of the 23 journal articles reviewed here, only nine used CFA to test their models of the factor structure of mate preferences. (See a structured and systematically tabulated overview in the Supplementary material.)

1.2. Overview of current research

The present study had two major goals. First, we wanted to see along which factors people rate actual and ideal partners. In this sense, this was a conceptual replication of several earlier studies, especially the one by Fletcher et al. (1999). The second goal was to see how these ratings differed across sex and context (long- vs short-term), how they correlated with relationship satisfaction, and how with the self-perception of mate value. Regarding the differences across sex and context, these are predicted by evolutionary theories (Buss & Schmitt, 1993; Trivers, 1972). The linkage between partner ratings and relationship satisfaction is predicted by the Ideal Standards Model (Fletcher et al., 1999). Concerning the self-perception of mate value, since our participants also rated themselves on the same traits, a measure of general mate value (the Mate Value Scale, MVS; Edlund & Sagarin, 2014) was also expected to correlate with the factors of self-ratings.

To achieve the goals above, a Hungarian questionnaire was needed to measure partner evaluations. Since the composition of the item list may have a substantial influence on the resulting factor structure, items have to be selected carefully. If items are added on a theoretical basis, they may yield factors which are actually not that important for people when they evaluate prospective or actual partners. Theoretically constructed item lists, on the other hand, may also omit characteristics which could reflect important factors of mate preferences, but, as they are omitted, they do not even have a chance to be represented in the factor structure. Simply translating an existing trait list may also cause such problems. Thus, Study 1 was performed to empirically collect characteristics along which people could evaluate actual and ideal partners.

In Study 2, participants rated actual and ideal partners as well as themselves on the traits collected. Using a relatively large sample ($N = 634$) and, as a within-subject variable, four different rating contexts (actual partner, oneself, ideal long-term partner, ideal short-term partner) we could establish a factor structure of mate preferences which, with its seven correlated first-order factors was reliable across sex and context.

Although the fit of the factor model to the data was tested by CFA, Study 2 had still been exploratory in nature, and many of the items in the original list had to be discarded. Therefore, Study 3 was performed to replicate the findings on an independent, even larger sample ($N = 1545$). Good fit indices supported the model established in the previous study.

Finally, the samples of Studies 2 and 3 were pooled to conduct further analyses, which had two goals. First, we tested long-standing evolutionary hypotheses about sex differences in mate preferences across long- vs short-term contexts (Buss & Schmitt, 1993). Second, regression analyses were performed to see how partner ratings in different factors contribute to relationship satisfaction and how self-ratings on the same factors predict self-perceived mate value. Before proceeding to these analyses, measurement invariance was tested for, with scalar equivalence established across sex, metric across the four contexts, and partial scalar invariance across long- vs short-term ideal ratings.

2. Study 1

The goal of Study 1 was to determine a list of important and relevant characteristics along which people discriminate potential relationship partners in long- and short-term contexts. Laypeople's expressions were collected without any theoretical bias. In this section, we adopted and expanded the methodology of Fletcher and his colleagues with adding a further relationship context (Fletcher et al., 1999).

2.1. Method

2.1.1. Participants

Participants were collected by convenience sampling through the Internet. Sixty Hungarian, heterosexual respondents completed the questionnaire (26 men and 34 women). Mean age was 29.12 years (SD = 10.81) ranging from 18 to 58 years. Only 4 people with a degree in psychology and 6 students of psychology were among the respondents, thus the sample is not overly biased in this respect.

2.1.2. Instruments and procedure

Participants answered two open-ended questions in random order. They had to imagine the ideal partner either in a short- or a long-term relationship. They had to describe the ideal partner's most important characteristics with words or expressions. Responses were collected anonymously via an online survey that contained information about the aim of the study and their task. After giving their informed consent, participants could answer the open ended questions by typing in a textbox without any time or space limitation. Anyone could quit the survey without any explanation.

2.2. Results and discussion

After selecting the expressions independently and coding synonyms or similar phrases in different grammatical forms we gained two overlapping lists of the characteristics from the two tasks. Items which were mentioned at least by two people were included so the primary list consisted of 65 long-term partner and 42 short-term partner characteristics. The number of short-term characteristics was smaller partly because 11 participants (six female) expressed a lack of interest in short-term relationships. Sixty-three items were selected for the final trait list according to the following criteria.

First, all items were excluded which implied the similarity between the partners or the shared activities (e.g., hobbies, friends, decisions, plans), since, although these are very important, they are also too subjective and imply the relationship quality rather than the partner's attributes. Items were also excluded if they had ambiguous and vague meanings (e.g., crazy, interesting, feminine/masculine) or if they were not neutral considering sex (e.g., muscular, strong, tall). Since sex-specific items were related to physical appearance anyway, we expected that more general and neutral items (e.g., 'has a good body') would represent these considerations in the final item pool. Items implying the partner's attitude towards the respondents (e.g., knows me, respects me, considers me attractive) were also excluded because they are more descriptive of the relationship than the person. Words with foreign origins were included only if Hungarian forms also existed (e.g., compromise, discrete) but emotional intelligence was excluded due to its complicated and divergent meanings. Thus, Study 1 yielded a list of trait words and expressions which could be used as items in a closed ended questionnaire in Study 2. (See the complete list in the Supplementary material.)

3. Study 2

The goal of Study 2 was to establish the empirical factor-structure for the 63 characteristics. Ratings were obtained in different contexts (actual and ideal partners as well as oneself), but, in line with previous research inspired by the Ideal Standards Model (e.g., Fletcher et al., 2014), we aimed at a common factor structure explaining the ratings in all contexts. We predicted that at least 3 factors will emerge: *warmth*, *physical appearance* and *status*, also found by the aforementioned studies (e.g., Fletcher et al., 1999). Whether other factors such as *dominance* and *intelligence* would emerge was a question left open.

3.1. Method

3.1.1. Participants and procedure

Respondents were reached through the Internet, via social media websites, forums, university groups and a boosted Facebook post, resulting in a convenience sample of 634 (414 female) heterosexual, Hungarian participants in their reproductive age (18 to 45 years; mean age was 26.47 years; SD = 5.97). Four hundred and five participants reported to be currently in a relationship. A majority (78.9%) of the participants were either having or studying for a degree. Among all the respondents there were 79 psychologists and psychology students (12.46%).

After giving their consent and providing demographic information, all 634 participants rated their actual partners, themselves, and their long-term ideal partners along the 63 traits. After this, they were asked if they were considering to have any short-term relationship and if they felt like continuing the survey. Agreeing participants (95 males and 109 females) continued with the optional part of the questionnaire and rated short-term partner ideals along the same 63 traits. During this procedure, there was no time limit and anyone could quit the survey without any explanation.

A possible concern about letting participants opt-out of short-term ideal ratings is that these ratings may then be biased, i.e., since they are given by only those participants interested in short-term mating, they are probably different from what they would be like if we asked every participant to rate the short-term ideal partner. However, forcing participants to give such ratings in an otherwise already lengthy questionnaire would not only have been frustrating to those firmly disinterested in short-term mating, it would also have put them into a paradoxical situation of having to consider their ideals of something they apparently do not want. Thus, asking these questions of each participant could have yielded data of questionable validity, eliminating the aforementioned bias at the cost of introducing another. Besides, as we wanted to find a factor structure that could be generalized across sex and context, the hypothesized structure was fitted to the data separately in each context anyway.

3.1.2. Instruments

Participants rated three different social objects along the 63 traits: their actual partner (or the most recent one if they currently had none), themselves, and an ideal long-term partner. They were also given the option to continue with the same trait list about the ideal short-term partner. The questions preceding each social object (hence referred to as context) were as follows:

1. How much do you think these characteristics describe your CURRENT or most RECENT partner?
2. How much do you think these characteristics describe YOURSELF?
3. How important do you consider these characteristics in your IDEAL LONG-TERM PARTNER?

The final, optional section:

4. How important do you consider these characteristics in your IDEAL SHORT-TERM PARTNER?

The 63 traits were those having emerged as a result of Study 1, and they were rated from 1 to 7 on a Likert scale in random order.

Before the actual partner ratings participants also filled in an 8-item version of the Relationship Assessment Scale (RAS; Hendrick, 1988). After the partner ideal ratings (but before they were asked if they wanted to continue with the short-term ideals) they filled in the 4-item Mate Value Scale (MVS; Edlund & Sagarin, 2014). These instruments will be reviewed in the combined samples analyses.

3.1.3. Data analysis

The four contexts of the survey are considered to be four aspects of mating standards, therefore, we pooled them in one big database to be

able to extract a shared, common factor structure across the four contexts. Before pooling, responses were standardized within each context to prevent the factor structure from being biased by between-context differences in mean ratings. We wanted the factor structure to be based on 'genuine' correlations, i.e., such that can be observed within the different contexts. If two items are uncorrelated within any context, but have different means in different contexts (e.g., the ideal partner is rated higher than the self on both), then, if unstandardized, such items may be correlated in the pooled data, influencing the factor structure without actually reflecting a genuine relationship between the two traits.

After pooling, we had 2106 cases: 634 each for the partner, self, and long-term ideal ratings, and 204 for the short-term ideal ratings. Cases were weighted to address imbalances regarding sex ratio and the lower number of participants opting to rate the ideal short-term partner as well.

On the standardized, pooled and weighted data exploratory factor analyses were performed. Due to the non-normal distribution of numerous ratings, principal axis factoring was used instead of maximum likelihood. Rotation was promax (oblique) to allow the factors to be correlated. EFA was conducted with SPSS 22. After dropping problematic (e.g., low-loading and cross-loading) items, the most promising solutions were submitted to confirmatory factor analysis. The hypothesized factor structures were fitted both to the pooled (but unstandardized and unweighted) data, and then separately for the two sexes and each of the four contexts. Due to the non-normality of the distribution of several ratings, MLR estimator was used. CFA was performed with Mplus 6.

3.2. Results

Eigenvalues and scree plots in exploratory factor analyses indicated that five to eleven factors could be retained. We extended our analyses, however, to three- and four-factor solutions, considering that the Ideal Standards Model is based on only three factors (Fletcher et al., 1999, 2014). Solutions with more than seven factors could be excluded because they either could not produce a clean model meeting the usual requirements for EFA (i.e., items loading high on one factor; no cross-loadings; interpretable structure – see e.g., Brown, 2006), or had poor fit in CFA.

Solutions with three to six factors all provided meaningful structures, but a pattern emerging between the various solutions suggested that the seven-factor structure be the most meaningful. Specifically, the three-factor solution was conceptually the same as the one suggested by Fletcher et al. (1999; warmth, attractiveness, and status), but at the cost of having to discard a number of items. As the number of factors to extract was increased, new factors emerged explaining some of the previously discarded items and leaving the factors from the previous solutions practically intact.

The final model presented here is one of seven correlated factors and 22 indicators. The seven factors were labelled as warmth, stability, physical appearance, passion, status, intellect, and dominance. The factors with indicators and loadings can be seen in Fig. 1, factor correlations can be seen in Table 1.

The original pool of 63 items was reduced on four criteria. Items were discarded if they had (1) low loadings on all factors, or (2) cross-loadings, as well as in case of (3) extremely high inter-item correlations (in particular, r = .85 for 'good job' and 'good salary'; the latter was discarded). Finally, (4) to keep the number of indicators per factor about equal, a dozen items were discarded from the first factor (warmth), which originally had the highest number of items, as many of the characteristics listed by the participants of Study 1 were related to this dimension. For this factor, four high-loading items were kept which represented the underlying dimension (i.e., of items with a similar content, e.g., 'loving' and 'kind' or 'nurturing' and 'caring' we selected only one). The model was then fitted to the pooled data, then to data from female or male participants separately, and then finally to each of the four different contexts.

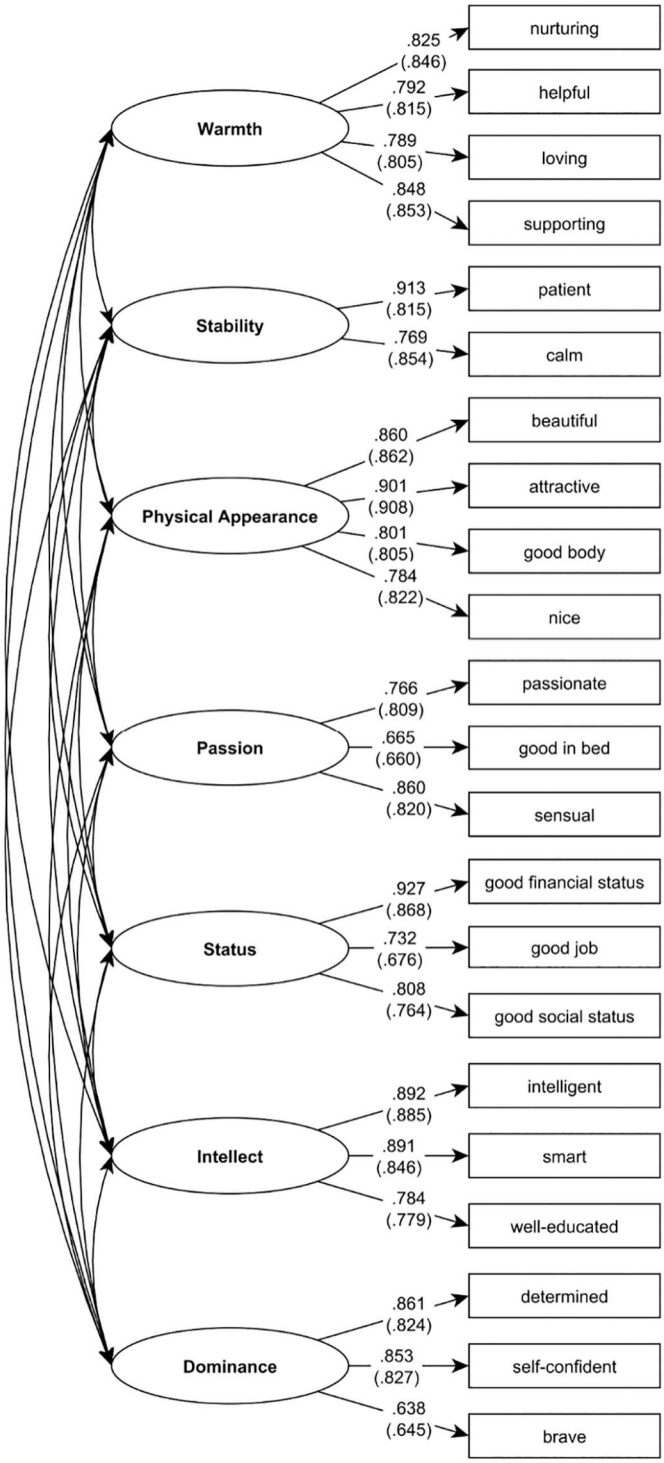

Fig. 1. Confirmatory factor analysis in the original (Study 2) and (in brackets) the replication (Study 3) sample. All the factor loadings are standardized and significant ($p < .01$).

The model had a good fit to the data: on the 2106 pooled cases, $\chi^2(188) = 975.959$, RMSEA = .045 (.042–.047), CFI = .960, TLI = .951. Fit indices were also good or at least acceptable when the two sexes and the four contexts were analysed separately (see Table 2). At this stage, only a configural model was tested, since the sample size of participants interested in short-term partners was low (109 women and 95 men). Measurement invariance across sex and context was tested on the combined samples of Studies 2 and 3.

Table 1
Inter-factor correlations in the 7-factor model.

Factor	1.	2.	3.	4.	5.	6.	7.
1. Warmth	***.886/.898***	*.584*	*.126*	*.445*	*.324*	*.586*	*.369*
2. Stability	.597	***.825/.821***	*.136*	*.276*	*.254*	*.409*	*.356*
3. Physical appearance	.077	.081	***.901/.910***	*.512*	*.361*	*.342*	*.344*
4. Passion	.355	.248	.559	***.804/.802***	*.251*	*.397*	*.506*
5. Status	.337	.195	.220	.181	***.854/.802***	*.464*	*.411*
6. Intellect	.568	.398	.243	.317	.417	***.887/.872***	*.509*
7. Dominance	.360	.350	.242	.486	.403	.441	***.820/.803***

Note. Find inter-factor correlations in Study 2 below the diagonal, and above in Study 3 in italic style. Cronbach alphas are put on the diagonal in boldface, results from the replication study are in italic and boldface as well.

The model was compared to several alternative models. Two alternative models (2a and 2b) included a second-order factor on which all the first-order factors loaded; in Model 2b, the error variances of the first-order factors warmth and stability as well as physical appearance and passion were freely estimated to covary, as these pairs of factors had high correlations in the first-order model and are conceptually related. Another alternative model (3) included two higher-order factors, appearance, passion, and dominance reflecting good genes, warmth and stability reflecting potentially high parental investment, while intellect and status were allowed to load on both (cf., Fletcher & Overall, 2007). Finally, in Models 4–6 we tested if the factor pairs warmth and stability, appearance and passion, or both could be substituted by a single factor. Model 1 of seven correlated first-order factors fit the data significantly better than any of the alternatives. Table 3 includes the alternative models and their fit indices in comparison to the seven-factor model on the pooled data.

3.3. Discussion

Study 2 yielded a model of seven correlated, first-order factors explaining how people evaluate actual and ideal partners as well as themselves. This is more than the three factors suggested by the Ideal Standards Model (Fletcher et al., 1999), but is rather an extension than a refutation of that model: five of the seven factors are conceptually equivalent or very similar to the three factors of ISM, warmth and stability corresponding to warmth-trustworthiness, physical appearance and passion corresponding to vitality-attractiveness, status corresponding to status-resources, while intellect and dominance emerged as conceptually new factors. The model had a good fit to the data and was based on characteristics actually listed as important in mating decisions by participants of a preceding study. However, Study 2 was still exploratory in nature, as its goal was to find a model rather than to test an a priori model, the model was found with reducing the number of items from 63 to 22, and CFA was used not only to test and confirm but also to establish and respecify the model. Therefore, a further, confirmatory study was needed.

4. Study 3

To confirm the seven-factor model, Study 3 was conducted as a replication with a shortened and revised trait list.

4.1. Method

4.1.1. Participants and procedure

Participants were collected via social media websites to fill in an online form, resulting in a convenience sample of 1545 (1293 female) heterosexual, Hungarian participants. Age range was identical to Study 2 (from 18 to 45 years), mean age was 23.56 years (SD = 5.26). Of the participants, 128 reported to be currently in a short-term relationship, 1157 reported to be in a long-term relationship. Regarding education, 1023 participants had or were studying for a degree (66.21%), with 74 studying psychology or being psychologists (4.79%).

Procedure and measures were identical to those in Study 2 except that to facilitate response rate, the trait list was shortened to 35 items. Besides the 22 traits from the model established in Study 2, a few other items were kept and new ones added to have some leeway for further analysis in case the replication failed, and to strengthen the factor of stability which had only two indicators. As the replication was successful, only one additional item ('peaceful' for the stability factor) was considered. All 1545 participants rated their actual or most recent partners, themselves, and their long-term ideal partners along the 35 traits, then 105 male and 313 female respondents volunteered to continue and rate short-term partner ideals as well.

4.1.2. Data analysis

As Study 3 was a replication of Study 2, the seven-factor model with 22 items was submitted to confirmatory factor analysis both with the ratings pooled across the four contexts and separately for each context and sex. Due to the non-normality of the distribution of several ratings, MLR estimator was used. CFAs were performed with Mplus 6.

4.2. Results and discussion

The seven-factor model with 22 items had a good fit to the data in the replication sample: on the 5053 pooled cases, $\chi^2(188) = 1620.603$, RMSEA = .039 (.037–.041), CFI = .965, TLI = .957, SRMR = .040. Fit indices were also good when the two sexes and the four contexts were analysed separately (see Table 4; for tests of measurement invariance, see analyses on the combined samples further below). Factor loadings and correlations can be seen in Fig. 1 and Table 1, respectively. By adding the item 'peaceful' to the model, the

Table 2
Fit of the seven-factor model in the original sample (N = 634).

Data	N[a]	χ^2	df	RMSEA, 90% CI	CFI	TLI	SRMR
Pooled across sexes and contexts	2106	975.959	188	.045 [.042, .047]	.960	.951	.044
Females (pooled contexts)	1351	628.543	188	.042 [.038, .045]	.962	.953	.043
Males (pooled contexts)	755	614.844	188	.055 [.050, .060]	.950	.938	.057
Partner	634	497.187	188	.051 [.046, .056]	.955	.945	.052
Self	634	459.374	188	.048 [.042, .053]	.951	.939	.048
Long ideal	634	399.287	188	.042 [.036, .048]	.960	.951	.046
Short ideal	204	302.064	188	.055 [.043, .066]	.941	.927	.067

[a] N of cases is higher than the number of participants for pooled analyses.

Table 3
Fit of the various models on 2106 pooled cases for 634 participants.

Model	χ^2	df	c[a]	$\Delta\chi^2$ (Δdf)	RMSEA, 90% CI	CFI	TLI	SRMR
1	975.959	188	1.289	–	.045 [.042, .047]	.960	.951	.044
2a	1662.400	202	1.294	656.186 (14)	.059 [.056, .061]	.926	.916	.085
2b	1228.421	200	1.294	241.666 (12)	.049 [.047, .052]	.948	.940	.059
3	1379.861	199	1.269	531.859 (11)	.053 [.050, .056]	.940	.931	.068
4	1721.771	194	1.294	668.478 (6)	.061 [.059, .064]	.923	.908	.052
5	2269.611	194	1.298	1068.319 (6)	.071 [.069, .074]	.895	.875	.079
6	3004.801	199	1.302	1740.485 (11)	.082 [.079, .084]	.858	.836	.084

Models:
1. Seven correlated, first-order factors.
2a. Seven first-order factors loading on a single second-order factor.
2b. Same as 2a, plus correlated error variances of warmth and stability as well as appearance and passion.
3. Seven first-order factors loading on two correlated higher order factors of genes and parental investment.
4. Six correlated, first-order factors (warmth and stability in a single factor).
5. Six correlated, first-order factors (appearance and passion in a single factor).
6. Five correlated, first-order factors (both pairs of related factors above replaced by single factors).
[a] Scaling correction factor for MLR. Comparisons were adjusted for MLR (Satorra, 2000).

'stability' factor could be complemented to have three indicators, with a standardized loading of 0.864 for this item and an alpha of 0.878 for the factor, with good model fit (on the 5053 pooled cases, $\chi^2(209) = 1804.536$, RMSEA = .039 (.037–.041), CFI = .964, TLI = .957, SRMR = .040).

Thus, Study 3 confirmed the factor structure from Study 2 on a larger sample, and showed that the single factor with only two indicators (stability) could be enhanced to a three-indicator factor by adding the item 'peaceful'.

5. Analyses on the combined samples

The convenience samples in Studies 2 and 3 were imbalanced in at least two ways. Across the two studies, only about 22% of the participants were males, and only about 28% of the participants elected to continue with short-term ideal ratings. By merging data from the two studies, we had large enough subsamples across all combinations of sex and context.

5.1. Goals, hypotheses, and questions

Samples from Studies 2 and 3 were merged to conduct further analyses with two goals. The first one was to validate the 7-factor structure by comparing long- and short-term ideals across sex and see if the results fall in line with previous findings and long-standing hypotheses of evolutionary psychology. Regarding main effect by context, rating dimensions related to high parental investment (i.e., the willingness or ability to invest in the offspring: warmth, stability, and status) were expected to be more important in the long-term context, while rating dimensions related to good genes (physical appearance and passion) were expected to be more important in a short-term context (see Buss, 1998; Buss & Schmitt, 1993; Fletcher & Overall, 2007). We did not have such hypotheses about intellect and dominance, as they may both reflect good genes and the ability to attain resources for high parental investment. Regarding main effect by sex, physical appearance was expected to be more important for males, status was expected to be more important for females, while there were no such hypotheses for the other five factors because previous research did not show consistent sex differences in them (see Buss, 1998; Buss & Schmitt, 1993; Fletcher et al., 2004; Katsena & Dimdins, 2015; Li & Kenrick, 2006).

Regarding sex-by-context interactions, a pattern consistent with evolutionary theories of human mating strategies was expected. As the biologically less investing sex, males are in general more interested in short-term relationships, which is a strategy emphasizing quantity over quality (Buss & Schmitt, 1993). To be able to approach a higher number of potential short-term partners, males tend to relax their standards when pursuing a short-term strategy (Buss, 1998), while females, as the biologically more investing sex, maintain relatively higher standards for short-term affairs as well (Buss & Schmitt, 1993), especially in trait dimensions related to good genes (see Simpson & LaPaglia, 2007). Therefore, it was expected that the sex-by-context interactions would be such that short-term ideals relative to long-term ones will be lower for males than for females, i.e., if the short-term mean is subtracted from the long-term one, the result will be a higher number for males than for females. Relatedly, it was also expected that a higher proportion of males than females would show interest in short-term relationships, i.e., to fill in the optional part of the questionnaire and give ratings to the short-term ideal.

The second goal of these analyses on the combined samples was to investigate how relationship satisfaction (as suggested by the Ideal Standards Model, e.g., Fletcher & Overall, 2007) and self-perceived mate value were predicted by ratings in the respective contexts along the seven factors. Specifically, we examined how partner ratings predicted relationship satisfaction and how self-ratings predicted mate value. A related question was whether a similar pattern of results would emerge from these two kinds of analyses. That is: do people consider themselves as partners along the same dimensions which members of the other sex find important in the long run?

Table 4
Fit of the seven-factor model in the replication sample (N = 1545).

Data	N[a]	χ^2	df	RMSEA, 90% CI	CFI	TLI	SRMR
Pooled across sex and context	5053	1620.603	188	.039 [.037, .041]	.965	.957	.040
Females (pooled contexts)	4192	1509.094	188	.041 [.039, .043]	.962	.953	.042
Males (pooled contexts)	861	427.614	188	.038 [.034, .043]	.966	.958	.052
Partner	1545	648.360	188	.040 [.036, .043]	.969	.962	.038
Self	1545	682.855	188	.041 [.038, .045]	.957	.948	.044
Long ideal	1545	453.609	188	.030 [.027, .034]	.976	.971	.033
Short ideal	418	281.335	188	.034 [.026, .043]	.972	.966	.050

[a] N of cases is higher than the number of participants for pooled analyses.

5.2. Method

5.2.1. Participants and procedure

The sample was created by merging samples from Studies 2 and 3, resulting in a convenience sample of 2179 participants (1707 women) with a mean age of 24.60 (SD = 5.91). More than two thirds of the participants studied in higher education or had a degree (1523 respondents in total, 69.89%), while 153 participants (7.02%) were psychology students or psychologists. Of the participants, 136 were currently involved in a short-term relationship, and 1553 reported to be in a long-term relationship. Short-term ideal ratings were obtained from 622 participants (422 female). See the procedure described in Studies 2 and 3. Data analyses were performed with SPSS 22 and Mplus 7.

5.2.2. Measures

5.2.2.1. Trait ratings. After testing for the measurement invariance across context and sex, factor means were calculated in all seven factors of the confirmed model, based on 22 items in each of the four contexts (actual or most recent partner, oneself, long-term ideal, short-term ideal).

5.2.2.2. Mate Value Scale (MVS). Mate Value Scale is a newly developed and very brief scale for measuring mate value of self or any other targets (Edlund & Sagarin, 2014). Its internal consistency has already been explored in a long-term context, but short-term implications are still unexplored due to its very recent publication. Its reliability was good in the current sample ($\alpha = 0.86$) and its one-factor structure was also supported by principal components analysis (specifically, by both the scree plot and the eigenvalues). A single factor explained 70.47% of the total variance.

5.2.2.3. Relationship Assessment Scale (RAS). Hendrick's Relationship Assessment Scale is a widely applied and easy to use, quick instrument that was found reliable across age, ethnic group and type of relationship (Hendrick, 1988; Martos, Sallay, Szabó, Lakatos, & Tóth-Vajna, 2014). It also predicts sexual malfunctions and abuse in relationships (Howard, O'Neill, & Travers, 2006; Naeem, Irfan, Zaidi, Kingdon, & Ayub, 2008). Therefore, it is a reasonable choice to measure relationship satisfaction. Martos et al. (2014) translated it into Hungarian and verified its one-factor structure but added an eighth item, therefore, the Hungarian version is one item longer than the English version.

In the current sample, internal consistency of the RAS was good ($\alpha = .88$). Principal components analysis also suggested a one-factor structure, a single factor accounting for 57.37% of the total variance.

5.3. Data analysis and results

5.3.1. Measurement invariance of the mating factors across context and sex

Before comparing partner ideals across context and sex, the factor structure was tested for measurement invariance (see Brown, 2006). Goodness-of-fit statistics are presented in Table 5. Scalar invariance was established across sex: although Chi Square differences were significant, the fit indices (CFI, TLI, RMSEA) diminished less than the recommended cut-off values (.010 for CFI and TLI; .015 for RMSEA; Chen, 2007). Regarding the four contexts, we did not expect much more than configural invariance, as the questions were different: about having the traits in the first two contexts, and about their importance in ideals. Still, even metric (but not scalar) invariance could be established. Since the comparisons involve ideals only, the factor structure was also tested for measurement invariance in only the two contexts of long- vs short-term ideals, showing metric but only approaching scalar invariance. Partial scalar invariance, though, could be established by relaxing the intercept of just one item ('has a good job'). Further concerns had to be addressed regarding possible differences between people who did or did not desire a short-term partner. The comparisons across context and sex involve only those who did, but their long-term ideals may not generalize to participants not interested in short-term mating. Thus, measurement invariance in long-term ideals was tested across participants interested vs not interested in short-term mating, yielding scalar invariance.

Mean differences in long-term ideals across people interested vs not interested in short-term partners were only significant for warmth and stability, but the differences were small (for warmth: $\eta_p^2 = .024$; for stability $\eta_p^2 = .015$), and were main effects only, i.e. in no case was there a significant interaction with sex. Therefore, we proceeded to compare long- and short-term ideals across sex.

5.3.2. Sex differences in long- and short-term ideals

As expected, a higher proportion (42.37%) of males than females (24.72%) declared interest in short-term relationships and took the option of rating short-term ideals. Sex differences in long- and short-term ideals were tested with seven two-way mixed ANOVAs on the means of the seven factors with sex and context as independent variables, and factor mean as the dependent variable. The item 'has a good job' was removed from the status factor, because measurement invariance between long- and short-term contexts was also established by relaxing the intercept of this item. Since context was a within-subject factor, the sample for this analysis included only those 622 participants (422 female) who also gave short-term ideal ratings. All the main effects and interactions were statistically significant, and all predictions were supported. Descriptive statistics are reported in Table 6. For the sake of brevity, only predicted effects will be treated in the text; see test statistics for all main effects and interactions in Table 7.

Regarding expected main effects by context, warmth ($F(1,620) = 902.39$, $p < .001$, $\eta_p^2 = .59$), stability ($F(1,620) = 349.12$, $p < .001$, $\eta_p^2 = .36$), and status ($F(1,620) = 87.31$, $p < .001$, $\eta_p^2 = 0.12$) were more important in long-term ideals, while physical appearance ($F(1,620) = 417.25$, $p < .001$, $\eta_p^2 = .40$) and passion ($F(1,620) = 126.73$, $p < .001$, $\eta_p^2 = .17$) were more important in short-term ones, just as predicted. Hypotheses regarding sex differences were also supported, physical appearance being more important for males ($F(1,620) = 38.51$, $p < .001$, $\eta_p^2 = .06$), and status for females ($F(1,620) = 68.27$, $p < .001$, $\eta_p^2 = .10$).

Sex-by-context interactions also showed the predicted pattern in all factors: short-term ideal standards relative to long-term ones were always lower for males than for females. That is, in factors which were more important in the long-term context (warmth, stability, status, intellect, and dominance), males relaxed their short-term ideal standards to a greater extent than females did. In factors which were more important in the short-term context (physical appearance and passion), a relative kind of 'relaxation' occurred: short-term ideal standards relative to long-term ones were not as high for males as for females. That is, in line with evolutionary theory on human mating strategies (Buss, 1998), females maintained relatively high standards for short-term partners as well.

5.3.3. Predictors of relationship satisfaction and self-perceived mate value

To assess the importance of more specific perceptions to general relationship satisfaction and mate value, respectively, the RAS mean score was regressed on the partner evaluations in the seven factors, while the MVS mean score was regressed on the self-evaluations in the seven factors. That is, two multivariate linear regressions were conducted with Enter method. Expecting different patterns for the two sexes based on previous research in evolutionary psychology (cf., Buss & Schmitt, 1993; Fletcher & Overall, 2007), we conducted regression analyses for the two sexes separately. Other variables (e.g., demographics or whether the relationship was current or terminated) were not included in the analysis, as they were considered part and parcel of relationship processes rather than confounding variables.

Multivariate linear regression with partner ratings as predictors yielded models explaining a high proportion of relationship satisfaction both for males ($F(7,464) = 120.37$, $p < .001$, adjusted $R^2 = .64$) and for

Table 5
Measurement invariance in the mating factors.

Model	χ^2 (df)	CFI	TLI	RMSEA	90% CI	$\Delta\chi^2$ (df)	ΔCFI	ΔTLI	ΔRMSEA
Sex invariance									
Configural	2575.097 (376)	.963	.955	.040	.039–.042				
Metric (loadings)	2649.138 (391)	.962	.955	.040	.039–.042	75.818 (15)	−.001	.000	.000
Scalar (intercepts)	2819.994 (406)	.960	.954	.041	.039–.042	195.795 (15)	−.002	−.001	.001
Context invariance									
Configural	2792.959 (752)	.965	.957	.039	.037–.040				
Metric (loadings)	3055.194 (797)	.962	.955	.040	.038–.041	254.130 (45)	−.003	−.002	.001
Scalar (intercepts)	4786.849 (842)	.933	.926	.051	.050–.053	2163.642 (45)	−.029	−.029	.011
Context invariance: long- vs short-term ideals									
Configural	706.233 (376)	.968	.960	.038	.033–.042				
Metric (loadings)	719.773 (391)	.968	.962	.037	.033–.041	15.394 (15)	.000	.002	−.001
Scalar (intercepts)	853.170 (406)	.956	.950	.042	.038–.046	164.549 (15)	−.012	−.012	.004
Scalar (partial)[a]	805.103(405)	.961	.955	.040	.036–.044	102.227 (14)	−.007	−.007	.003
Invariance of long-term ideals across people interested vs not interested in short-term partners									
Configural	839.126 (376)	.972	.966	.034	.031–.037				
Metric (loadings)	865.860 (391)	.971	.966	.033	.030–.036	27.351 (15)	−.001	.000	−.001
Scalar (intercepts)	887.532 (406)	.971	.967	.033	.030–.036	18.131 (15)	.000	.001	.000

[a] Partial scalar invariance was assessed by relaxing the intercept of one item ('has a good job') in the factor 'status'.

females ($F(7,1699) = 371.32$, $p < .001$, adjusted $R^2 = .60$). Significant predictors of men's relationship satisfaction in order of their standardized coefficients were the partner's passion ($\beta = .317$), warmth ($\beta = .242$), appearance ($\beta = .232$), stability ($\beta = .163$) and intellect ($\beta = .105$). Women's relationship satisfaction was predicted by the same factors but in a different order: warmth ($\beta = .397$), passion ($\beta = .253$), appearance ($\beta = .133$), intellect ($\beta = .110$) and stability ($\beta = .072$). For the correlation matrices and regression coefficients see Tables 8 and 9.

A similar multivariate linear regression with self-ratings as predictors yielded models explaining a moderate to high proportion of self-perceived mate value for males ($F(7,464) = 79.44$, $p < .001$, adjusted $R^2 = .54$), and for females ($F(7,1699) = 200.15$, $p < .001$, adjusted $R^2 = .45$). Significant predictors of men's self-perceived mate value were in order of their importance: self-ratings of appearance ($\beta = .518$), status ($\beta = .124$), passion ($\beta = .109$), dominance ($\beta = .106$) and intellect ($\beta = .081$). Women's perceptions of their mate value were significantly predicted by self-ratings of appearance ($\beta = .529$), passion ($\beta = .144$) and dominance ($\beta = .084$). See the correlation matrices and the coefficients in Tables 10 and 11.

5.4. Discussion

Partner preferences differed in every hypothesized way by context (long vs short) and by sex, and also by the sex-by-context interaction. The differences were in line with classic hypotheses and findings in evolutionary psychology (cf., Buss & Schmitt, 1993; Buss, 1998; Li & Kenrick, 2006; see also Simpson & LaPaglia, 2007), validating the factor structure.

Summarizing the results of the linear regressions, there were some striking differences for both sexes regarding which factors predicted self-perceived mate value and which factors predicted actual relationship satisfaction for members of the other sex. While physical appearance was by far the strongest predictor of self-perceived mate value for both sexes, it was only one among four other factors, and never the most important one to predict relationship satisfaction. Mate value for males was also predicted by their self-perceptions of status and dominance, which, as partner characteristics, did not seem to make females more satisfied with their relationships. Instead, what predicted female satisfaction best was partner warmth, a factor with no effect on male self-perception of mate value. Females perceived their mate value to be high if, besides having a good physical appearance, they also thought they were passionate and dominant, whereas female partners that actually made males satisfied with their relationships were high not only on appearance and passion, but on warmth, stability, and intelligence as well, while partner dominance did not seem to matter. Thus, it seems that the combination of factors which makes people satisfied with themselves as potential partners is quite different from that which actually makes their partners satisfied with them in a relationship.

6. General discussion

In Studies 1 to 3, a factor structure of mate preferences was explored and then confirmed in large samples, based on a pool of mate characteristics empirically collected with open-ended questions. Thus, contrary to some of the previous studies, the traits were neither an arbitrary list compiled by the researchers nor a translated questionnaire from

Table 6
Factor means of long- and short-term ideals.

Factor	Long-term ideals						Short-term ideals					
	Men		Women		Total		Men		Women		Total	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Warmth	5.95	0.92	6.28	0.77	6.17	0.83	3.89	1.49	4.70	1.39	4.44	1.47
Stability	5.58	1.03	5.80	0.99	5.73	1.01	4.20	1.47	4.94	1.48	4.70	1.52
Appearance	5.55	0.97	4.83	1.10	5.06	1.11	6.19	0.85	6.00	0.96	6.06	0.93
Passion	5.78	0.85	5.85	0.96	5.82	0.92	6.08	0.85	6.39	0.87	6.29	0.87
Status	3.80	1.42	4.53	1.38	4.29	1.43	3.02	1.57	4.10	1.58	3.75	1.66
Intellect	5.81	0.86	6.04	0.89	5.97	0.89	4.27	1.58	5.36	1.24	5.01	1.45
Dominance	4.96	1.11	5.81	0.90	5.53	1.05	4.53	1.45	5.71	1.12	5.33	1.35

Note. $N_{men} = 200$; $N_{women} = 422$.

Table 7
Test statistics for the two-way mixed ANOVAs.

Factor	Main effect by sex		Main effect by context		Sex × context interaction		Long-short term difference	
	F(df1,df2)	ηp2	F(df1,df2)	ηp2	F(df1,df2)	ηp2	Men	Women
Warmth	51.748(1,620)***	.077	902.388(1,620)***	.593	15.887(1,620)***	.025	2.06	1.58
Stability	28.738(1,620)***	.044	349.124(1,620)***	.360	18.378(1,620)***	.029	1.38	0.86
Appearance	38.505(1,620)***	.058	417.250(1,620)***	.402	36.602(1,620)***	.056	−0.64	−1.17
Passion	8.380(1,620)**	.013	126.725(1,620)***	.170	11.040(1,620)***	.017	−0.30	−0.54
Status	68.269(1,620)***	.099	87.310(1,620)***	.123	7.568(1,620)**	.012	0.78	0.43
Intellect	64.243(1,620)***	.094	416.433(1,620)***	.402	62.294(1,620)***	.091	1.54	0.68
Dominance	161.446(1,620)***	.207	25.052(1,620)***	.039	10.148(1,620)**	.016	0.43	0.10

** p < .01.
*** p < .001.

an earlier study with a different sample, but characteristics people actually listed as important in a partner. The factor structure was, again contrary to some of the earlier studies, tested with confirmatory factor analysis across four different and relevant contexts: ratings of the partner, the self, the long-term ideal and the short-term ideal. Then, in the analyses on the combined samples, the factors were validated by testing long-standing hypotheses in evolutionary psychology about differences by sex and context. The factor means of partner- and self-ratings could also be used to predict relationship satisfaction and self-perceived mate value, respectively, with notable differences between how people evaluate themselves as potential partners and what actually makes members of the other sex more satisfied in a relationship.

Our studies, however, are hardly the last word on the number, composition, and role of these factors. First of all, a factor structure depends much on what items are submitted to it. In the studies reported here, an empirical approach was taken, using only items mentioned by the people themselves. However, people are not necessarily aware of all aspects they consider in potential partners, or even if they are, they do not necessarily verbalize them when asked about an ideal partner (e.g. symmetry or waist-to-hip ratio). One may even go as far as to call the rated items rationalizations or verbalizations reflecting but not identical to actual mate preferences – a limitation inherent to most, if not all, investigations relying on self-reports. Another problematic decision was to discard items which were not neutral considering sex. However, omitted sex-specific characteristics pertained to physical attractiveness (e.g., strong, muscular, tall) and were represented in that factor by other, more neutral items (attractive, good body, beautiful, nice). The also omitted characteristics 'masculine/feminine' either fall into this category, or, if understood in broader terms (including e.g., behaviour), they are so vague that they are likely to end up loading on more than one factor. Besides, inclusion of items in the questionnaire was also subject to a practical consideration of keeping it within reasonable length lest our unpaid, volunteer participants lose their motivation as they proceed responding to the same set of traits across three or some of them even four contexts. Future studies could benefit from addition of further items on a theoretical basis, especially if these items could yield further factors or at least reveal more details about the content of existing ones.

A further problem was that many of the traits had to be discarded from the factor analysis because they had cross-loadings, although they were clearly relevant adjectives used to describe people as potential partners. The trait 'balanced', for example, has consistently loaded on both stability and dominance. A possible eighth factor, related to adventurousness, having an interesting personality and being able to entertain others (by, for example, humour), despite its relevance in previous evolutionary psychological studies of mate selection (cf., Bressler & Balshine, 2006) could not be established because its items cross-loaded on factors of intellect, passion, and dominance. Perhaps it is the nature of several trait adjectives that they describe people in ways relevant to multiple dimensions. In this case, one could either acquiesce to a factor model with cross-loadings or use sentences instead of mostly single-word items.

The factor structure of mate preferences may also depend on cultural and linguistic influences. The studies reported here use samples from a country, Hungary, from where, to our knowledge, no similar research efforts have been published yet. It is possible that the emergence of other factors besides the most often found ones (warmth, appearance, and status, as in the Ideal Standards Model; Fletcher et al., 1999; Fletcher & Overall, 2007) depends on the language of data collection. However, even culture and living conditions may play a role. This does not contradict to an evolutionary approach, as evolved human psychological processes can be complex and flexible enough to be responsive to situational, social, and economic factors (e.g., Buss & Schmitt, 2011;

Table 8
Zero-order correlations between RAS and the predicting variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. RAS	–	.701	.434	.540	.632	.304	.513	.446
2. Partner's warmth	.678	–	.527	.466	.561	.316	.506	.430
3. Partner's stability	.473	.536	–	.286	.287	.242	.371	.228
4. Partner's appearance	.635	.513	.253	–	.581	.361	.450	.438
5. Partner's passion	.689	.600	.304	.648	–	.295	.445	.511
6. Partner's status	.362	.420	.328	.345	.355	–	.450	.448
7. Partner's intellect	.550	.582	.399	.502	.465	.491	–	.460
8. Partner's dominance	.304	.327	.261	.324	.357	.371	.372	–

Note. $N_{male} = 472$, $N_{female} = 1707$; Correlation coefficients in the male sample are reported below the diagonal, and in the female sample above. All the coefficients are significant (p < .001).

Table 9
Regression model of the RAS and the partner evaluations across sex.

	Unstandardized		Standardized	
	β	Std. error	β	t
Male (Adjusted $R^2 = .64$)				
(Constant)	.436**	.137		3.194
Partner's warmth	.157***	.027	.242	5.784
Partner's stability	.085***	.017	.163	4.886
Partner's appearance	.173***	.029	.232	6.042
Partner's passion	.185***	.023	.317	7.866
Partner's status	−.013	.018	−.024	−0.709
Partner's intellect	.064**	.023	.105	2.785
Partner's dominance	−.019	.017	−.036	−1.141
Female (Adjusted $R^2 = .60$)				
(Constant)	.595***	.075		7.920
Partner's warmth	.258***	.014	.397	18.300
Partner's stability	.036***	.009	.072	3.979
Partner's appearance	.087***	.013	.133	6.699
Partner's passion	.148***	.012	.253	11.868
Partner's status	−.014	.010	−.026	−1.411
Partner's intellect	.073***	.013	.110	5.538
Partner's dominance	.019	.012	.032	1.636

** p < .01.
*** p < .001.

Table 10
Zero-order correlations between MVS and the predicting variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. MVS	–	.211	.127	.649	.446	.276	.373	.356
2. Self-perceived warmth	.263	–	.355	.258	.472	.153	.351	.239
3. Self-perceived stability	.123	.397	–	.184	.124	.163	.167	.136
4. Self-perceived appearance	.693	.199	.125	–	.492	.319	.477	.371
5. Self-perceived passion	.485	.548	.137	.499	–	.276	.381	.413
6. Self-perceived status	.413	.195	.101	.379	.237	–	.342	.340
7. Self-perceived intellect	.402	.366	.165	.367	.369	.357	–	.412
8. Self-perceived dominance	.449	.382	.146	.402	.512	.344	.415	–

Note. $N_{male} = 472$, $N_{female} = 1707$; Correlation coefficients in the male sample are reported below the diagonal, and in the female sample above. All the coefficients are significant ($p < .05$).

Confer et al., 2010). For example, Study 1 was replicated in a Norwegian sample, and not a single Norwegian participant mentioned material or financial aspects as important characteristics of a partner – perhaps due to the fact that Norway is an affluent and highly developed country with a relatively equal income distribution and low level of poverty.

Other important issues to consider are the conceptual nature of the trait ratings and the problem of causality. Trait ratings are not objective descriptions, especially partner ratings which can also be considered as attributions, susceptible to errors and biases known in social psychology, and most importantly, influenced by the dynamics of interactions (cf., Fletcher, 2015). This and the fact that our studies were correlational make it difficult to infer causality and interpret some of the results. It is, for example, possible that people will be less satisfied with a partner actually lower in warmth, but it is also possible that they will give a lower warmth rating to a partner they are less satisfied with. It is also possible that due the presence or absence of problems or conflicts in the relationship the partner (and the person as well) will behave in ways that actually make them seem to be higher or lower in warmth – or passion, or dominance, or other factors, for that matter. Questions like these could be studied in longitudinal settings.

All these methodological considerations notwithstanding, the notable differences between what makes people think they are desirable potential partners and what makes members of the other sex actually satisfied in a relationship may also have more fundamental, theoretical interpretations. Although research inspired by the Ideal Standards Model treats self-ratings in the same factor structure as partner ratings and ideals (Campbell, Simpson, Kashy, & Fletcher, 2001; Fletcher & Overall, 2007; Fletcher et al., 2014; see also Katsena & Dimdins, 2015, but also this very paper), the former may function in a different way, for at least three reasons.

The first reason is time. All traits are not created equal with regards to how fast they can be detected and reacted to in a relationship (see Fletcher & Overall, 2007). Physical appearance, for example, can be assessed very early, while more time may be needed for an accurate evaluation of other factors. As Fletcher et al. (2014) have shown, perceptions of attractiveness are not only the most accurate (compared to those of warmth and status) after an initial encounter with an other-sex stranger, but they are also predominant in early decisions about prospective partners. Thence, it is entirely realistic for people to judge their own mate value based mostly on their physical appearance and respond to the Mate Value Scale as if they were assessing their chances with a desirable other-sex stranger in a first encounter, while satisfaction is more about whether a relationship stands the test of time.

Second, the two most important factors to predict relationship satisfaction for both sexes, warmth and passion, may be more susceptible to interaction dynamics than physical appearance. If the same person's warmth and passion can vary more according to the partner's traits and behaviours than can physical appearance, then it is not surprising that the former two are more closely related to relationship satisfaction, which they can be both causes and consequences of, while physical appearance, as a more inherent (i.e., relationship-independent) characteristic may then dominate self-perceptions of mate value.

The third possible reason for the discrepancy between factors predicting mate value and satisfaction is that the mate value of the person and the satisfaction of the partner may not be the two sides of the same coin, after all. While mate value perceptions may serve the function of selecting the other parent of our offspring, relationship satisfaction may serve the function of explaining, maintaining, regulating, improving or breaking off the already going relationship with that person – often only after offspring has been created. From this point of view, there is nothing surprising in the possibility of people having genetically valuable partners and still be dissatisfied with the relationship; or people being in a happy relationship with genetically less-than-perfect partners. Although from a rationally hedonic point of view, it might be wiser for people to choose their long-term partners based on warmth, evolved psychological processes were designed by natural selection to maximize reproductive success, and not to make people happy.

Table 11
Regression model of the MVS and the self-evaluations across sex.

	Unstandardized		Standardized	
	β	Std. error	β	t
Male (Adjusted $R^2 = .54$)				
(Constant)	0.639*	.291		2.195
Self-perceived warmth	.006	.052	.005	0.124
Self-perceived stability	.000	.025	.000	0.002
Self-perceived appearance	.446***	.034	.518	13.140
Self-perceived passion	.110*	.045	.109	2.441
Self-perceived status	.107**	.031	.124	3.495
Self-perceived intellect	.108*	.050	.081	2.173
Self-perceived dominance	.096**	.035	.106	2.714
Female (Adjusted $R^2 = .45$)				
(Constant)	1.786***	.158		11.320
Self-perceived warmth	−0.035	.026	−.029	−1.328
Self-perceived stability	.000	.013	.001	0.039
Self-perceived appearance	.444***	.019	.529	23.479
Self-perceived passion	.133***	.022	.144	6.107
Self-perceived status	.027	.016	.033	1.637
Self-perceived intellect	.035	.026	.030	1.363
Self-perceived dominance	.066***	.017	.084	3.969

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Appendix A. Supplementary tables

Supplementary tables to this article can be found online at http://dx.doi.org/10.1016/j.paid.2017.03.044.

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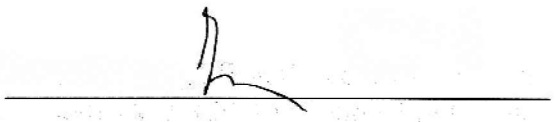
She significantly contributed to the statistical analysis and interpretation of the results, as well as writing the results and discussion sections of the manuscript.

The supervisor signed below agrees with submitting this article as part of her PhD thesis.



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Coupled individuals adjust their ideal mate preferences according to their actual partner

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ABSTRACT

It has been suggested that coupled individuals tend to adjust their ideal partner preferences according to their actual partner. In Study 1, we developed a mate preference trait-list and found a four-factor structure (Physical attractiveness, Status/Resources, Vitality, and Warmth/Trustworthiness), which we confirmed in Study 2. In Study 3, we compared ideal and actual partner preferences in continually-coupled and newly-coupled individuals. Ideal partner preferences were recorded in continually-coupled participants while in the relationship and in single participants before they established a relationship. Results showed that discrepancy between ideal and actual partner evaluations was lower in continually-coupled than in newly-coupled individuals when computing Manhattan distance between them. When comparing ideal partner preferences, continually-coupled individuals rated Warmth/Trustworthiness and Vitality lower than newly-coupled individuals. No difference between continually-coupled and newly-coupled individuals was found in their actual partner evaluations. Our results indicate that relationship status significantly affects ideal partner preferences.

1. Introduction

Mate choice is undoubtedly a crucial step in one's life. Researchers often assume that this decision is based on a set of mental representations, known as mate preferences or ideal partner preferences. Since the pioneering cross-cultural study by Buss (1989), several dozen studies on mate preferences have been carried out (for a recent review see Csajbók & Berkics, 2017). Although individual studies vary in the underlying structure of mate preferences they employ, perhaps the currently most influential design is a three-factor model introduced by Fletcher, Simpson, Thomas, and Giles (1999), which includes: (i) Warmth/Trustworthiness, (ii) Vitality/Attractiveness, and (iii) Status/Resources. The most robust finding from mate preference studies is that both women and men highly value partners who are agreeable, committed, and faithful. Furthermore, it appears that men on average tend to show a higher preference for physical attractiveness while women tend to show a stronger preference for partners with a high status and resources than men do (for review, see Feingold, 1992). It should be noted, however, that most studies reported both high intrasexual and intersexual variability of preferences. The size of the sex differences is positively related to, for instance, some cultural (gender inequality; Eagly & Wood, 1999), social (income inequality; Zentner & Mitura, 2012), and environmental factors (high parasite load; Gangestad, Haselton, & Buss, 2006). What is, however, less clear is whether these factors also affect the structure of mate preferences.

A related issue relevant to assessing partner preferences concerns the inclusion criteria of characteristics and the choice of data reduction methods such as factor-extraction. For instance, Csajbók and Berkics (2017) recently published a large collection of studies that deal with the extraction of the crucial dimensions of mating preferences. They show that the number and content of the factors strongly depend on the inclusion of measured characteristics. Reasons for inclusion can be broadly defined as theoretical or empirical. The theoretical approach (i.e., a top-down approach) has the advantage of covering all characteristics that are considered important in mate choice from a given theoretical perspective, but this approach increases the likelihood of the loss of external validity of the items. For instance, Ellis, Simpson, and Campbell (2002) employed evolutionary theory to identify domains relevant to mating under ancestral conditions. Correspondingly, the empirical approach (i.e., a bottom-up approach) has a higher ecological validity, but the qualitative nature of this method may lead to less generalizable results (Csajbók & Berkics, 2017; Fletcher et al., 1999). It is therefore reasonable to combine the two approaches and inspect the factor structure of partner preferences using mixed items. Moreover, in many studies, factor extraction methods are not accompanied by confirmatory factor analysis (e.g., Furnham, 2009; Schwarz & Hassebrauck,

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2012), tests of measurement invariance across sex or context on the proposed model (e.g., Atari & Jamali, 2016; Ellis et al., 2002), or the proposed model's further replication (e.g., Jonason, Websterb, & Gesselmanb, 2013; Katsena & Dimdins, 2015), which steps are of key importance for assessing the robustness and validity of the tested model. To account for the potential drawbacks of the previous studies, we combined a top-down and a bottom-up approach, performed confirmatory factor analysis, and tested the measurement invariance.

Apart from the structure of the mate preferences, an important area of inquiry is whether the preferences predict actual mate choice. Several recent studies employed a speed-dating paradigm as an inspiring model for testing the congruence between mate preferences and actual choice. The speed-dating model is based on short meetings (usually 3–7 min) where participants can freely chat with a preferred-sex individual and then move on to another individual. They meet approximately 10 individuals and mark whom they would like to meet again. In case both parties agree on a meeting, organizers provide them with each other's contact details. Previous speed-dating studies have shown, for instance, that partner preferences do not predict with whom individuals later initiate a romantic relationship (Eastwick & Finkel, 2008; Todd, Penke, Fasolo, & Lenton, 2007). As expected, male participants reported more frequently than women that they prefer physically attractive partners, while women were more likely to state a preference for partners with higher status/resources, but no sex differences emerged in the characteristics of the actually selected partners (Eastwick & Finkel, 2008). In another study, both men and women based their preferences on self-similarity, but their actual choice was predicted by the target's physical attractiveness (Todd et al., 2007). Nevertheless, it has also been demonstrated that where there is within the studied sample a sufficient variation in the key characteristics, such as social status and physical attractiveness, mate preferences do function as reliable predictors of actual mate choice (Li et al., 2013). Moreover, it has recently been suggested that findings from speed-dating studies might have a limited generalizability since they possibly overestimate the significance of characteristics that can be readily perceived, such as physical attractiveness, and could be biased by individuals who are involved in such studies (e.g., rarely involving individuals low in extraversion, Eastwick, Luchies, Finkel, & Hunt, 2014).

An alternative approach for testing differences between mate preferences and actual partner characteristics is to survey coupled individuals. It has been argued that mate decisions might not be guided by the absolute values of the actual partner's characteristics but by the size of discrepancy between the ideal and the actual partners' characteristics. The validity of a model based on discrepancy is supported by studies that show that this factor predicts both relationship satisfaction (Fletcher et al., 1999) and the probability of relationship dissolution (Fletcher, Simpson, & Thomas, 2000). The main drawback of this approach is that individuals in a committed, long-term relationship may adjust their preferences according to the characteristics of their actual partner in order to minimize the perceived level of the discrepancy (Morry, 2005). Possible differences between mate preferences in single and coupled individuals have been investigated mainly in studies on physical attractiveness. For instance, it has been shown that, in comparison with single women, coupled women have a higher preference for more masculine and symmetrical male faces (Little, Jones, Burt, & Perrett, 2007; Little, Jones, Penton-Voak, Burt, & Perrett, 2002) and body odors of dominant men (Havlicek, Roberts, & Flegr, 2005). Nevertheless, all these studies are based on cross-sectional design and cannot therefore imply causality. This limitation could be circumvented by asking participants about their ideal preferences while they are single and then assessing their partner once they meet one.

In this study, we thus compared reports about participants' ideal and actual partner, whereby the preferences were tested both prospectively (i.e., participants reported about their ideal partner before they met their current partner) and concurrently (i.e., they reported about their ideal partner while being coupled).

1.1. Current research

The aim of this research was twofold: first, we wanted to extract an underlying factor structure of the ideal partner preferences using a Czech sample (Study 1). Our aim was to fully cover a wide range of characteristics that, based on empirical and theoretical considerations, seem to be preferred in a potential partner. Furthermore, in order to assess the generalizability of the proposed factor structure, we replicated the initial study using a larger sample of English-speaking participants; and in order to assess the validity of the comparison between actual and ideal partner ratings, we assessed its measurement invariance (Study 2 and 3). Subsequently, we tested whether partner preferences might change depending on relationship status (Study 3). We compared ideal partner preferences of individuals who were already in a relationship with those who reported their ideal partner preferences while being single. We later contacted the single participants again, and those who established a new relationship reported about their current partner.

2. Study 1

To cover a wide range of characteristics relevant to partner assessment we used i) 34 characteristics from the Trait Specific Dependence Inventory which are based on an approach derived from the evolutionary theory (Ellis et al., 2002). The inventory covers six main domains relevant to mating under ancestral conditions such as Resource Accruing Potential and Physical Prowess. We further used ii) 5 characteristics originally used in the Ellis's study but omitted from the final inventory and iii) 5 characteristics based on our empirical pilot study. Subsequently, we employed Principal Components Analysis (PCA) and Confirmatory Factor Analysis (CFA) to investigate the factor structure of the measured characteristics.

2.1. Method

2.1.1. Pilot study

In the pilot study, 10 students (5 men and 5 women, mean age 25.7, SD = 2.67), mainly from the Charles University, Prague, the Czech Republic, were asked to complete a questionnaire assessing ideal partner preferences ("I wish my ideal partner was: …") on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Participants completed the Trait Specific Dependence Inventory (TSDI, Ellis et al., 2002), which consists of 34 characteristics loading into six factors: Agreeable/Committed, Resource Accruing Potential, Physical Prowess, Emotional Stability, Surgency, and Physical Attractiveness (for individual characteristics see Supplementary Table 1). We translated the questionnaire into Czech using a method of translation and back-translation. Immediately after completing the questionnaire, participants were asked about their comprehension of the individual items and whether they could think of other characteristics important in a potential romantic partner. Completion of the pilot study took approximately 30 min. Based on the participants' reports, we excluded two items from the original TSDI: good companion and good-looking. In the Czech translation, the item 'good companion' could not be clearly distinguished from the item 'outgoing'. A similar problem occurred with the item 'good-looking': we could not find a Czech expression that would clearly distinguish it from the item 'physically attractive'. To fully cover potentially important characteristics, we also included 5 items from the original Ellis study which were omitted from the final version of the TSDI because of their poor loading values, namely 'energetic', 'healthy', 'perceptive', 'creative', and 'open-minded'. Furthermore, we included 5 characteristics which participants stated at least twice as missing in the list of characteristics they consider important in a potential partner. These are: 'hygienic' (reported 4 times), 'likes children', 'has good sense of humor' (all reported 3 times), 'religious', and 'empathic' (reported 2 times). The final list thus comprised 42 items.

2.1.2. Participants and procedure

Altogether, 204 single heterosexual individuals from the Czech Republic (138 women and 65 men) participated in Study 1. Their mean age was 25.53 years (SD = 3.78). Participants were recruited via social media to take part in an online study on mate preferences. Participation was subject to the following conditions: age between 18 and 40 and being single (i.e., currently not in a long-term, stable relationship). Each participant was asked to carefully read and confirm the informed consent form prior to answering the questionnaire about their preferred ideal partner characteristics. The study was run using the Qualtrics platform, and its completion took approximately 15 min.

2.1.3. Measures

Participants rated their ideal partner preferences along 42 characteristics ("I wish my ideal partner was: …") on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The individual characteristics are shown in Supplementary Table 1. Participants were also asked to provide their basic demographic information.

2.1.4. Statistical analyses

To explore the underlying factor structure of ideal partner preferences, we ran PCA with Varimax rotation and Kaiser normalization on the 42 items. The ratio of participants to items was sufficient (4.8:1). Statistical packages SPSS and Mplus were used for all the analyses.

2.2. Results

Based on parallel analysis, which was supported by the eigenvalue scree, a four-factor solution was extracted providing an interpretable structure that explained 46.42% of data variance. The four factors along with loadings of the items are shown in Supplementary Table 1. Consistent with previous studies, ideal partners were defined by the following factors: (1) characteristics related to social status and access to resources became factor Status/Resources; (2) characteristics related to loyalty and development of intimacy were labelled a Warmth/Trustworthiness factor; (3) characteristics related to being energetic and strong were included in the Vitality factor, and (4) characteristics related to the person's attractiveness and health were labelled Physical attractiveness factor. To achieve a simple and easily measurable structure, only four items from each factor were retained. This resulted in excluding 26 of the original 42 items. Next, we performed a CFA, which confirmed the four-factor structure, but only 12 items loaded sufficiently (Fig. 1). For the fit indices, see Table 1. For explorative purposes, we retained the remaining four items in the replication study (i.e., hygienic, healthy, intelligent, and athletic), since they were clearly emphasized either by participants in previous studies (Ellis et al., 2002) or in our pilot study. In the subsequent study, we thus employed 16 characteristics.

2.3. Discussion

The main aim of this study was to explore the underlying factor structure of mate preferences. To cover various characteristics important in mate selection, we employed a list of 37 characteristics developed by Ellis et al. (2002) based on considerations derived from evolutionary psychology. This theoretical approach was complemented by a qualitative study (the Pilot Study) which led to adding 5 more characteristics ('hygienic', 'likes children', 'has good sense of humor', 'religious', and 'empathic') which were reported as significant in mate evaluation. The exploratory factor analysis yielded a four-factor structure. Importantly, three of the four factors (Warmth/Trustworthiness, Status/Resources, and Physical attractiveness) conceptually replicated the factors of Fletcher et al. (1999), while the fourth factor (Vitality) also appeared in Fletcher's model, although only as part of the Physical attractiveness factor. Subsequent confirmatory factor analysis showed a good fit of the model. Four items used in this study did not load well in either PCA or CFA. Since the pilot study suggested that these characteristics might be important in partner assessment, we decided to retain them in the replication.

3. Study 2

The main aim of this study was to assess the generalizability of the four-factor structure obtained in Study 1 to a larger sample of English-speaking participants. In Study 2, we therefore recruited participants using an online platform and tested the model's fit against the data.

3.1. Method

3.1.1. Participants and procedure

Altogether 1215 single and 419 coupled individuals from English-speaking countries participated in an online study. To avoid possible bias due to cultural variation, we excluded 87 participants from underrepresented countries (Australia, New Zealand, Ireland, and unspecified countries). Since the study focused on heterosexual relationships, we also excluded 80 homosexual participants as they frequently show different preference patterns (Valentova, Štěrbová, Bártová, & Varella, 2016). The final sample consisted of 1092 single participants (557 women and 535 men; mean age 27.45, SD = 5.18) and 375 coupled participants (198 women and 120 men; mean age 28.88, SD = 4.70.). Altogether 807 participants were from the USA, 344 from Canada, and 316 from the UK.

Participants were recruited via the Crowdflower platform and were asked to complete a short online questionnaire on mate preferences run in the Qualtrics platform. Each participant was asked to carefully read and confirm the informed consent form prior to completing the questionnaire. Participation took approximately 10 min, and participants were motivated by a small financial reward (equivalent to 1 USD) to complete the questionnaire. All participants completed a questionnaire about their ideal partner preferences, and coupled participants also completed a questionnaire about their current partner's characteristics.

3.1.2. Measures

Participants completed a list of 16 characteristics resulting from the PCA based analysis in Study 1 which assessed ideal partner preferences ("I wish my ideal partner was: …") on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Coupled participants were further asked to assess their current partner on a 7-point scale ("My partner is: …") using the same list of the characteristics.

3.1.3. Statistical analysis

To confirm the underlying four-factor structure of ideal partner preferences and current partner assessment, we ran a confirmatory factor analysis on the 16 items. Due to the non-normal distribution of some variables, we employed the MLR estimator; furthermore, we accepted RMSEA and SRMR if < 0.08; CFI and TLI if > 0.90 (Brown, 2006). Based on the modification indices reported by the Mplus 7 software, we excluded four items that caused a poor model fit either by loading to more than one latent factor or by high correlation between two variables' error variances.

3.2. Results

We first performed CFA separately for 3 different datasets: (i) assessments of the ideal partner based on the responses of 1092 English-speaking single individuals, (ii) assessments of the ideal partner based on the responses of 375 coupled individuals, and (iii) assessments of the current partner based on the responses of 375 coupled individuals. In all samples, the four-factor structure was supported (Figs. 1 and 2). Similarly, as in Study 1, we excluded items 'hygienic', 'healthy', 'intelligent', and 'athletic' because they rendered the model fit worse than acceptable (i.e., RMSEA and SRMR > 0.08; CFI and TLF < 0.90). For

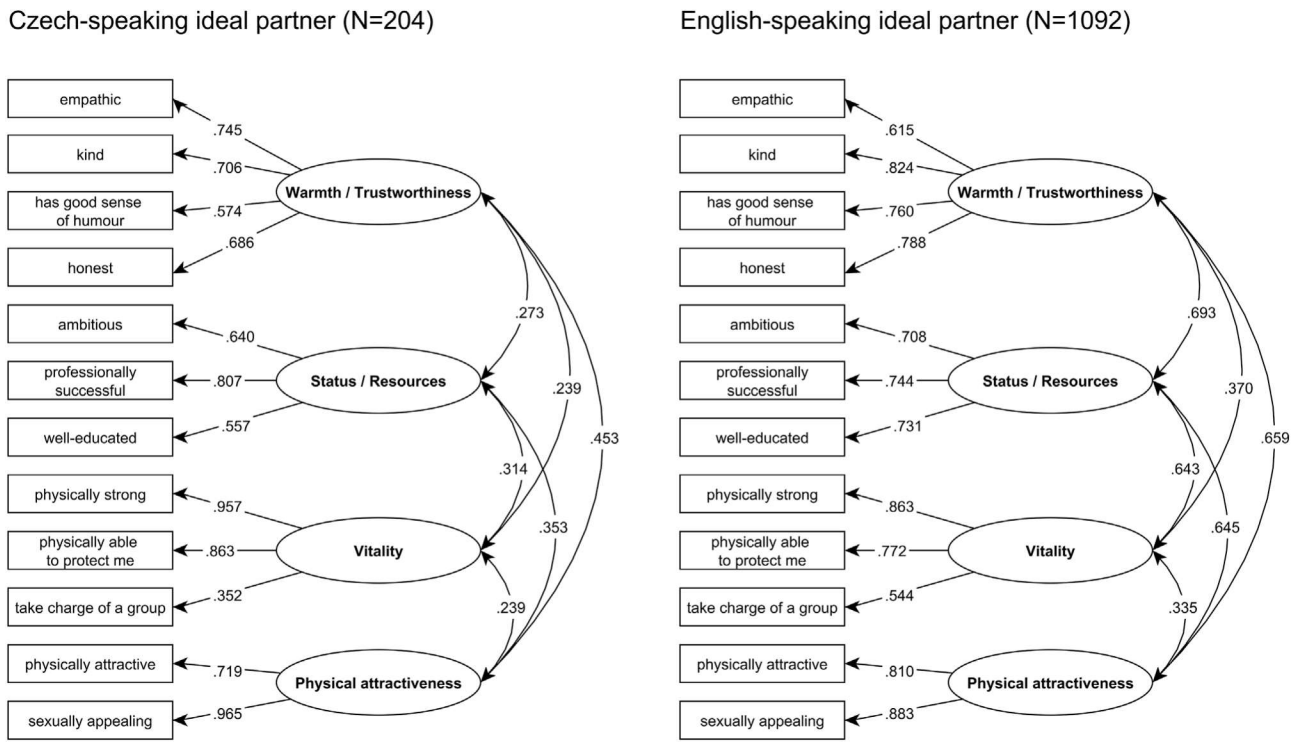

Fig. 1. Results of the confirmatory factor analyses of ideal partner preferences in the Czech- and English-speaking samples.

detailed results of the fit indices, see Table 1. In addition, the individual factors in all samples showed homogeneity based on Cronbach's alpha values which ranged from 0.704–0.901 (for details, see Supplementary Table 2).

3.3. Discussion

The study revealed that the 12-item four-factor structure fits sufficiently well to both single and coupled participants' assessment of their ideal partner, and in the case of coupled participants, to actual partner assessment as well. Moreover, the factors have a good internal consistency. It is therefore a reasonable choice to test our hypotheses regarding the effect of relationship status on ideal partner preferences using the current measure.

Our model very closely resembles the model of Fletcher et al. (1999), which is the most replicable partner preferences model, especially in Anglo-Saxon countries (cf., Fletcher et al., 1999; Fletcher, Boyes, Overall, & Kavanagh, 2006; Fletcher, Kerr, Li, & Valentine, 2014; Fletcher, Tither, O'Loughlin, Friesen, & Overall, 2004; Overall, Fletcher, & Simpson, 2006). Compared with the original study, 'kind' and 'honest' items loaded similarly well on the Warmth/Trustworthiness factor (Fletcher et al., 1999). Surprisingly, 'empathic' was not included in Fletcher and colleagues' study, the semantically closest item in their model being 'understanding'. In contrast, 'having good sense of humor' and 'ambitious' loaded on the Vitality/Attractiveness factor in Fletcher and colleagues' study, while in our study, these items loaded well on the Warmth/Trustworthiness and Status/Resources factors, respectively. 'Physically attractive' and 'sexually appealing' items of the Physical attractiveness factor are conceptually akin to 'attractive' and 'sexy' items respectively in Fletcher and colleagues' model. The Status/Resources factor seems to resemble the item 'successful' (from Fletcher et al., 1999), but in our model, it is phrased as 'professionally successful'.

Another interesting possibility is to compare differences between the partner preference-evaluation structure used in the current research and the likewise structure used in Ellis et al. (2002), whose item-list we adopted in this study. Curiously, items 'energetic', 'healthy', 'perceptive', 'creative', and 'open-minded' did not fit well on any of the factors employed in this study. Among the five items we had added based on the qualitative pilot study, however, 'has good sense of humor' and 'empathic' did have a good fit in our factor model. While our study resulted in a four-factor solution, Ellis et al. (2002), based on the theoretically included items, derived a six-factor structure, which included the following factors: Agreeable/Committed, Resource accruing potential, Physical prowess, Emotional stability, Surgency, and Physical attractiveness. Our factor Warmth/Trustworthiness is the equivalent of the Agreeable/Committed factor proposed by Ellis et al., but with the inclusion of the two newly proposed items ('empathetic' and 'has good sense of humor'). The factor Physical attractiveness is the same in the two studies, and our Status/Resources factor is closely related to Ellis' Resource accruing potential. On the other hand, our Vitality factor's items appeared in Ellis et al. (2002) in the Physical prowess and

Table 1
Fit indices of the four-factor solution in the individual samples.

	Model	N	χ^2 (df)	RMSEA (CI 90%)	CFI	TLI	SRMR
Study 1	Ideal partner: Czech-speaking sample (singles)	204	83.682 (48)	0.060 (0.038–0.082)	0.950	0.931	0.063
Study 2	Ideal partner: English-speaking sample (singles)	1092	231.556 (48)	0.059 (0.052–0.067)*	0.953	0.935	0.055
Study 2	Ideal partner: English-speaking sample (coupled)	318 + 57	96.168 (48)	0.052 (0.037–0.067)	0.956	0.940	0.046
Study 2	Actual partner: English-speaking sample (coupled)	318 + 57	150.036 (48)	0.075 (0.062–0.089)*	0.926	0.898	0.083

* $p < .05$.

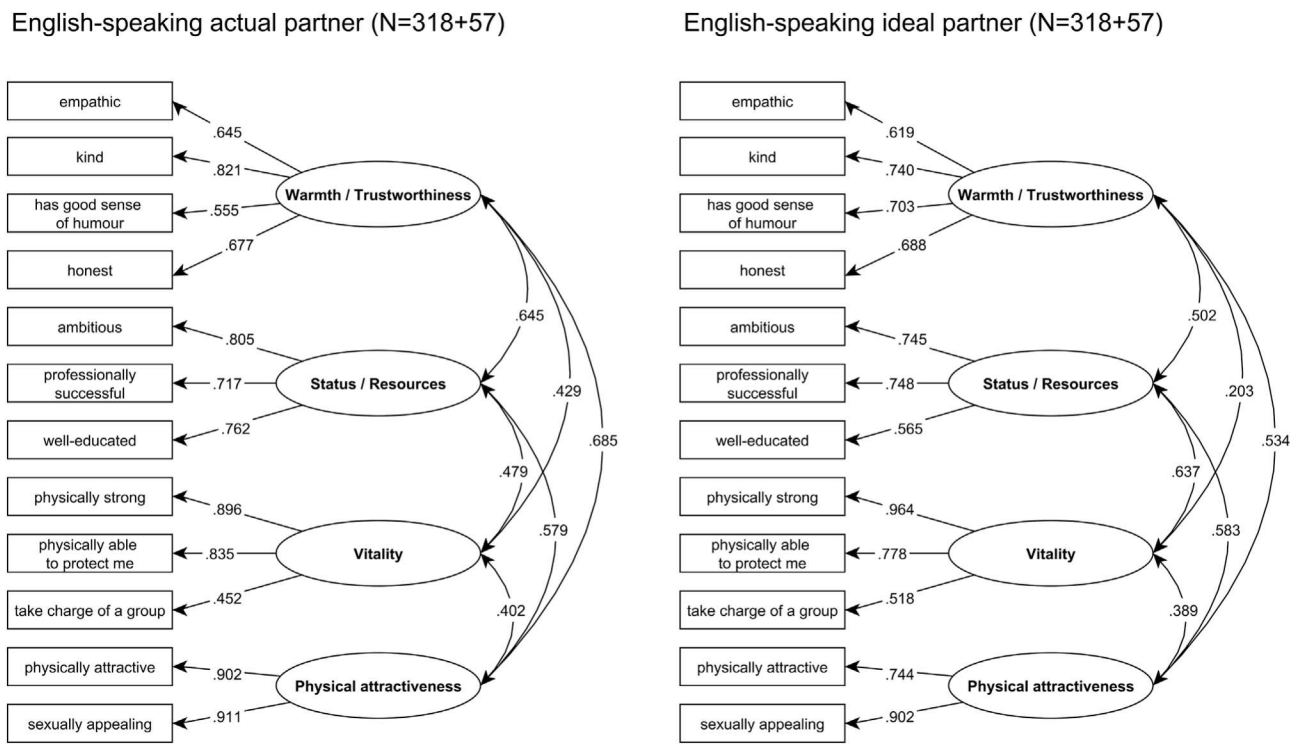

Fig. 2. Results of the confirmatory factor analyses of ideal partner preferences and actual partner evaluations in the English-speaking sample of coupled individuals.

Surgency factors. Overall, of the factors included in Ellis et al. (2002), only the Emotional stability factor was found to have no counterpart in the current study.

Researchers on mate preferences frequently specify context as long- and short-term relationship (for review see Marzoli, Havlíček, & Roberts, 2018). It has been repeatedly shown that some characteristics such as physical attractiveness are more valued in short-term context while other characteristics such as warmth are more valued in long-term context. Interestingly, a recent study by Csajbók and Berkics (2017) has shown measurement invariance between short- and long-term contexts suggesting shared factor structure.

To conclude, this study resulted in an interesting finding that in comparison with a clearly empirically developed factor model (Fletcher et al., 1999), our model, which employed both theoretically and empirically derived items, loaded on a conceptually highly similar factor structure, although with partly different items in the final structure.

4. Study 3

In this study, we investigated whether ratings of an ideal partner depend on the relationship status and how being in a relationship affects the discrepancy between the assessment of the ideal and the actual partner. We collected ideal partner preferences and actual partner evaluations from participants who were already in a relationship (sample labelled as continually-coupled) as well as ideal partner preferences from participants who were single during the first session. After a six-month follow-up, participants who had subsequently found a partner (sample labelled as newly-coupled) were asked to rate their actual partners. Those who did not find a partner within six months were labelled as remained-single.

We expected that continually-coupled participants would adjust their ideal partner preferences to their actual partners' characteristics. In other words, we hypothesized that the overall discrepancy (as measured by Manhattan distance in the four-dimensional space) between the ideal and the actual partner would be larger among newly-coupled participants than among continually-coupled participants (Hypothesis 1a); and we also expected that the four individual differences (i.e., ideal partners compared to actual partners in the four individual factors) would be larger in newly-coupled participants then in continually-coupled participants (Hypothesis 1b). We further expected higher correlation across the individual factors between ideal and actual partner evaluations in continually-coupled participants than in newly-coupled participants (Hypothesis 1c). In order to investigate how the evaluations are related to the length of time spent together, we correlated the ideal and actual partner ratings as well as the discrepancy between them with the length of relationship in continually-coupled individuals (Hypothesis 1d). Here we aimed to explore whether the possible changes over time in the discrepancy between the ideal and actual partner evaluations are due to changes in ideal preferences or changes in the actual partner's assessment.

We further expected (Hypothesis 2) that remained-single participants would have the highest ideal partner preferences (as initially-single individuals who remained single may have done so because they have overly high ideal partner expectations that are less likely to be met, Apostolou, 2017). In comparison, newly-coupled participants would have lower ideal partner preferences but higher than continually-coupled participants (as they were tested while being single, and we expect them to adjust their ideal preferences after being coupled). Lastly, we expected that continually-coupled and newly-coupled participants did not rate their actual partners significantly different indicating that the difference between the groups is due to the changes in partner ideals and not the consequence of significant distortions in partner-evaluation at the initial phase of the relationship (Hypothesis 3).

4.1. Method

4.1.1. Participants and procedure

Overall data from 472 individuals from English-speaking countries who participated in Study 2 were employed in Study 3. Similarly, as in Study 2, we excluded 37 participants from underrepresented countries (Australia, New Zealand, Ireland, and unspecified countries) and 27

Table 2
Measurement invariance in the factor structure across language, sex, and target.

Model	χ^2 (df)	CFI	TLI	RMSEA	90% CI	$\Delta\chi^2$ (df)	ΔCFI	ΔTLI	ΔRMSEA
Language invariance (Czech vs English, pooled for sex, only ideal preferences)									
Configural	418.320 (96)	0.948	0.928	0.063	[0.057–0.069]**				
Metric (loadings)	466.565 (104)	0.941	0.926	0.064	[0.058–0.070]***	+48.245 (8)	−0.007	−0.002	+0.001
Scalar (intercepts)	608.704 (112)	0.920	0.905	0.072	[0.067–0.078]***	+142.139 (8)	−0.021	−0.021	+0.008
Sex invariance (pooled for target)									
Configural	248.593 (96)	0.946	0.926	0.065	[0.055–0.075]**				
Metric (loadings)	271.273 (104)	0.941	0.926	0.065	[0.056–0.075]**	+22.680 (8)	−0.005	0.000	0.000
Scalar (intercepts)	284.138 (112)	0.940	0.929	0.064	[0.055–0.073]**	+12.865 (8)	−0.001	+0.003	−0.001
Target invariance (ideal vs actual, pooled for sex)									
Configural	252.337 (96)	0.944	0.924	0.066	[0.056–0.076]**				
Metric (loadings)	266.088 (104)	0.942	0.927	0.064	[0.055–0.074]**	+13.753 (8)	−0.002	+0.003	−0.002
Scalar (intercepts)	304.058 (112)	0.932	0.920	0.068	[0.059–0.077]**	+37.970 (8)	−0.010	−0.007	+0.004

** $p < .01$.
*** $p < .001$.

homosexual participants. The final sample consisted of 408 participants (239 from the USA, 87 from Canada, 82 from the UK), mean age 28.88, SD = 4.70. A total of 318 participants (198 women and 120 men) reported being in a long-term romantic relationship. The mean length of the relationships was 62.96 months (SD = 57.57). These participants took part in our study only once. Another 90 participants (61 women and 29 men) were single during the first part of the study. They were contacted again 6 months after the first part, and those who were now in a relationship (57 in total, 42 women) were asked to rate their actual partners along the same 16 characteristics. A total of 33 individuals (19 women) remained single during the 6-months period.

4.1.2. Measures

Based on the results of Study 1, all participants were asked to assess 16 characteristics measuring ideal partner preferences ("I wish my ideal partner was: …") on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Continually- and newly-coupled participants further assessed their current partner ("My partner is: …") using the same 7-point scale. Based on the results of the CFA performed in Study 2, we used the factor means of the 12-item four-factor model (Status/Resources, Warmth/Trustworthiness, Physical attractiveness, and Vitality).

4.1.3. Statistical analysis

Measurement invariance was tested to compare the latent structure of ideal partner preferences and actual partner assessments in order to assess whether comparisons across these two constructs are valid (in the pooled sample of continually- and newly-coupled participants). Language and sex invariance were tested, for exploratory purposes.

To measure and compare the discrepancy between the ideal and actual partner evaluations in the continually-coupled and newly-coupled participants, we employed Manhattan distances (for a technical introduction, see Micko & Fischer, 1970). These are calculated by subtracting the actual partner-ratings from ideal partner ratings in each factor and then calculating the sum of the absolute values of the differences. Manhattan distances thus measure a discrepancy along all the four factors simultaneously in a multidimensional space (i.e., the dimensions are the measured factors). This estimates the differences in the general rating pattern better than if we computed discrepancies among individual factors (i.e., subtracting actuals from ideals in each factor separately), and it is better suited for the research method we used than possible alternatives. For example, one could alternatively use a Euclidean method, which measures straight-line distances (e.g., Conroy-Beam, Goetz, & Buss, 2016), however, using Euclidean distance is less suitable for our additive approach of target ratings (i.e., ideal or actual partners), in which the ratings cumulatively count towards an overall score. This applies due to two considerations. Firstly, the sum of the ratings, i.e., the overall 'values' of the targets, are equal to the Manhattan distance from the origin, and thus targets with equal sums will have equal Manhattan distances from the origin (in the coordinate system). Secondly, the Euclidean distance from the origin may be different across targets having an equal sum of the characteristics (e.g., Target 1 has $T_1(5, 5)$ coordinates while Target 2 has $T_2(7, 3)$ in the two-dimensional space; both of their sums are 10, but their Euclidean distance from the origin are 7.07 and 7.62, respectively), and this difference is smaller when the target's profile is imbalanced (x and y values are far from each other) and larger when the target's profile is balanced (x and y values are close to each other).

To inspect how much the individual factors contribute to the resulting Manhattan distances, Pearson correlations and paired-samples *t*-tests were applied separately along each factor between ideal and actual partner evaluations. Subsequently, we employed four one-way ANOVAs to compare differences in ideal partner ratings between our three groups (i.e., we compared ratings of the continually- and newly-coupled individuals and those who remained single). Actual partner ratings were further compared between continually- and newly coupled participants by using independent-samples *t*-tests.

4.2. Results

4.2.1. Measurement invariance

Measurement invariance was tested between the ideal and actual partner ratings, between English and Czech samples, and across sex. Chi Square differences indicated significant differences across configural, metric, and scalar models, but fit indices changed less than the suggested maximal values (maximally −0.010 for CFI and TLI; and maximally +0.015 for RMSEA; Chen, 2007). The results thus indicate a metric invariance across the two languages (Czech and English) and a scalar invariance across sex and across the contexts of actual and ideal partner ratings. This allows us to compare men and women as well as ideal and actual partner ratings (Table 2).

4.2.2. Effect of relationship status

Manhattan distances were computed between the overall (i.e., along all the four factors) ideal, and actual partner ratings to test Hypothesis 1a (see mean values in Table 3). As expected, results showed that continually-coupled individuals rated their partner ideals closer to their actual partner in the four-dimensional space than newly-coupled participants ($t(373) = -3.387$, $p < .01$, $D = -0.509$).

Results of paired-samples *t*-tests performed between ideal and actual partner evaluations across continually- and newly-coupled individuals (Hypothesis 1b) suggested that the ideal evaluation of the Warmth/Trustworthiness factor is significantly higher than the actual partner's rating both in the continually- and newly-coupled individuals (see

Table 3
Manhattan distance means between ideal and actual partner in a four-dimensional space across groups.

	Group	N	Mean (SD)	*t*(df)	95% CI	Cohen's D
Manhattan distance	Continually-coupled	318	3.511 (2.822)	−3.387 (373)**	[−2.136, −0.567]	0.509
	Newly-coupled	57	4.863 (2.479)			

CI = confidence intervals.
** p < .01.

Table 4 for test results and Table 6 for descriptive statistics). Ideal Status/Resources preferences were also higher among the continually-coupled participants than Status/Resources evaluations of the actual partner. Unexpectedly, however, the ideal preference for the Vitality factor was much lower than the actual partner's reported level of Vitality in the continually-coupled participants. To test whether this effect could be due to sex differences in mate preferences, we compared the sexes in the rating of Vitality, but the results of the two-way ANOVA (across sex and ideal versus actual partner) were not significant.

To test how the particular factors further affect this discrepancy emerging in the Manhattan distances (Hypothesis 1c), we correlated the actual and ideal partner ratings along the individual factors across continually- and newly-coupled participants. As expected, in continually-coupled participants, the ideal and actual evaluations showed consistent associations along the factors. In contrast, newly-coupled participants who rated their ideal partners six months before evaluating their actual partner showed very limited associations along the factors (Table 5).

We further performed correlational analysis between the length of relationship and ideal partner preferences as well as current partner evaluations in continually-coupled individuals, but no linear (all r coefficitents between −0.083 and 0.078) or non-linear effect was significant. Neither did we find a significant relation between the length of relationship and the Manhattan distance between the ideal and actual partners (Hypothesis 1d).

Results of the four one-way ANOVAs comparing the three groups in their partner ideals suggested that continually-coupled participants rate Warmth/Trustworthiness of their ideal partner lower than newly-coupled and remained-single participants; and remained-single participants rate Vitality lower than newly-coupled participants (Table 6) as hypothesized in Hypothesis 2. Although, no differences were found between newly-coupled and remained-single participants. Finally, the actual partner evaluations did not differ significantly between the newly- and continually-coupled participants (Hypothesis 3).

4.3. Discussion

The main aim of this study was to compare the discrepancy between ideal and actual partners as rated by continually- and newly-coupled individuals who found their partner during the six-month follow-up. We expected a lower level of discrepancy in continually-coupled individuals who, as we hypothesized, may tend to modify their ideal partner preferences to match their actual partners. An analysis based on Manhattan distances supported this hypothesis and showed an overall lower level of discrepancy between ideal and actual partners in continually-coupled individuals compared to those who were newly-coupled (Hypothesis 1a). We also found that there is a higher correlation between the ideal partner preferences and actual partner evaluations in continually-coupled individuals than in newly-coupled participants across all the four factors individually as expected (Hypothesis 1c). In continually-coupled participants, we observed no statistically significant relationship between the length of the relationship and their ideal partner ratings, actual partner ratings, or the discrepancy between them (Hypothesis 1d). More specifically, continually-coupled participants did not change their ideals over time systematically (i.e., no correlation between the ideal factors and the length of relationship), nor did we find a consistent adjustment pattern of their partner-evaluation (i.e., the actual partner's rating did not decrease or increase over the time spent together). This result, together with the difference detected between continually- and newly-coupled participants' ideals but not actual partners, suggests that the adjustment in partner ideals might occur in the initial months of the relationship, or in this case we may have observed a “survival bias”, meaning that only couples who stay together are recorded in such a research design. It is unfortunate, however, that in the absence of more detailed data on the length of the newly-coupled participants' relationships and without more detailed and more frequent records on changes in partner ideals, we cannot conclude with certainty what the mechanisms behind such adjustments are.

Results of Hypothesis 1b are somewhat surprising and complex. Firstly, both continually- and newly-coupled participants had significantly higher ideal Warmth/Trustworthiness than those rated in their actual relationship. Nevertheless, newly-coupled participants seemingly compromised more in their expectations in this regard (based on the effect sizes). A potential interpretation is that continually-coupled individuals already adjusted their ideals or lowered the importance of Warmth/Trustworthiness. On the other hand, continually-coupled participants had significantly higher ideals in Status/Resources and lower in the Vitality factor, while newly-coupled participants showed no significant difference in factors other than the aforementioned Warmth/Trustworthiness. In terms of effect sizes, the differences between ideal and actual partner ratings are roughly similar, the difference in the significance lies in the draw-backs of the substantially lower sample size in the newly-coupled group. Overall, this result does

Table 4
Paired-samples *t*-tests to compare ideal and actual partner evaluations across continually- and newly-coupled individuals.

Factor	Continually-coupled			Newly-coupled		
	t(df)	95% CI	Cohen's D	*t*(df)	95% CI	Cohen's D
Physical attractiveness	0.990 (317)	[−0.076, 0.230]	−0.055	−0.180 (56)	[−0.426, 0.356]	0.024
Vitality	−4.668 (317)***	[−0.450, −0.183]	0.262	0.780 (56)	[−0.284, 0.647]	−0.104
Status/Resources	2.850 (317)**	[0.064, 0.347]	−0.161	1.969 (56)	[−0.007, 0.826]	−0.266
Warmth/Trustworthiness	5.930 (317)***	[0.253, 0.504]	−0.333	3.862 (56)***	[0.304, 0.959]	−0.518

CI = confidence intervals.
** p < .01.
*** p < .001.

Table 5
Correlations between the ideal and actual partner evaluations along the four factors across the two samples.

	Physical attractiveness		Vitality		Status/Resources		Warmth/Trustworthiness	
	r	95% CI	r	95% CI	r	95% CI	r	95% CI
Continually-coupled	0.331***	[0.229, 0.425]	0.613***	[0.539, 0.677]	0.457***	[0.365, 0.539]	0.383***	[0.285, 0.473]
Newly-coupled	−0.024	[−0.283, 0.238]	0.017	[−0.245, 0.276]	0.111	[−0.154, 0.361]	−0.051	[−0.307, 0.212]

CI = confidence intervals.
*** $p < .001$

not contradict the findings of comparing Manhattan distances in the four-dimensional space of partner-evaluation (Hypotheses 1a).

Previous research indicates both 1) that people frequently form relationships with partners who do not match their ideal preferences in all characteristics (for a review, see Eastwick et al., 2014) and 2) that agent-based model simulations successfully predict real-world preference-driven mate choice (Conroy-Beam & Buss, 2016a). In current research, we found substantial differences in the factors Status/Resources and Warmth/Trustworthiness. We also found a significant difference between the ideal and actual partner in the Vitality factor where, rather unexpectedly, the ratings of the actual partner were higher than the ideal partner preferences. To investigate whether this unexpected finding was due to gender differences in the ideal preferences for Vitality, we tested the effect of sex but found no significant results. Currently, this finding rather supports that there are profile differences between ideal and actual partners, but future studies should evaluate its robustness also by involving other measures in the analyses such as relationship satisfaction.

Subsequent analysis, which tested differences in the individual factors of ideal partner preferences, revealed that continually-coupled individuals report lower values in the Warmth/Trustworthiness and Vitality factors than the newly-coupled ones (Hypothesis 2). Remained-single individuals, however, did not differ significantly from newly-coupled participants in contrast to our predictions (cf. Apostolou, 2017), although, these findings should be interpreted with caution because the sample sizes were relatively limited.

Since we also did not find any differences between continually-coupled and newly-coupled individuals in their actual partner evaluations (Hypothesis 3), it is indicated that the observed pattern of adjustment is restricted to ideal partner evaluations especially with respect to evaluating Warmth/Trustworthiness, however, this contradicts other agent-based research (Conroy-Beam & Buss, 2016a). Overall, the results of Hypothesis 3 allow us to tentatively conclude that the difference between the continually- and newly coupled participants is only due to the relationship status and not to the study design.

5. General discussion

First, our research explored the structure of ideal partner preferences. This part of the study produced a four-factor model that included Physical attractiveness, Vitality, Status/Resources, and Warmth/Trustworthiness (Study 1). Generalizability of this model was subsequently confirmed in an independent sample from another population (Study 2). Finally, we used this model of ideal partner preferences to compare the discrepancy between ideal and actual partner preferences and evaluations across continually-coupled and newly-coupled individuals (Study 3).

In general, we found that continually-coupled individuals showed lower discrepancy between their ideal and actual partners than individuals who found their partner during the six month follow-up, i.e., newly-coupled individuals. These results suggest that continually-coupled individuals tend to adjust their ideal partner preferences, though it requires further investigation into how and in what direction the adjustment is processed. Null results of the correlation between the length of their relationship and the level of discrepancy between ideal and actual partners (as well as the ideal and actual partner ratings) indicate that the adjustment of relationship preferences may occur in the very early phases of the relationship. Such an adjustment might be adaptive since it lowers the discrepancy between ideal mate preference and actual partner evaluation thereby decreasing cognitive dissonance (Campbell, Simpson, Kashy, & Fletcher, 2001) as a function of strain and conflict reduction in a relationship. Gerlach, Arslan, Schultze, Reinhard, and Penke (in press) refer to the phenomenon as “survival bias”, indicating that the relationship cannot survive without the

Table 6
Descriptive statistics of the factor means of the ideal and actual partner-ratings (if applicable) across the samples ($N_{continually\text{-}coupled} = 318$; $N_{newly\text{-}coupled} = 57$; $N_{remained\text{-}single} = 33$).

	Factor	Continually-coupled	Newly-coupled	Remained-single	One-way ANOVA	
		Mean (SD)	Mean (SD)	Mean (SD)	Main effect of relationship status	η^2
Ideal	Physical attractiveness	5.737 (1.189)	5.895 (0.981)	6.076 (1.032)	F(2,405) = 1.584	0.008
	Vitality	4.758_a (1.411)	5.275_b (1.115)	5.121_{ab} (1.359)	F(2,405) = 4.097*	0.020
	Status/Tesources	5.341 (1.188)	5.573 (0.949)	5.121 (1.083)	F(2,405) = 1.733	0.008
	Warmth/Trustworthiness	5.903_a (1.048)	6.360_b (0.710)	6.311_b (0.813)	F(2,405) = 6.889**	0.033
		Continually-coupled	Newly-coupled	Remained-single	Independent-samples *t*-test	
		Mean (SD)	Mean (SD)	Mean (SD)	*t*(df) 95% CI	Cohen's D
Actual	Physical attractiveness	5.660 (1.212)	5.930 (1.075)	–	−1.571 (373) [−607, 0.068]	0.236
	Vitality	5.074 (1.332)	5.094 (1.374)	–	−0.099 (373) [−0.398, 0.359]	0.015
	Status/Resources	5.135 (1.275)	5.164 (1.360)	–	−0.154 (373) [−0.393, 0.336]	0.022
	Warmth/Trustworthiness	5.525 (0.998)	5.730 (0.974)	–	−1.418 (373) [−0.484, 0.078]	0.208

SD = standard deviation, CI = confidence intervals. Subscripts denote comparisons within the row of Vitality and Warmth/trustworthiness, where one-way ANOVA was significant. Means with different subscripts are significantly different from one another ($p < .05$, Games-Howell type post hoc analysis).
* $p < .05$.
** $p < .01$.

adjustment of these cognitive representations, and as a consequence, we will observe only those relationships that have gone through this process. A further possible explanation is that instead of changing the image of the ideal partner, the importance of the particular characteristic is reduced so that the relationship can be maintained despite the conflict between the aspirations and reality (Gerlach et al., in press) meaning also that this could be captured only by measures that target changes specifically in these features distinctly. Which of these scenarios is more realistic still needs further investigation.

We also investigated the structure of mate preferences. The most frequently employed paradigm in research on mate preferences consists of a list of characteristics. Nevertheless, individual studies highly vary in the number, content, and inclusion criteria for items that appear on their lists (for review, see Csajbók & Berkics, 2017). We combined a theoretical approach (a list developed by Ellis et al., 2002) and an empirical approach (characteristics detected in our pilot study). Subsequently, we conducted exploratory and confirmatory factor analyses to extract a factor model that would explain the variance of the rated items. The resulting structure was then replicated on a large sample of English-speaking participants and the model was found to be a reliable measure of ideal partner preferences. Our four-factor model closely resembles Fletcher et al.'s (1999) three-factor model which includes the following factors: Physical attractiveness/Vitality, Status/Resources, and Warmth/Trustworthiness. The only major difference is that, in our study, Vitality loaded separately.

We may also compare our four-factor structure and a seven-factor model proposed and replicated by Csajbók and Berkics (2017) on a Hungarian sample, in which study Warmth, Physical Appearance, and Status also did appear, but Vitality did not. One can thus conclude that three factors namely Warmth/Trustworthiness, Vitality/Attractiveness, and Status/Resources emerge as present in all three studies referred to above (Csajbók & Berkics, 2017; Ellis et al., 2002; Fletcher et al., 1999) and in our current research.

Since we used this list also for the actual partner assessment, we performed measurement invariance analysis to find out whether the ideal and actual partner assessments have similar and comparable structures. Our results suggest that the measurement invariance is sufficient, which in turn allows for a meaningful comparison of the two constructs, but even so, future research should inspect test-retest reliability and measurement invariance across time.

Additionally, our measurement invariance analysis, which compared the responses of Czech and English-speaking participants, showed that translation of the items did not lead to configural or metric variance in the factor structure. This indicates that the measurable characteristics of mate preferences works similarly for English and Czech speakers. It also suggests that the structure of mate preferences shows certain configural stability at least within Western cultural context. This is further supported by a study which compared ideal partner preferences of Brazilian and Portuguese participants and found a similar factor structure (Neto, da Conceição Pinto, & Furnham, 2012). A comparison of US and Chinese ideal partner preferences, on the other hand, had shown considerable structural differences in the resulting factor models (Kline & Zhang, 2009). Nevertheless, it is not clear whether the reported differences are the consequence of differences in language, culture, or both. Future studies should therefore compare countries where the same language is spoken but cultures are highly dissimilar.

Subsequently, continually-coupled and newly-coupled individuals (who found a partner during the six-month follow-up period) rated their ideal partner preferences and evaluated their actual partners. Our comparison of Manhattan distances between the ideal and actual partner ratings across the groups shows that these distances are significantly smaller in continually-coupled individuals than in the newly-coupled individuals. A similar change in preferences was recently reported by Gerlach et al. (in press) who also found that individuals who established a relationship tended to carry out a downward revision of their preferences. These results are also in line with a study which reported fluctuations in partner evaluations during early relationship formation (Fletcher et al., 2000). In that particular study, however, ideal partner preferences had not been assessed before the relationship initiation, that limits the possibility of comparison with our results.

Interestingly, most previous studies which investigated the effect of relationship status on mate preferences focused on physical attractiveness. It has been reported, for instance, that coupled women prefer more masculine and symmetrical faces (Little et al., 2002; Little et al., 2007) and body odors of dominant men (Havlicek et al., 2005). In contrast, single women preferred dissimilar faces (Lindová et al., 2016) and faces with a direct gaze, which indicates personal interest (Conway, Jones, DeBruine, & Little, 2010). The effect of relationship status on mate preferences is not restricted to heterosexual individuals. It has been reported, for example, that single gay men prefer masculine male voices while a similar association has not been observed in coupled gay men (Valentová, Roberts, & Havlíček, 2013).

Since all the above mentioned studies are based on cross-sectional comparisons, one cannot deduce whether the reported differences in ideal partner preferences are due to the actual relationship status or whether differences in mate preferences influence the probability of being in a relationship. For this reason, we employed a prospective study design: we asked our participants to report their ideal partner preferences while they were single, and then evaluate their actual partner once they met one. The newly-coupled and continually-coupled participants, however, also differed in the time frame of their responses. The continually-coupled individuals reported about their current partner and their ideal preferences within one session, while the newly-coupled individuals reported first about their ideal preferences and six months later about their actual partner. It is thus possible that some part of the observed differences is due to the difference in the procedure. We do not think, however, that this is likely, because we found no significant differences in the ratings of their actual partners between the two groups, i.e., newly- and continually-coupled participants. Nevertheless, future studies should employ a complete longitudinal design to fully comprehend relationship status-related changes in ideal partner preferences.

Related to this, we would argue that the introduction of using Manhattan distance is a better solution than simply subtracting the actual partner's evaluation from the partner ideals in each factor, four times over, since overall, even small differences in each dimension can mean a large profile difference when accounting for all the factors at the same time. Computing discrepancies between two points in a multidimensional space is a task with several potential solutions. We propose that Manhattan distance is an optimal choice in defining mate value and distance between targets when the research design implies an Additive Model of mating (i.e., the participants rate a list of characteristics as if each of them would be an additional benefit of the evaluated partner), while others used Euclidean distance approach (Conroy-Beam et al., 2016; Conroy-Beam & Buss, 2016b). As explained above, in the current research, use of Manhattan distance is in accordance with the implicit mate value definition of the design (i.e., the sum of the characteristics is equal to the assumed mate value and also equal to the Manhattan distance from the origin, while Euclidean distance from the origin can result different mate values for different target points even when the sums of the characteristics are the same). However, one may consider other mating models or research designs where the benefits of each method should be carefully considered. We believe that our proposed method will inspire future research designs including computational models.

To conclude, we developed a reliable measure for assessing both an ideal and an actual partner. Our four-factor model can be seen as an extension of Fletcher's widely used three-factor model. More importantly, we show that people in romantic relationships adaptively adjust their ideal mate preferences in such a way that a discrepancy between their ideal and actual partner is reduced. Future studies should

employ a complete longitudinal design to show in what phase of relationship formation and in what type of relationships such changes take place, and whether they are rather gradual or take a form of sudden drop. Furthermore, one may expect some interindividual differences in the flexibility of mate preferences: it is possible that some individuals adjust their preferences to a lower degree, which may in turn decrease their relationship satisfaction and lead to a breakdown of the relationship. A better understanding of these psychological processes might help identify individuals vulnerable to repeated discord in their romantic relationships.

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Appendix A. Supplementary material

Supplementary Tables to this article can be found online at https://doi.org/10.1016/j.paid.2018.07.019.

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Self-Perceived Mate Value Is Poorly Predicted by Demographic Variables

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Abstract

Mate value is a construct that can be measured in various ways, ranging from complex but difficult-to-obtain ratings all the way to single-item self-report measures. Due to low sample sizes in previous studies, little is known about the relationship between mate value and demographic variables. In this article, we tested the Mate Value Scale, a relatively new, short, 4-item self-report measure in two large samples. In the first sample of over 1,000, mostly college-age participants, the scale was found to be reliable and correlated with criterion variables in expected ways. In the second, larger sample, which included over 21,000 participants, we have tested for differences across demographics. Contrary to theoretical expectations and previous findings with smaller samples, the differences were either very small (sexual orientation, age, education) or small (sex, socioeconomic status, relationship status) in terms of their effect size. This suggests that the scale is not measuring "objective" mate value (as understood either in terms of fitness or actual mating decisions by potential partners on the "market"), but a self-perception of it, open to social comparison, relative standards, possibly even biases, raising questions about measuring self-perceived versus objective mate value.

Keywords

mate value, demographics, self-perception, psychometrics, mate preferences

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Research is often portrayed like a process of construction, where your carefully laid plans and purposeful efforts result in a neat, well-organized structure. Research, however, can also be similar to a journey when you do not necessarily end up where you planned to be. This article is a story of such a journey. We set out to simply validate a measure of mate value and test its relationship with demographics but ended up with unexpected results and perhaps more questions than answers.

Mate value and the perception thereof are practically unavoidable concepts in evolutionary psychology. If human beings, in the course of evolution, were selected to find "good" partners to enhance their reproductive fitness, then this implies that potential partners can be assigned different "values," and the self can also be assigned such a "value" to save time and energy by not trying to get access to potential mates who would reject one anyway. Similarly, mating someone without detecting his or her low mating potential can be the costliest mistake both in the proximate and ultimate perspective (Jonason, Garcia, Webster, Li, & Fisher, 2015).

Thus, it is no wonder that over the past several decades, there has been a lot of theorizing on the "mate value" (e.g., Buss, 1989, Symons, 1985; and later, for instance, Brase & Guy, 2004; Buss & Shackelford, 1997; Edlund & Sagarin, 2010; Fisher, Cox, Bennett, & Gavric, 2008; Regan, 1998; Singh, 2002). All this research seems to share four underlying assumptions, namely, (1) individuals differ with respect to their value as potential mates on the "mating market," (2) this value is assessed by their potential mates, (3) individuals have a by and large accurate sense of how much they are "worth" as potential romantic partners, and (4) the preferences driving these assessments were shaped by fitness and parental investment concerns over the course of evolution, that is, how to choose a mate who

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provides good genes or high parental investment or both to one's offspring.

This concept of mate value may be difficult to measure, mainly due to the complexity of the variables involved and the cost of measuring some of them (for a short overview, see Edlund & Sagarin, 2014, pp. 72–73). Moreover, it can be measured either along distinct factors (e.g., Fisher et al., 2008) or holistically (e.g., Edlund & Sagarin, 2014). One may want to answer several further questions before measuring mate value. Along what dimensions do people evaluate themselves as potential partners? Are these dimensions the same as the ones they use to evaluate others (cf. Csajbók & Berkics, 2017; Fletcher, Simpson, Thomas, & Giles, 1999)? How are these dimensions combined to form up an "overall mate value?" Do people simply add up (or average) their evaluations or do they use some kind of weighting? Do they consider low evaluations along some dimensions to be "dealbreakers" (Jonason et al., 2015) or can these be compensated for by excelling in other traits? How do interactions on the mating market affect perceptions of one's own mate value as well that of others?

One, apparently easy and practical way to overcome all these challenges is to accept a seemingly plausible assumption and simply ask people to assess their own mate value. If Assumption 3 is true, that is, people by and large know their own mate value (even without necessarily being aware of the underlying processes; Brase & Guy, 2004; Edlund & Sagarin, 2014), then, from a measurement perspective, all the complexities of mate value can be left for further research, and the researcher wanting to use mate value as a variable can proceed with a simple instrument. Finally, a brief and simple scale can easily be transformed so as to evaluate different targets (e.g., self, partner), and its briefness and simplicity reduce participant fatigue during administration of extensive test batteries (Gillen, Collisson, Murtagh, Browne, & McCutcheon, 2016).

Using this approach, one may go even as far as to assess mate value with a single item (Brase & Guy, 2004). Recently, a Mate Value Scale (MVS) was developed by Edlund and Sagarin (2014) along the same lines, but in order to increase reliability, it includes 4 items instead of just 1. Studies that used this scale report excellent internal consistency as measured by Cronbach's αs, and this applies even to the partner's mate value assessment (Blake, Bastian, O'Dean, & Denson, 2017; Brindley, McDonald, Welling, & Zeigler-Hill, 2018; Csajbók & Berkics, 2017; Edlund & Sagarin, 2014; Erik & Bhogal, 2016; Gillen et al., 2016; Kasumovic, Blake, Dixson, & Denson, 2015; Lemay & Wolf, 2016; March & Wagstaff, 2017; McDonald, Coleman, & Brindley, 2019). Evidence regarding the robustness of the MVS's structure as assessed by confirmatory factor analysis (CFA) is, however, limited.

The research presented in this article started with the simple goals of testing the psychometric properties of the MVS and then by using novel and large samples, extending its validity and learning more about the relationship between mate value and demographics.

Mate Value and Self-Esteem

Self-perceived mate value and self-esteem are related constructs, as both of them involve an evaluation of the self. Manipulated rejections based on mating-specific attributes decreased self-esteem in both men and women (Pass, Lindenberg, & Park, 2010), and analogous results were achieved when individuals received derogatory comments regarding their mating-specific attributes (Campbell & Wilbur, 2009). Similarly, self-perceived mate value decreased when participants faced heterosexual rejection (Zhang, Liu, Li, & Ruan, 2015). Correlation between the global self-esteem and mate value in previous research varied according to how these variables were measured, from as low as $r_{male} = .16$, $r_{female} = .26$ (Shackelford, 2001), and $r = .325$ (Brase & Guy, 2004) to as high as $r = .51$ and .55 (Kirkpatrick, Waugh, Valencia, & Webster, 2002), $r = .56$ (Edlund & Sagarin, 2014), and $r_{male} = .61$ and $r_{female} = .53$ (Penke & Denissen, 2008). This may suggest that the global self-esteem and mate value can be concepts related yet distinct from one another (cf. Brown, 2006).

Mate Value and Demographics

Evolutionary psychology offers quite a few hypotheses about the relationship between demographics and mate value. Because men's parental investment in terms of resources is essential at times when the mother cannot contribute due to caring for a child or children (Trivers, 1972), socioeconomic status (SES) should be more closely related to self-perceived mate value in men than in women. On the other hand, female appearance is an indicator of fertility, which is age-dependent, it is therefore expected that women's age should be an important predictor of their mate value (Brase & Guy, 2004). Furthermore, it is predicted that being coupled is an indicator of being desired as a spouse (Brase & Guy, 2004), but since self-esteem and marital satisfaction are also related (Roberts & Donahue, 1994), one may expect that relationship satisfaction will have a moderating effect on any positive relation between relationship status and mate value (Brase & Guy, 2004). Unfortunately, only a very limited amount of research exists on the demographics of mate value. The few studies that were published by and large support these evolutionary predictions (with respect to SES: Mafra & Lopes, 2014; sex and culture: Goodwin et al., 2012; sex, age, and marital status: Brase & Guy, 2004). On the other hand, although these studies both theoretically and empirically support the assumption of a relation between demographic variables and mate value, the robustness of their findings should be considered with caution due to small and special samples. Brase and Guy (2004) had a UK university campus sample of 155 participants, divided into as many as 12 cells in a $2 \times 2 \times 3$ analysis of variance (ANOVA). Goodwin et al. (2012) had a large sample, but from seven different countries, making the sample size per country between 85 and 198, and all participants were students. Mafra and Lopes (2014) had a sample of 64 undergraduate students compared with 86 public school students. Thus, although the studies above are important

because they seem to be the first and thus far only ventures to explore the demographics of mate value, their results were based on small samples of mainly students, limiting their external validity.

Self-perceived mate value is important in choosing a partner because people tend to adjust their preferences to their self-perceived mate value (Edlund & Sagarin, 2010; Regan, 1998; Wenzel & Emerson, 2009). As a consequence, people may apply positive assortment with respect to self-perceived mate value and self-evaluation of the partner (cf. Luo, 2017). Self-perceived mate value is therefore expected to correlate positively with expectations about a potential partner. The strength of these relations may, however, vary across the measured dimensions and may differ in men and women (cf. Csajbók & Berkics, 2017).

Goals and Presentation of the Studies

The aim of the current research was 2-fold: first, to test the MVS as a conveniently short measure of mate value against several measures of other, more or less related constructs (Study 1). Other measures of mate value were not included, as the MVS was already tested against the Mate Value Inventory (Kirsner, Figueredo, & Jacobs, 2003) and the Mate Value Single Item Scale (Brase & Guy, 2004) in the debuting research on the scale (Edlund & Sagarin, 2014). Additionally, in a previous study (Csajbók & Berkics, 2017), in a large sample of 2,179 participants, we have already obtained moderate to high positive correlations between MVS scores and self-ratings of mating-relevant traits (the correlations were especially high with self-ratings of physical attractiveness, .65 and .69 for females and males, respectively).

The second goal was to use the MVS to test for mate value differences across demographics in an unprecedentedly large sample (Study 2). To give a stronger emphasis to our findings regarding the demographics, many of the psychometric details, especially from Study 1, are moved to the Supplementary Material, and only the essentials are presented here.

Study 1

Convergent and discriminant validity of the MVS was tested by CFA in a large Hungarian sample, whereby self-esteem, life satisfaction, loneliness, and sociosexual orientation were employed as criterion variables. Since self-perception of mate value and self-esteem both involve an evaluation of the self, and thus can be related constructs, and also because previous research, too, has shown them to be correlated, it was expected that these two variables should correlate substantially but not so closely as to suggest that they are one single construct (cf. Brown, 2006, where it is suggested that discriminant validity is poor when $r > .80$). Correlation with mate value was expected to be moderate in the case of life satisfaction and loneliness, because these factors are conceptually less strongly related to mate value. Although mate value may be an important predictor (as well as a consequence) of life satisfaction and loneliness, these two factors may have other correlates as well, buffering against the link between mate value and them. For instance, a person with low mate value may have many friends or enjoy professional success and therefore score high on satisfaction and low on loneliness. For sociosexual orientation, expectations may be a bit more complex, as this construct consists of three distinct factors: desire for causal relationships, attitudes about them, and behavior (engaging in casual sex). For the former two, weak correlations were expected, because attitudes about and desire for casual sex may still be high in people with a relatively low mate value. For behavior, the correlations were expected to be positive, because for people with high mate value it is easier to attract casual partners, and high-value males may even adopt a more short-term strategy. However, as this link is more complex—also depending on how high (or low) people set their standards, what cultural values they have, and so on—the correlation is not expected to be as strong as with self-esteem.

Method

Participants and Procedure

A convenience sample of 1,131 heterosexual Hungarian adults (62.7% female) aged between 18 and 45 ($M = 23.19$, $SD = 5.01$) completed an online questionnaire using Google Forms platform. The questionnaire was advertised on social media. Participation was voluntary and anonymous.

Measures

The MVS (Edlund & Sagarin, 2014) was translated into Hungarian and back to English to check translation quality. The goal was to measure participants' perceptions of their own mate value (see also Csajbók & Berkics, 2017; for the Hungarian translation of the scale, see the Supplementary Material). The scale consists of 4 items (all measuring in a single direction), which are rated on an anchored Likert-type scale from 1 to 7. Internal consistency of the scale in our sample was good ($\alpha = .86$). Criterion variables were measured with the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965; Hungarian version: Sallay, Martos, Földvári, Szabó, & Ittzés, 2014), the Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; Hungarian version: Martos, Sallay, Désfalvi, Szabó, & Ittzés, 2014), the short version of the UCLA Loneliness Scale (ULS; Peplau & Cutrona, 1980; Hungarian version: Bőthe et al., 2018), and the revised Sociosexual Orientation Inventory (SOI-R; Penke & Asendorpf, 2008; Hungarian version: Meskó, Láng, Kocsor, & Rózsa, 2012). All of the above listed criterion measures had at least good ($\alpha > .80$) internal consistencies in our sample.

Data Analysis

First, only the four MVS items (Partial Model 1), then the MVS and the RSES items together (Partial Model 2), and finally all of the items of the instruments above (full model) were entered

into CFA models of increasing complexity in Mplus Version 7 as indicators, whereas the measured constructs functioned as latent variables or factors on which their respective indicators loaded. The full model and its results are presented here; see the Supplementary Material for further details. In line with previous literature, the MVS, the SWLS, and the short version of the ULS were represented as single factors; the SOI-R as three factors; and the RSES with a bifactorial structure including a general self-esteem factor and two methodological factors for positive/negative item wording (see Figure 1; cf., Urbán, Szigeti, Kökönyei & Demetrovics, 2014). The SOI-R behavior factor was measured with just 2 items: Item 2 was omitted due to a strong interitem correlation ($r > .80$). The full model was first fitted to the whole sample, then measurement invariance was tested across sex. Due to the nonnormal distribution of some items, MLR estimator was used.

Results

The full model fit the data acceptably in the pooled sample and had scalar invariance across sex (Table 1) because the decrease in fit indices did not exceed the recommended cutoff values (Chen, 2007). As seen from Table 2, the latent variable for MVS had a medium to strong correlation with self-esteem, life satisfaction, and loneliness (in descending order) in both the male and female subsamples. Mate value had only weak, if any, correlations with sociosexual orientation, the strongest being the link between mate value and the behavioral factor of the SOI-R. The means of the latent variables differed between the sexes in self-esteem and two of the SOI-R factors: Males had a somewhat higher self-esteem ($M = .159$), a much more positive attitude about casual sex ($M = .853$), and a much higher level of desire for casual sex ($M = .926$; all male means are standardized values with female means set at zero). The two sexes did not differ significantly in the latent mean of the MVS items (male $M = -.093$).

Discussion

Results of Study 1 suggest that the MVS is a reliable and valid measure of self-perceived mate value. It correlates strongly with general self-esteem but not as strongly as to suggest that the two variables measure the same phenomenon. The latent mean of the MVS also shows medium to strong correlations with life satisfaction and loneliness, and its correlation with sociosexual orientation is, as expected, rather weak for the attitude and desire factors, while significant but still not high for the behavioral factor.

Study 2

The goal of Study 2 was to test the association between various demographic characteristics and mate value. More specifically, we examined differences in mate value across age, sex, level of education, SES, relationship status, and sexual orientation.

Females were expected to have a higher self-perceived mate value than men. Females tend to have a larger parental investment, thus they are the more selective or demanding of the two sexes, while males as the less investing sex have lower standards and are more interested in having more partners and initiating sexual relationships (cf. Buss & Schmitt, 1993). This implies that for men, it should be a more common experience that they have to compete and put effort in finding partners and face the possibility of rejection and failure, while for women, it should be a more common experience that they are desired and sought-after as potential partners, even though many times by men whom they themselves do not prefer. Certainly, there is much more to self-perceived mate value than that, so the effect may be so small that a really large sample is needed to detect it. In fact, previous studies with smaller samples have not found a main effect by sex (Brase & Guy, 2004; Goodwin et al., 2012; Mafra & Lopes, 2014), but in a previous sample of 2,179 participants, we did find such an effect (Csajbók & Berkics, 2017).[1] Since in Study 2, we had an even larger sample (see below), we expected a weak but statistically significant difference to emerge.

Concerning age, we predicted that its effect is sex dependent. Since in women, mate value is more dependent on youthful appearance than in men, it is expected to decline with age. In contrast, mate value in men is more closely related to status achievement, a factor that shows a positive association with age. Mate value in men ought to be therefore either stable across different ages or even increase with age (see Brase & Guy, 2004). Similarly, we expected that sex and SES would show an interaction with respect to mate value, as well as sex and education, since the latter is an important predictor of social status. Previous studies suggest that men with higher status and education estimate their mate value higher, and in women, this relation is much weaker (Mafra & Lopes, 2014).

Finally, we tested the effect of relationship status on mate value. We expected that single participants would have lower self-perceived mate value for two reasons: (1) they may be single because of actually having a low mate value and evaluate their mate value in the light of their lack of success in mating and (2) they may temporarily assess their self-perceived mate value lower due to recent mating failures. However, this hypothesis may be qualified by the concern that some of the single participants might stay single to pursue more short-term affairs, thus having a more unrestricted sociosexuality. Additionally, we have seen in Study 1 that SOI's behavioral aspect correlates positively with self-perceived mate value. Therefore, single participants were analyzed according to how many sexual partners they had. Further, in coupled participants, relationship satisfaction may also correlate with mate value. It has been shown that marital disharmony decreases self-esteem (Shackelford, 2001). One may therefore compare the self-perceived mate value of single participants to values found in persons unsatisfied with their existing relationships.

Method

Participants and Procedure

The participants were Hungarian adults (14,441 male, 6,847 female), aged between 18 and 76 ($M = 33.45$, $SD = 11.29$).

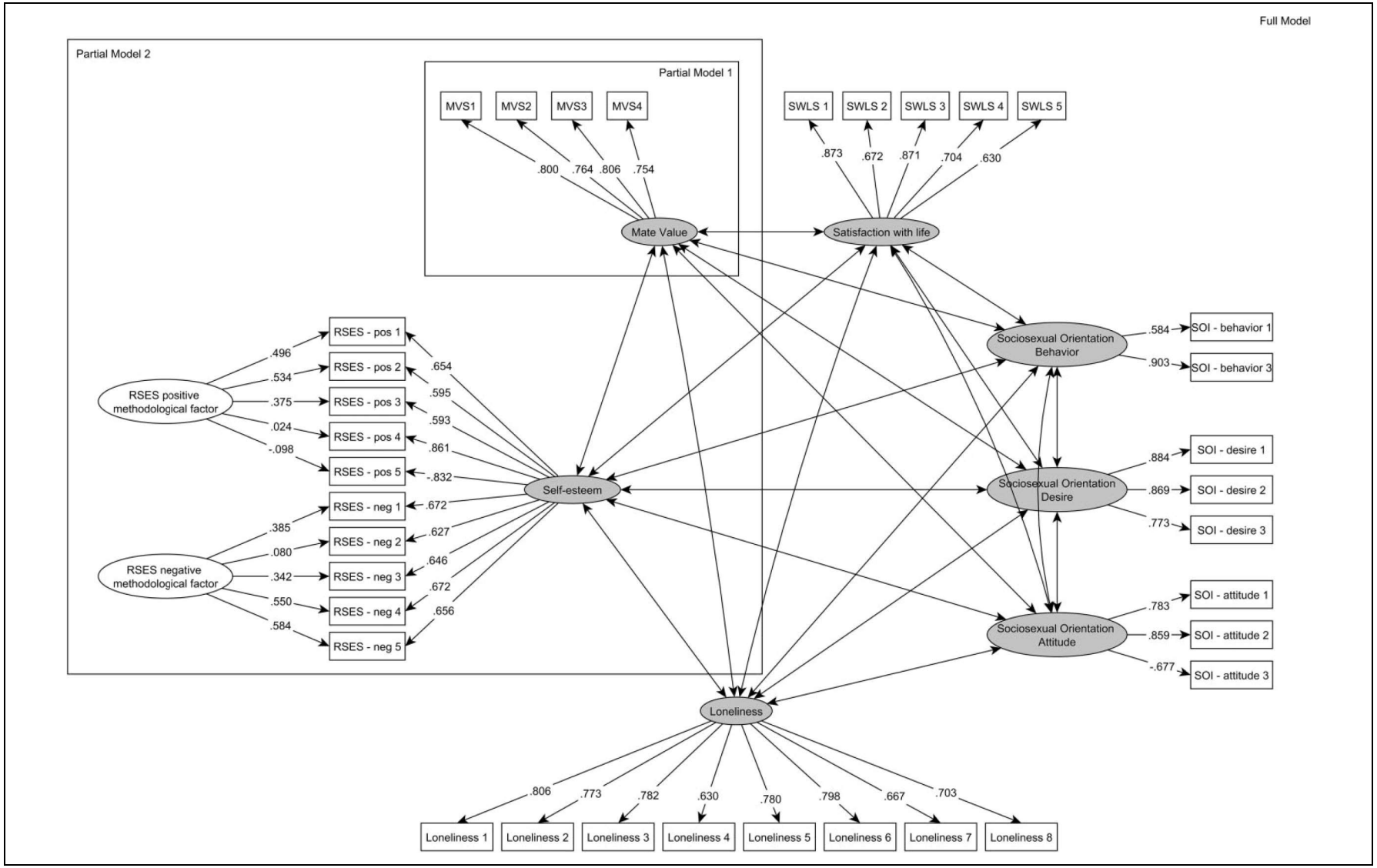

Figure 1. Illustration of the Partial Models 1 and 2, and standardised loadings of the full model.

Table 1. Model Fit and Invariance of the full model.

Model	χ^2 (*df*)	CFI	TLI	RMSEA [90% CI]	$\Delta\chi^2$ (*df*)	ΔCFI	ΔTLI	ΔRMSEA
Pooled	1,733.037 (529)	.940	.933	.045 [.043, .047]				
Configural	2,218.085 (1,058)	.942	.935	.044 [.041, .147]				
Metric (loadings)	2,293.237 (1,094)	.940	.935	.044 [.042, .047]	75.169 (36)	−.002	.000	.000
Scalar (intercepts)	2,514.515 (1,120)	.930	.926	.047 [.044, .049]	230.646 (26)	−.010	−.009	.003

Table 2. Interfactor Correlations and Standardized Sex Differences of Means.

Measures	1.	2.	3.	4.	5.	6.	7.	Std. Sex Diff.
1. MVS	—	.651***	.513***	−.391***	.183***	.164***	−.022	−.093
2. RSES	.631***	—	.671***	−.605***	.105*	.104*	−.121**	.159*
3. SWLS	.549***	.688***	—	−.593***	−.004	.063	−.181***	−.029
4. Loneliness	−.502***	−.647***	−.633***	—	−.064	.003	.300***	−.116
5. SOI behavior	.308***	.209***	.138**	−.200***	—	.653***	.355***	.060
6. SOI attitude	.123	.123	.040	−.016	.399***	—	.486***	.853***
7. SOI desire	−.103	−.140*	−.121*	.234***	.105	.440***	—	.926***

Note: All variables are latent variables of the full scalar model tested in Mplus Version 7. Correlations in the female subsample are above the diagonal, correlations for males below it. MVS = Mate Value Scale; RSES = Rosenberg Self-Esteem Scale; SWLS = Satisfaction With Life Scale; SOI = Sociosexual Orientation Inventory. Std. sex diff. = standardized sex difference. Female means were standardized to zero, values in the table are standardized male means.
*p < .05. **p < .01. ***p < .001.

Participants were recruited online on "444.hu," a gonzo-type, politically leftist-liberal news portal popular among young, urban, educated readers. Thus, the sample was not representative of the Hungarian adult population, but it was large enough to include at least a few hundred participants from demographics that were underrepresented in it (e.g., people above 50, people with only a primary education, or people having below-average living conditions).

To enhance data reliability, participants were removed from the sample if their responses were largely incomplete or if they gave inconsistent responses (e.g., reporting that their first sexual encounter happened at an age they were younger than) or if they gave unengaged responses (e.g., they gave the same response to a number of questions including reverse items).

Based on their self-report, 17,978 (84.5%) participants viewed themselves as heterosexual, 1,932 (9.1%) as heterosexual with some same-sex attraction, 563 (2.6%) as bisexual, 140 (0.7%) as homosexual with some other-sex attraction, 511 (2.4%) as homosexual, 37 (0.2%) participants viewed themselves as asexual, and 127 (0.6%) were ambiguous as to their sexual orientation (the latter two groups were excluded from group comparisons due to small sample sizes). In total, 5,248 (24.7%) participants reported being single, 8,939 (42%) in a relationship, 851 (4%) engaged to be married, 5,233 (24.6%) married, 596 (2.8%) divorced, 104 (0.5%) widowed, and 317 (1.5%) reported other specific types of relationship. Again, the two last-named groups were excluded from group comparisons due to small sample sizes.

Of the participants, 59% reported higher education, 33.1% graduated from high school, 4.7% from vocational education, and 3.3% from elementary school. SES was assessed by a single item ranging from 1 (*the worst living conditions*) to 7 (*the best living conditions*). However, due to a low number of participants who indicated a low status, we decided to create subgroups in order to create sufficient sample sizes for comparison. In this way, we ended up with 4.8% participants who reported living in worse-than-average conditions, 25% in average living conditions, 43.4% somewhat better than average, and 26.8% better than average or best living conditions. With respect to the place of residence, 52.6% lived in the capital, 37.7% in cities and towns, and 9.6% in villages. In total, 68% of participants had no children and 3% had not yet had a sexual partner in their life.

Measures

Participants completed an online questionnaire implemented with the Qualtrics platform. They filled in the MVS, and if they were in a relationship, they also rated their general relationship satisfaction on a 5-point Likert-type scale. They were also asked to give the number of sexual partners they had (response options were exact numbers up to 10, and categories, e.g., "21–30" above 10).

Minimum long-term partner standards were assessed by a partner preference trait list adapted from Csajbók and Berkics (2017). This trait list consists of 23 items, loading on seven essential dimensions of partner evaluation. In the current study, participants were asked—independently of being currently in a relationship—to indicate the minimum level of each characteristic they would require in order to initiate a long-term relationship with a potential partner on a 7-point Likert-type scale (1 = *not at all important that my partner should be like this*, 7 = *very important that my partner should be like this*).

Data Analysis

First, only the 4 MVS items (simple model), and then the 4 MVS as well as the 23 minimum standards items (full model), were entered into CFA models in Mplus Version 7 as indicators. The measured constructs were latent variables or factors on which their respective indicators loaded: one factor for the MVS items, and seven factors for the minimum standards items. The seven factors of minimum standards were warmth, emotional stability, physical appearance, sexual passion, social status, intellect, and dominance (for details, see Csajbók & Berkics, 2017).

The psychometrics of Study 2 are presented in more detail, because invariance testing was necessary for comparisons across demographics. First, both models were fitted to the whole sample, then measurement invariance in the simple model was tested across the demographic variables used for comparisons. Invariance was first tested across sex and sexual orientations, then for heterosexual participants only, across age groups, education, SES, and relationship status. For the simple model (MVS only), ML estimator was used. Of the fit indices, CFI was considered to be the most important, because TLI and especially RMSEA are sensitive to model parsimony, imposing a penalty on models with a low *df* (see Brown, 2006, pp. 83–86), but the latter indices are also included for the sake of comparing configural, metric, and scalar models. Due to a nonnormal distribution of some of the minimum standards items, MLR estimator was used for the full model. In this model, invariance was tested across sex only, because the purpose of adding the minimum standards items was to analyze the MVS in a more complex model with better RMSEAs and to see if the MVS scores correlate positively with minimum standards as previous research has shown. In the full model, only heterosexual participants were included because in some of the nonheterosexual groups the sample sizes were low. The models are shown in Figure 2.

The effect of the various demographic variables (sexual orientation, education, SES, age, and relationship status) on the mean of the MVS was tested using two-way ANOVAs, with sex as the other independent variable, to compare categories of education, status, and age in a way similar to previous studies (Brase & Guy, 2004; Mafra & Lopes, 2014). Except for sexual orientation, demographic effects were tested in heterosexual participants only.

When testing for the effect of age—in order to detect a possible significant drop around menopause or other specific age categories—ranges were based on two considerations: (1) balancing the number of participants in each age group and (2) setting the ranges in meaningfully specific sections. The sample was therefore divided in eight groups based on cutoff points at 21, 26, 31, 36, 41, 46, and 51 years of age (see Table 3 for mate value results for both sexes and all age groups). Since sample sizes and variances in the different demographic groups in some cases differed significantly, Games–Howell type post hoc analysis was chosen. Although the results of the two-way ANOVAs are reported, for ease of interpretation, post hoc analyses are performed on the two sexes separately. Where possible, Pearson (for age) or Spearman (for education and SES) correlation was computed to test the linear relationship between mate value and interval or ordinal demographic variables.

To estimate the overall predictive strength of the demographic variables for mate value, we ran two linear regression analyses, one for each sex. For SES, education, and relationship (combined with relationship satisfaction and number of sexual partners), we created dummy variables and chose their baseline according to the largest subgroups to avoid multicollinearity (somewhat better than average living conditions, high school education, and being in a good relationship for SES, level of education, and relationship status, respectively).

Results

Model Fit

The simple model with the 4 MVS items fits the data in the pooled sample well (see Table 4) with the exception of a poor RMSEA, which is, however, known to perform badly in very simple models (for a model consisting of four indicators loading on one factor, just like in our case, see Kenny, Kaniskan, & McCoach, 2015). Scalar invariance was established across all of the demographic variables, except SES, for which partial scalar invariance was established at the cost of relaxing the intercept of 1 item (see the Supplementary Material for details). The full model also had an acceptable fit to the data, although scalar equivalence across sex could only be partially established, by relaxing the intercept of an MVS and a minimum standards item.

Correlations between the MVS and the minimum standards factors, as well as sex differences in these variables, can be found in Table 5. The two sexes were analyzed separately but the pattern was similar: The MVS correlated positively with the seven minimum standards dimensions, and in both sexes, the highest level of correlation was observed with passion and appearance.

Mate Value Across Demographics

The average male mate value was 4.71 ($SD = 1.08$), while the average female mate value was 5.05 ($SD = 1.05$). This indicates a small but statistically significant difference in mate value between the sexes in the expected direction (i.e., females have higher mate value), $t(13{,}846.60) = -22.20$, $p < .001$, Cohen's $d = .32$, $R^2 = .026$. Highly similar results were achieved when only heterosexuals were tested: Females scored higher self-perceived mate value than men ($M_{male} = 4.72$, $SD = 1.06$; $M_{female} = 5.06$, $SD = 1.03$), $t(17{,}976) = -19.343$, $p < .001$, Cohen's $d = .33$, $R^2 = .025$.

Further analyses tested the effects of other demographic variables in 2 × 2 ANOVAs involving sex as the other independent variable. To test the effect of sexual orientation on self-perceived mate value, a two-way ANOVA was performed

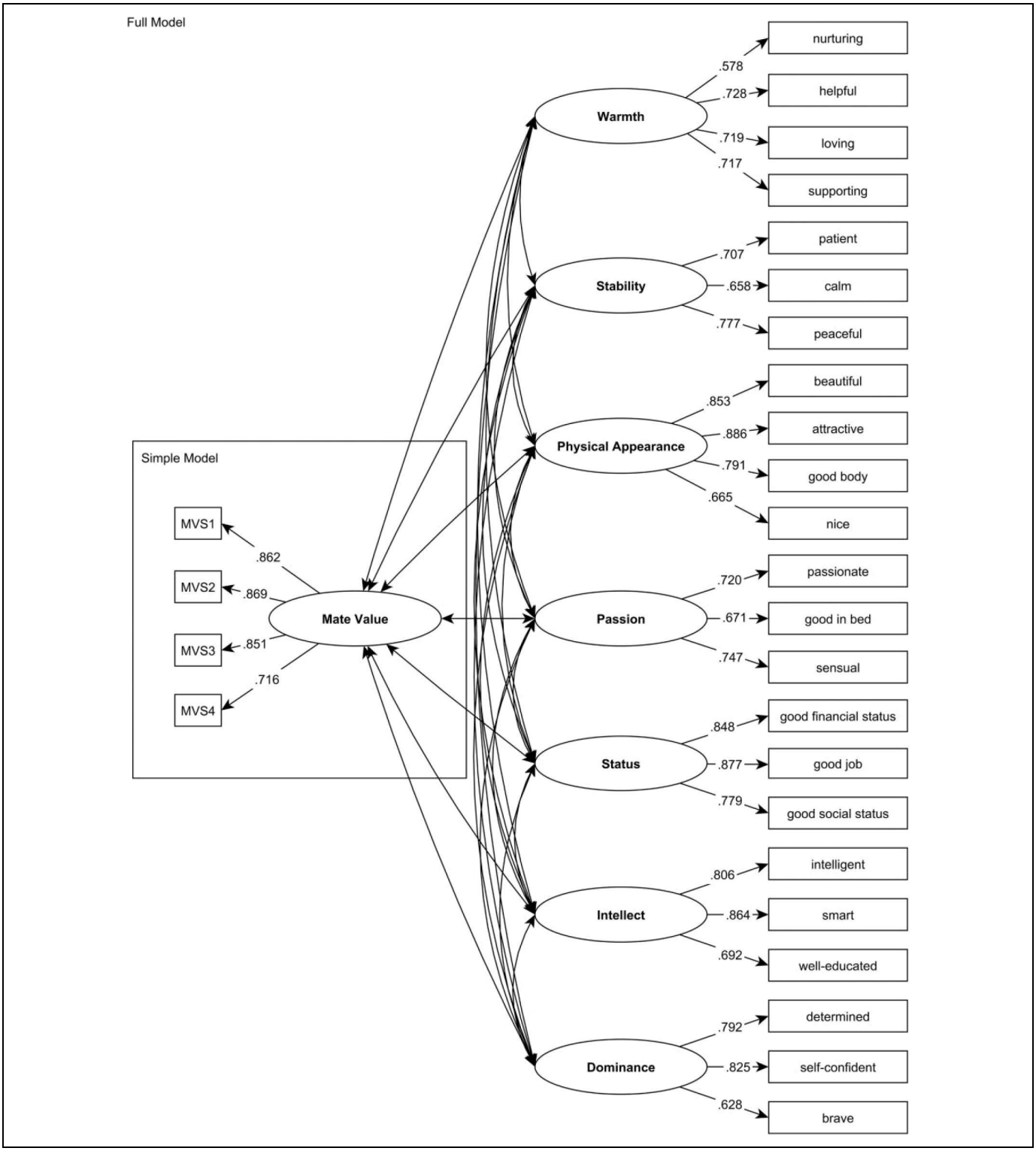

Figure 2. Illustration of the Simple Model, and standardised loadings of the Full Model.

(across sex and sexual orientation; for the means and standard deviations, see Table 6). Results showed significant main effects of both sex, $F_{sex}(1, 21114) = 48.727$, $p < .001$, $\eta_p^2 = .002$, and sexual orientation, $F_{orientation}(4, 21114) = 3.956$, $p = .003$, $\eta_p^2 = .001$, and a significant interaction between sex (male or female) and sexual orientation, $F_{sex \times orientation}(4, 21114) = 5.265$, $p < .001$, $\eta_p^2 = .001$. The Games–Howell post hoc test suggests that female mate value does not differ significantly across sexual orientation. Among male participants, on the other hand, hetero- and homosexual individuals scored

Table 3. Descriptive Statistics for Mate Value in Relation to Sex and Age.

Sex	Age Groups (Years)	*N*	Mean	*SD*
Male	18–20	733	4.86	1.16
	21–25	2,341	4.76	1.14
	26–30	2,316	4.76	1.10
	31–35	1,818	4.72	1.08
	36–40	1,756	4.72	1.07
	41–45	1,453	4.71	1.01
	46–50	927	4.64	0.97
	Older than 51	1,439	4.62	0.93
Female	18–20	432	5.03	1.06
	21–25	1,523	5.11	0.95
	26–30	1,171	5.13	1.07
	31–35	669	5.16	1.00
	36–40	478	5.00	1.04
	41–45	401	4.97	1.06
	46–50	258	4.75	1.11
	Older than 51	263	4.78	1.04

higher self-perceived mate values than heterosexuals with some same-sex attraction.

After testing for the effects of sexual orientation, further analyses were performed on heterosexual participants only. Education had a significant main effect on mate value, $F_{\text{education}}(3, 17970) = 13.483$, $p < .001$, $\eta_p^2 = .002$, as also had sex, $F_{\text{sex}}(1, 17970) = 108.103$, $p < .001$, $\eta_p^2 = .006$. The interaction between these two factors was also significant, $F_{\text{sex} \times \text{education}}(3, 17970) = 3.681$, $p = .012$, $\eta_p^2 = .001$, Spearman's ρ was .088 for males ($p < .001$) and .026 for females ($p = .056$). For descriptive statistics, see Table 7. Games–Howell post hoc test had revealed that participants with only vocational or primary education had the lowest mate value among men, while high school graduates had higher, and college or university graduates had the highest self-perceived mate value. In women, education had no statistically significant effect on mate value.

SES had a significant main effect and interaction with sex on mate value, $F_{\text{SES}}(3, 17970) = 322.447$, $p < .001$, $\eta_p^2 = .051$; $F_{\text{sex}}(1, 17970) = 235.824$, $p < .001$, $\eta_p^2 = .013$; $F_{\text{SES} \times \text{sex}}(3, 17970) = 5.583$, $p = .001$, $\eta_p^2 = .001$, Spearman's ρ was .282 for males and .229 for females (p < .001 for both sexes). For descriptive statistics, see Table 8. Post hoc analyses suggest that SES affects self-perceived mate value systematically at all levels of status. In particular, the lower the individuals' SES, the lower their self-perceived mate value. This holds for both sexes. Since Item 4 of the MVS had a problematic measurement invariance across SES, the two-way ANOVA was repeated on the mean of the first 3 items only. The results,

Table 4. Model Fit and Invariance in the Simple and the full model.

Model	χ^2 (*df*)	CFI	TLI	RMSEA [90% CI]	$\Delta\chi^2$ (*df*)	ΔCFI	ΔTLI	ΔRMSEA
Simple model (Mate Value Scale [MVS] only)—equivalence across sex and sexual orientation								
Pooled	922.086 (2)	.982	.946	.148 [.140, .156]				
Configural	962.848 (12)	.981	.944	.150 [.142, .158]				
Metric (loadings)	1,002.393 (27)	.981	.974	.101 [.096, .107]	39.546(15)	.000	.030	−.049
Scalar (intercepts)	1,423.163 (42)	.973	.977	.097 [.092, .101]	420.770(15)	−.008	.003	−.004
Simple model (MVS only)—equivalence across age groups								
Configural	882.806 (16)	.980	.941	.155 [.147, .164]				
Metric (loadings)	944.837 (37)	.980	.973	.104 [.099, .110]	62.041(21)	.000	.032	−.041
Scalar (intercepts)	1,258.049 (58)	.973	.978	.096 [.091, .101]	313.202(21)	−.007	.005	−.008
Simple model (MVS only)—equivalence across education								
Configural	805.963 (8)	.982	.946	.149 [.140, .158]				
Metric (loadings)	845.871 (17)	.981	.973	.104 [.098, .110]	39.908(9)	−.001	.027	−.045
Scalar (intercepts)	983.523 (26)	.978	.980	.091 [.086, .095]	137.652(9)	−.003	.007	−.013
Simple model (MVS only)—equivalence across socioeconomic status								
Configural	747.382 (8)	.982	.947	.143 [.135, .152]				
Metric (loadings)	799.428 (17)	.981	.974	.101 [.095, .107]	52.045(9)	−.001	.027	−.042
Scalar (intercepts)	1,428.052 (26)	.966	.969	.110 [.105, .114]	628.625(9)	−.015	−.005	.009
Scalar (partial)[a]	987.922 (25)	.977	.976	.097 [.092, .102]	188.494(6)	−.004	.002	−.004
Simple model (MVS only)—equivalence across relationship status								
Configural	832.835 (12)	.980	.941	.152 [.143, .161]				
Metric (loadings)	925.701 (27)	.979	.971	.106 [.100, .112]	92.866(15)	−.001	.030	−.046
Scalar (intercepts)	1,057.489 (42)	.976	.979	.090 [.086, .095]	131.788(15)	−.003	.008	−.016
Full model (MVS and minimum standards scales)—equivalence across sex								
Pooled	10,431.191 (296)	.937	.925	.044 [.043, .044]				
Configural	10,642.896 (592)	.934	.922	.043 [.043, .044]				
Metric (loadings)	10,946.087 (611)	.933	.923	.043 [.043, .044]	306.605(19)	−.001	.001	.000
Scalar (intercepts)	12,863.778 (630)	.920	.911	.046 [.046, .047]	2,248.779(19)	−.013	−.012	.003
Scalar (partial)[b]	12,068.345 (628)	.925	.917	.045 [.044, .046]	1,281.858(17)	−.008	−.006	.002

[a]Partial scalar invariance was assessed by relaxing the intercept of 1 item (MVS4).
[b]Partial scalar invariance was assessed by relaxing the intercept of 2 items (MVS2 and "attractive").

Table 5. Interfactor Correlations and Standardized Sex Differences of Means.

Latent factors	1.	2.	3.	4.	5.	6.	7.	8.	Std. Sex Diff.
1. MVS	—	.145	.064	.290	.331	.185	.162	.209	0.287***
2. MS warmth	.153	—	.737	.178	.289	.160	.389	.495	0.850***
3. MS stability	*.022*	.748	—	.106	.158	.191	.247	.313	0.248***
4. MS appearance	.347	.275	.161	—	.454	.442	.187	.292	−1.039***
5. MS passion	.342	.431	.304	.620	—	.314	.247	.526	0.052*
6. MS status	.132	.115	.181	.241	.247	—	.233	.362	0.780***
7. MS intellect	.193	.425	.281	.284	.304	.165	—	.420	0.593***
8. MS dominance	.183	.493	.418	.223	.469	.381	.483	—	1.200***

Note: All variables are latent variables of the full model tested in Mplus Version 7. Correlations in the female subsample are above the diagonal, correlations for males below. All correlations are significant at $p < .001$, except the one in italics (between MVS and minimum standards for warmth in the male sample), which is not significant. MS = minimum standards; MVS = Mate Value Scale. Std. sex diff. = standardized sex difference. Male means were standardized to zero, values in the table are standardized female means.

Table 6. Descriptive statistics for the Mate Value Scale Across Sex and Sexual Orientation.

Sex	Sexual Orientation	*N*	Mean	*SD*
Male	Heterosexual	12,783	4.72	1.06
	Heterosexual with some same-sex attraction	804	4.56	1.15
	Bisexual	237	4.57	1.24
	Homosexual with some opposite-sex attraction	99	4.49	1.23
	Homosexual	445	4.76	1.14
Female	Heterosexual	5,195	5.06	1.03
	Heterosexual with some same-sex attraction	1,128	5.12	1.00
	Bisexual	326	4.94	1.24
	Homosexual with some opposite-sex attraction	41	4.93	1.06
	Homosexual	66	4.89	0.99

Table 7. Descriptive statistics for the Mate Value Scale Across Sex and Level of Education.

Sex	Level of Education	*N*	Mean	*SD*
Male	Primary	380	4.61	1.22
	Vocational	778	4.53	0.96
	High school	4,172	4.64	1.09
	Higher education	7,453	4.80	1.04
Female	Primary	173	5.01	1.01
	Vocational	116	4.99	1.00
	High school	1,679	5.03	1.05
	Higher education	3,227	5.08	1.02

however, including the post hoc analyses, showed the same pattern, $F_{SES}(3, 17970) = 251.986, p < .001, \eta_p^2 = .040$; $F_{sex}(1, 17970) = 223.473, p < .001, \eta_p^2 = .012$; $F_{SES \times sex}(3, 17970) = 3.237, p = .021, \eta_p^2 = .001$.

Age also had a significant main effect, as well as sex, $F_{age}(7, 17962) = 11.780, p < .001, \eta_p^2 = .005$, $F_{sex}(1, 17962) = 179.801, p < 0.001, \eta_p^2 = .010$, and their interaction was statistically significant, $F(7, 17962) = 3.988, p < .001, \eta_p^2 = .002$. The Games–Howell post hoc test indicates that male mate value is the highest age between 18 and 35, and a decline, significant in comparison to the young, starts at the age of 46. A similar pattern was detected in females: Self-perceived mate value is the highest between 18 and 35 and starts to decline from 46. Linear correlations between mate value and age were $r = -.050$ for males ($p < .001$) and $r = -.081$ for females ($p < .001$). See Table 3 for mate value results across age groups and sexes.

Given that age frequently correlates with SES, especially in males, two separate two-way ANOVAs were performed for both sexes, with age groups and SES as independent variables. The dependent variable was the mean of the first 3 items of the MVS to avoid any potential bias using Item 4. Contrary to expectations, interaction between age and SES was significant only in females, not in males, $F_{male}(21, 12751) = 1.348, p = .132, \eta_p^2 = .002$, and $F_{female}(21, 5163) = 2.048, p = .003, \eta_p^2 = .008$. The pattern was, however, similar. In particular, there was a slight drop in mate value among participants with low SES between ages 36 and 40 in both sexes (for tables and figures, see the Supplementary Material).

The effect of relationship status was tested by comparing single, dating, engaged, married, and divorced participants within each sex. To control for a potential effect of age, that was expected to covariate with relationship status and mate value, we performed two one-way ANCOVAs (to allow for post hoc analyses) for each sex separately. As single participants could be single either because they failed to attract a partner or because they succeeded in attracting many short-term partners, and since there were more than 4,000 of them in the sample, they were grouped according to how many sexual partners they have had. One group included singles having had no sexual partners yet, while other groups consisted of singles having had 1–4 partners, 5–10 partners, and more than 10 partners, respectively.

Although age had a significant effect in both sexes, relationship status had a more pronounced effect on mate value: male age: $F(1, 12567) = 238.186, p < .001, \eta_p^2 = .019$; male relationship status: $F(7, 12567) = 252.193, p < .001, \eta_p^2 = .123$; female age: $F(1, 5065) = 46.189, p < .001, \eta_p^2 = .009$; and female relationship status: $F(7, 5065) = 35.327, p < .001, \eta_p^2 =$

Table 8. Mean Results on the Mate Value Scale Across Sex and Socioeconomic Status (SES).

Sex	SES	*N*	Mean of 4 Items	*SD* of 4 Items	Mean of 3 Items	*SD* of 3 Items
Male	Lower than average	632	3.97	1.23	3.86	1.29
	Average	2,926	4.42	1.04	4.31	1.11
	Somewhat better than average	5,614	4.73	1.02	4.59	1.10
	Better than average	3,611	5.10	0.98	4.93	1.06
Female	Lower than average	203	4.44	1.23	4.34	1.30
	Average	1,501	4.81	1.01	4.70	1.09
	Somewhat better than average	2,216	5.12	0.98	5.01	1.05
	Better than average	1,275	5.34	1.00	5.22	1.07

Table 9. Mean Results of the Mate Value Scale Across Relationship Status and Sex and the Estimated Means in ANCOVA controlling for Age.

Sex	Relationship Status	*N*	Observed Mean	*SD*	Estimated Mean[a]	*SE*
Male	Single, Sex partners: 0	388	3.35	1.46	3.20	.05
	Single, Sex partners: 1–4	991	4.02	1.25	3.89	.03
	Single, Sex partners: 5–10	758	4.52	1.12	4.43	.04
	Single, Sex partners: 11+	907	4.95	1.02	4.91	.03
	Dating	4,791	4.94	0.94	4.89	.02
	Engaged	484	4.91	0.91	4.87	.05
	Married	3,888	4.74	0.93	4.87	.02
	Divorced	369	4.65	1.13	4.83	.06
Female	Single, Sex partners: 0	72	3.65	1.34	3.58	.12
	Single, Sex partners: 1–4	295	4.69	1.11	4.62	.06
	Single, Sex partners: 5–10	361	4.96	1.03	4.92	.05
	Single, Sex partners: 11+	382	5.09	1.03	5.11	.05
	Dating	2,647	5.18	0.98	5.15	.02
	Engaged	245	5.05	0.97	5.03	.07
	Married	905	4.95	1.04	5.05	.04
	Divorced	167	5.14	0.94	5.30	.08

[a]Age as a covariate appearing in the model is evaluated at 35.18 years of age for males and at 30.83 years of age for females. *SE* = standard error; *SD* = standard deviation.

.047. In both sexes, divorced, married, engaged, and dating participants had the highest self-perceived mate value, together with those who are single but have had at least 11 sexual partners. Then, singles with less previous sexual partners had lower MVS scores, the singles having had no sexual partners at all scoring lowest (see Table 9).

Subsequently, we investigated whether relationship satisfaction affects self-perceived mate value. To avoid low frequency in some categories, we first pooled all participants who reported being in a relationship (i.e., dating, engaged, and married). The mate value of coupled individuals varying in their level of relationship satisfaction was then compared to single and divorced participants using a two-way ANCOVA with sex as another independent variable and age as a covariate. Single participants were again grouped according to the number of sexual partners they have had, the same way as in the previous analysis. Thus, what we below call "relationship satisfaction" was actually a complex variable, reflecting the complexity of the underlying phenomena.

The main effect of relationship satisfaction, $F_{\text{satisfaction}}(7, 17631) = 169.516$, $p < .001$, $\eta_p^2 = .071$; sex, $F_{\text{sex}}(1, 17631) = 138.643$, $p < .001$, $\eta_p^2 = .008$; age, ($F_{\text{age}}(1, 17631) = 304.704$, $p < .001$, $\eta_p^2 = .017$); and their interaction was significant, $F_{\text{satisfaction} \times \text{sex}}(7, 17631) = 9.237$, $p < .001$, $\eta_p^2 = .004$. As predicted, relationship satisfaction was positively associated with self-perceived mate value. Again, as with relationship status, single participants with no or only a few previous sexual partners had the lowest self-perceived mate value, coupled participants had higher and differed according to how satisfied they were with their relationship, while divorcees (especially females) and singles with more than 10 previous partners had an MVS score comparable to that of people living in a good or happy relationship (for details, see Supplementary Material).

Finally, linear regression analyses were performed separately for the two sexes to assess the magnitude of a global effect of demographic variables on mate value. Since the R^2 coefficients were of primary interest, only these are reported (for further details, see Supplementary Material). Taken together, level of education, SES, age, and relationship satisfaction variables (for the last one, the grouping of singles outlined previously was retained) predicted a significant but rather small part of the variance in self-perceived mate value, males: $R^2 = .196$, $F(15, 12767) = 208.843$, $p < .001$; females: $R^2 = .108$, $F(15, 5179) = 43.006$, $p < .001$. Moreover, of the independent variables, the strongest predictor of a low self-

perceived mate value was being single with no previous sexual partners.

Discussion

Results of Study 2 again suggest that the MVS may be a reliable and valid measure of self-perceived mate value, although with important qualifications. To start with the positive findings, in the full CFA model, the latent mean of the MVS correlated positively with most minimum standard values for a potential partner, which indicates that people with a higher mate value do indeed have higher expectations about a potential partner in line with previous findings (Edlund & Sagarin, 2010; Regan, 1998; Wenzel & Emerson, 2009). In both sexes, the strongest correlation was found with passion and physical attractiveness. This is fully in line with findings reported in our earlier study (Csajbók & Berkics, 2017), where a self-assessed MVS score was predicted primarily by self-rated physical attractiveness.

It is very important, however, that relationships between demographic variables and mate value as measured by the MVS were in line with expectations regarding their direction only, but not their size. Although the differences between demographics were statistically significant, this was due to the large sample. The effect sizes were actually rather small, in most cases $\eta_p^2 < .01$. Only SES and relationship status had a larger (but still small) effect on self-perceived mate value, and even the effect of relationship status was mostly due to a remarkably low self-perceived mate value of single participants having had no (or only a few) previous sexual partners.

General Discussion

The research presented in this article started with the plausible and comfortable assumption shared by some of the previous literature that mate value can be measured in an easy way, simply asking people about it, because they have a by and large accurate sense of their own mate value, regardless of the complexities of the underlying processes and any awareness—or lack thereof—about them. However, in light of the results, one has to question this assumption.

From our two studies, we have two seemingly conflicting sets of findings. First, the MVS has good psychometric properties, performs well in CFA models, and is correlated to other measures in the expected way, especially strongly with self-esteem and almost as strongly with life satisfaction. On the other hand, whatever the scale measures it has only little to do with demographics, although evolutionary theory and a body of previous research implicate that "actual" mate value, measured in a more "objective" way, should vary considerably with age (especially for females) as well as with SES and education (especially for males). In our case, however, although most of these effects were statistically significant, the effect sizes were rather modest. Why, for example, do women in their early 40s have almost the same self-perceived mate value as women in their twenties? If the strongly underpinned and replicated evolutionary psychological theories are not supported by results obtained with a short measure of mate value, then the problem may lie with the measurement instrument.

When an instrument so simple and short is intended to measure a complex construct, some uncertainty regarding its conceptual clarity is possible to emerge. The apparent contradiction above might be resolved by considering "self-perceived" and "objective" mate value as two conceptually different constructs and considering the MVS as measuring self-perceived, but not objective mate value. This would explain why scores on the MVS hardly vary with demographics, although they are correlated quite strongly with self-esteem. In fact, the self-perception of mate value might be conceptually more akin to self-esteem than to objective mate value. This is not only suggested by our findings but can also be reasoned for with theoretical considerations.

Judgments are known to be subject to social comparisons (cf. Festinger, 1954) and also to goal-related comparisons. Self-esteem is just like that: It is not an indicator of one's objective value in society but an indicator of, or feedback about, how well that person is doing relative to significant others or to relevant goals (cf. Leary & Baumeister, 2000). A biology teacher at the local school, for example, may have the same self-esteem as an eminent biologist at an Ivy League university. In fact, a local biology teacher whose students just won the county science competition may even have a somewhat higher self-esteem than a world-class biologist who just *almost* won the Nobel Prize. Certainly, both may be aware of the difference regarding their objective value in the science of biology, but this is hardly relevant to them as they are competing in different "leagues."

Similarly, a 46-year-old woman may compare herself to other women of a similar age, and with regard to men in their late 40s or 50s as potential partners but not to women in their 20s or with the goal of acquiring a 30-year-old man as a long-term partner. Self-perceived mate value conceptualized this way, one should not expect any dramatic differences related to demographics, in this case to age.

This, of course, does not mean that self-perceived mate value should be considered useless as a psychological construct or as an operational variable. It only means that just as other subjective and relativistic self-perceptions, like self-esteem or life satisfaction, self-perceived mate value is also different from an objective mate value and may serve a different function. Although an objective mate value may put people into different leagues with regard to mating goals and strategies, competition, and social comparison, a self-perceived mate value may convey information about how well individuals are doing within their "league," within the context of their goals, and levels of comparison. Indeed, besides being strongly correlated to self-esteem, self-perceived mate value as measured by the MVS also correlated—albeit not very strongly—with how high people would set their standards with regard to potential partners (cf. Edlund & Sagarin, 2010; Regan, 1998; Wenzel & Emerson, 2009). Of all demographic variables, relationship status combined with relationship satisfaction was one of the

strongest predictors of MVS scores, while the strongest effect was that being single with no (or only a few) previous sexual partners that predicted a conspicuously reduced score. Despite the fact, as it was shown, self-perceived mate value is not objective, it can be a stronger predictor of mating-related behavior or preferences than mate value as perceived by others (see Arnocky, 2018). It may be, for instance, an important factor in determining whom one would approach as a potential partner, and who would be a target of jealousy and what intensity that jealousy would have.

Thus, the MVS indeed seems to be a reliable and valid instrument measuring self-perceived mate value, but with a strong emphasis on *self-perceived*. Further studies should be directed at a more objective mate value and the relationship between that and self-perceptions. Objective mate value may be operationalized in terms of transactions on the mating market. In economy, the price of goods is the amount of money paid when they are sold at a certain point in time under certain circumstances. Potential partners, however, are "goods" that are only supplied in one copy each and are exchanged rather than bought and sold, therefore, transactions involving them are rare and difficult to trace.

Measuring objective mate value, of course, would not be a process as easy and convenient as asking people to read and respond to four simple questions. The promise that a complex construct can be measured in a simple way was only partially fulfilled: We have an easy-to-measure construct, but it may not quite be the construct that was intended in the first place. At the same time, "objective mate value" can and should be conceptualized clearly, most probably in the way as values in economics go, that is, in terms of transactions on the mating "market"—but to its measurement, there is no royal road.

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Supplemental Material

Supplemental material for this article is available online.

Note

1. Result was not reported in the cited paper because it had a different focus. Mate values (measured by the MVS for 1,707 females and 472 males): $M_{female} = 5.15$, $SD_{female} = 0.97$; $M_{male} = 4.99$, $SD_{male} = 1.09$, $t(2,177) = 3.222$, $p = .001$, Cohen's $d = .16$.

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3.4 Csajbók, Berkics, & Havlíček, under review

Csajbók, Z., Berkics, M., & Havlíček, J. (under review). Integration of mate preferences: Meeting minimal thresholds is more important than the overall score. *Social and Personality Psychology Bulletin.*

Integration of mate preferences: Meeting minimal thresholds is more important than the overall score

Abstract

Mate choice is driven by a set of mate preferences. It is, however, unclear how preferences for individual characteristics are integrated into actual mate choice decisions. According to the Additive model, the most desirable partner is the one with the highest overall sum of relevant characteristics. In contrast, the Threshold model predicts that only partners who meet a certain threshold value in all characteristics will be considered. We conducted two studies to compare the two models using vignettes describing potential partners. Each vignette was predicted to be preferred either by the Additive or by the Threshold model. Overall, participants preferred the vignettes following the Threshold model, except if the violated characteristic had low importance. Our results indicate that in mate choice, decisions are directed by thresholds in preferences but take also into account the overall sum of the relevant characteristics.

Keywords: mate choice, Additive model, Threshold model, mate preferences, romantic relationship

Introduction

How would you grade a student who in an exam consisting of four parts excels in three of sections but fails miserably on the fourth? Would you let the student pass – and if so, with what overall grade – or would you let them fail? What would be this student's overall grade in comparison to someone who did a mediocre job on all parts of the exam? Such dilemmas pertaining the evaluation of someone who excels in some domains but fails in others can and do emerge in many areas of life, including mating decisions.

In recent decades, vast amount of research investigated how people select their romantic partners. What is clear is that mate selection is at least in part based on the perception of potential partners. There is also a general consensus on mate preferences being multidimensional (for an overview, see Csajbók & Berkics, 2017), but how these dimensions

combine to form an overall evaluation and then the resulting clear-cut yes/no decision is much less well understood (cf. Edlund & Sagarin, 2014).

Various studies implicitly assume that the overall evaluation of a potential partner is either the sum, or perhaps a weighted sum, of the evaluations of various trait dimensions. For instance, the highly influential Ideal Standards Model (Fletcher et al., 1999) treats overall evaluation of a partner as either one (Fletcher & Overall, 2007) or several (Fletcher et al., 1999) second order factors behind first order factors that represent particular trait dimensions. Similarly, this implicit assumption is often made in studies that regress a single variable concerning a potential or actual partner (e.g., relationship satisfaction) on several trait factors (e.g., Csajbók & Berkics, 2017). In the following, for the sake of clarity, let us call mate choice models that work with the sum of individual characteristics as "Additive models". According to this approach, individuals with the highest overall score should be preferred over individuals whose overall score is lower.

Alternatively, it has been argued that only individuals who exceed a minimal threshold in all important characteristics are viewed as potentially suitable mates. For instance, in an early study of Kenrick et al. (1990), participants were asked to indicate minimal and maximal acceptable levels of certain partner characteristics (e.g., easygoingness, earning capacity, or intelligence). They found that the minimum threshold for an acceptable partner varies depending on the assessor's sex and the type of relationship as context (i.e., single date, sexual encounter, steady dating, or marriage). Their results indicate that people may indeed take into account certain threshold levels of characteristics when selecting an acceptable partner. Similarly, Hitsch et al. (2010) assumed that users of dating sites use threshold-based decisions when screening potential partners. In particular, they suggested that in the online dating environment, participants make series of decisions when screening potential partners. When users define their search filters with the intention to find acceptable potential partners, they display their aspirations, i.e., thresholds or minimal standards in mate choice. Further in the text, we use the term "Threshold model" to refer to models that employ such minimum level of acceptability.

To illustrate the difference between the predictions made by the Additive and the Threshold model (Figure 1), let us consider two gentlemen, say Tim and Andrew, who are assessed by a potential partner on four characteristics: Warmth, Attractiveness, Status, and Intellect. Andrew outperforms Tim on the overall score but has a notably low score in one characteristic (Warmth). According to the Additive model, Andrew should be preferred to Tim. His higher overall score ought to imply higher desirability. On the other hand, according to the

Threshold model, Andrew falls below the minimal acceptable value in one characteristic (Warmth). Tim should be thus preferred to Andrew regardless of having lower overall score.

(Insert Figure 1. about here)

In this study, we tested these two competing models. The Additive model assumes that when evaluating potential partners, people simply add up their trait ratings. The Threshold model, on the other hand, predicts that potential partners must meet certain minimal standards (pass over a threshold) in all relevant traits to "pass the exam" of mate selection. If the Additive model is how people actually choose, one trait on which a person fails may well be compensated by excellence in other traits. If the Threshold model holds, participants should give considerably less favorable "grade" to potential partners who fail on one trait – although they may do well on others – than to reliably mediocre candidates whose overall rating is lower. These comparisons can reveal how people process information about particular characteristics into a single overall evaluation of potential partners, which then steers the decision about whether they would engage in a relationship with such a person.

Study 1

In Study 1, we performed an experiment with "vignettes", i.e. brief descriptions of potential partners. Participants were asked to read these vignettes, rate their overall desirability, and either accept or reject such person for a long-term relationship. Work with vignettes combines the advantages of the survey method and the experimental design thus increasing the internal and external validity of the results (Atzmüller & Steiner, 2010; Sniderman & Grob, 1996). The vignettes consisted of four characteristics previously identified as key factors in mate preferences, namely Warmth, Attractiveness, Status, and Intellect (Csajbók & Berkics, 2017)[1]. Each of the factors could take three values (low, medium, high), whereby the low level in a characteristic was expected to fall below acceptance threshold.

[1] Four versions of the study were run. Each differed in the fourth characteristic used for the vignettes' description. Therefore, in Study $1_{Intellect}$, we used Warmth, Attractiveness, Status, and *Intellect*, in Study $1_{Dominance}$, Warmth, Attractiveness, Status, and *Dominance*, in Study $1_{Stability}$ Warmth, Attractiveness, Status, and *Stability*, and in Study $1_{Passion}$, Warmth, Attractiveness, Status, and *Passion* to describe potential partners in the vignettes. We did so because although there is ample research showing the robustness of the first three factors (Warmth, Attractiveness, and Status), extension of the three-factor model to include a fourth factor is much less clear (Csajbók & Berkics, 2017). To avoid a potential methodological bias stemming from selection of the fourth characteristic, we have decided to run the study using all four likely candidate factors as the fourth factor. Here, however, we describe only the version that used Warmth, Attractiveness, Status, and Intellect, as Intellect is perhaps a universally recognized factor. Results of the other versions can be found in Supplementary Table S2.

Methods

Participants

A total of 255 heterosexual, Hungarian participants (68.9% women), aged 18–26 took part in the study (M_{age} = 21.27, SD = 1.96). Recruitment was performed within the personal social media circles of undergraduate psychology students at the Eötvös Loránd University in Budapest.

Measures and Procedure

Descriptions, instructions, and the form of the vignettes were based on previous research (Fletcher et al., 2004). The vignettes were constructed along four factors obtained in previous research (Csajbók & Berkics, 2017, cf. footnote 1). Each characteristic was present in one of the three levels (low, medium, high). Participants were asked to imagine they had just met someone at a party and formed the impression that the person is low, medium, or high on the four characteristics of Warmth, Attractiveness, Status, and Intellect.

From all possible combinations (3^4 = 81), only some differentiate between the two models. We selected four vignettes which the Additive model predicts to be more desirable and another four that are predicted as more desirable by the Threshold model. In particular, all four vignettes that should be desirable according to the Additive – but not the Threshold – model describe a person who scores high on three characteristics but low on one. The four Additive vignettes differ in the characteristic that is set to a low value. In contrast, each of the four vignettes desirable according to the Threshold model describes a person who is medium on three characteristics and high on one. These four Threshold vignettes vary in the characteristic set to high value. The Additive vignettes have higher overall sum but include a violation of a threshold value, while the Threshold vignettes violate no thresholds but have lower overall sum of the characteristics. Each respondent rated all the eight vignettes which were presented in a random order. For the complete set of vignettes, including instructions, see Methodological file, for the short labels used for each vignette, see Table 1.

(Insert Table 1. about here)

Participants rated the desirability of the potential partners described by the vignettes using a 0–10 (not at all – very much) Likert-type scale. They were also asked to decide whether they would consider a long-term relationship with an individual described by the vignettes (possible answers were “yes” or “no”). The binary data (yes/no) allowed us to mimic a real-life decision-making process, for instance, acceptance or rejection of an invitation to a date, while

the use of a Likert-type scale made our study comparable with previous research (e.g., Fletcher et al., 1999, cf. Table 4).

We further used a short version of the validated 7-factor questionnaire that measures ideal partner preferences (Csajbók & Berkics, 2017) to assess the extent to which the vignettes are related to previously used measurement techniques following the recommended procedure (Atzmüller & Steiner, 2010). The seven factors assessed in an ideal partner were Warmth, Stability, Attractiveness, Passion, Status, Intellect, and Dominance. In the short version of the questionnaire, each factor was expressed by two characteristics loading on each factor (e.g., Warmth is expressed by "loving and caring"). Participants then rated the importance of each factor in their ideal partner on a 1–7 (not at all – very important) Likert-type scale. Demographic data (sex, age, education, sexual orientation, and relationship status) were also collected. The study was performed via Qualtrics online data collection platform, which allowed for complete randomization between vignettes and characteristics within vignettes to avoid the basic cognitive and social psychological phenomena of serial position and primacy effects (Anderson, 1965a).

Data analysis

Average desirability of the four pooled Additive and four pooled Threshold vignettes was compared with paired samples t-tests separately for each sex. Desirability of the particular vignettes was compared using mixed ANOVA with the eight vignettes as repeated measures and sex as a between-subject factor. Pairwise comparisons were performed using Bonferroni-type post hoc test. Chi-square tests were applied to test whether participants favored one model over the other. To perform this analysis, we pooled the number of "yes" answers across all the four Additive and four Threshold vignettes and tested the proportion of preference for the two models against each other (for each sex separately). The effect size of the differences is expressed in r, d, and partial eta-squared. We also performed Cohran's Q test to compare relative acceptability (i.e. the yes/no ratio) of the eight individual vignettes as repeated measures.

Results

All in all, the Threshold vignettes were rated as more desirable than the Additive vignettes by both men and women (men: $M_{Additive}$ = 6.42 (SD = 1.04), $M_{Threshold}$ = 6.81 (SD = 1.12), t(74) = -2.629, p = .010; d = 0.303; women: $M_{Additive}$ = 6.13 (SD = 1.31), $M_{Threshold}$ = 7.02 (SD = 1.54), t(179) = -7.393, p < 0.001; d = 0.552; Figure 2, see Table 1 for the labels and

composition of the individual vignettes). Ratings of the individual vignettes were tested by a mixed ANOVA. There was a statistically significant main effect of the vignette types ($F(7,1771) = 92.307$, $p < 0.001$, $\eta_p^2 = 0.267$). Sex did not have a significant main effect ($F(1,253) = 0.075$, $p = 0.784$, $\eta_p^2 < 0.001$) but the interaction between vignettes and sex was significant ($F(7,1771) = 13.111$, $p < 0.001$, $\eta_p^2 = 0.049$). For easier interpretation, we have therefore subsequently tested men and women separately. Ratings of the individual vignettes significantly differed within both sexes (men: $F(7,518) = 40.377$, $p < 0.001$, $\eta^2 = 0.353$; women: $F(7,1253) = 86.116$, $p < 0.001$, $\eta^2 = 0.325$) but in both sexes, the most preferred vignette was the Additive vignette low in Status, but high in Warmth, Attractiveness, and Intellect. Men rated the desirability of this vignette even higher than women did. Other Additive vignettes, however, were among the lowest rated by both men and women (e.g., low in Warmth, and low in Intellect). There was one notable difference between the sexes: men rated as considerably less desirable the Additive vignette low in Attractiveness. Among the Threshold vignettes, both men and women rated as especially desirable the vignettes that included high Warmth and high Intellect (Figure 2). Detailed results including concrete values and results of post hoc analyses are presented in Supplementary Table S2.

(Insert Figure 2. about here)

Results of the yes/no question (i.e., whether they would accept the described partner for a long-term relationship) followed a similar pattern (Figure 3). Both sexes accepted as potential long-term partners more frequently the candidates described by the Threshold vignettes than those depicted by the Additive vignettes (men: positive answer for pooled Additive vignettes = 54.33%, positive answer for pooled Threshold vignettes = 67%, $\chi^2(1) = 21.770$, $p < 0.001$; $r = 0.304$; women: positive answer for pooled Additive vignettes = 52.5%, positive answer for pooled Threshold vignettes = 70.28%, $\chi^2(1) = 108.972$, $p < 0.001$; $r = 0.389$). For detailed results, see Supplementary Table S3.

(Insert Figure 3. about here)

Ideal partner ratings showed significant main effect of the rated factors ($F(6,1518) = 150.989$, $p < 0.001$ $\eta_p^2 = 0.374$) and sex ($F(1,253) = 37.700$, $p < 0.001$, $\eta_p^2 = 0.130$). Interaction between the seven factors and sex was also significant ($F(6,1518) = 25.480$, $p < 0.001$, $\eta_p^2 = 0.091$). Bonferroni post hoc tests showed that in both sexes, Status factor was the lowest rated item (for details, see Table 2). Moreover, desirability ratings of each vignette were correlated with ideal partner (importance) ratings in Warmth, Attractiveness, Status, and Intellect. As expected, the desirability of the Additive vignettes

negatively correlated with the importance of the respective factor in which the Additive vignettes were low in both sexes (r coefficients between -0.234 and -0.631). Desirability ratings of the Threshold vignettes positively correlated with the importance of factors in which the vignettes were high in both sexes (r coefficients between 0.129 and 0.392; Supplementary Table S4).

(Insert Table 2. about here)

Discussion

On average, participants preferred the Threshold model, but we also identified some specific differences between the vignettes. Interestingly, the Additive vignette low in Status but high in all other characteristics was by far the most desirable (96% of men and 89% of women would accept such a person as a long-term partner among all eight vignettes). The rating task and yes/no questions yielded remarkably similar results: the pattern was identical in terms of the order of desirability of the vignettes.

Why was the Additive vignette low in Status rated as the most desirable? One possible explanation is that since Status was the lowest rated factor in an ideal partner, being low in Status was not – in contrast to what we intended – perceived as a violation of a mate choice threshold. In fact, previous studies in several cultures found that high status does not play a particularly important role in mate choice. Status was rated as the least important or one of the least important characteristics in several studies on mate preferences, including Buss & Barnes (1986), Csajbók & Berkics (2017), Flegr et al. (2019), Fletcher et al., (1999), Katsena & Dimdins (2015), Neto et al. (2012), and Regan et al. (2000). Apart from the Additive vignette with low Status, which is something of an exception, the pattern of the results is clear. People tend to give higher valuations to mediocre potential partners than to those who excel in most domains but fail to meet the threshold in (at least) one important characteristic.

One could also wonder whether this effect holds for partners within a wider range of overall quality. In Study 1, it was sensible to start with potential partners whose quality was mediocre, that is, those who were generally not bad at all but far from perfect. We expected that the effect we investigated would be easiest to detect in this kind of cases. However, would a similar effect also be found in potential partners with even higher overall value? We could set the thresholds to a higher level: after all, some people may give lower overall evaluation to a potential partner not only if that candidate scores low on a characteristic but even if the score

is just slightly lower than the average. We could also increase the validity of the results by manipulating the levels of various characteristics in different ways (cf. Study 2).

Study 2

In Study 2, we investigated whether the effect found in Study 1 generalizes to other ranges of potential partners. To test this, we designed five alternative variants of Study 1 with the purpose of systematically investigating different violations of thresholds. Moreover, we wanted to test whether the results of Study 1 are not merely a consequence of the scale used to indicate the level of the characteristics.

We employed the same eight vignettes as in Study 1, that is, we used the same four characteristics (Warmth, Attractiveness, Status, and Intellect), each characteristic could be present at three levels and the pattern of the vignette's desirability supported either the Additive or the Threshold model. On the other hand, the description of the three levels of the characteristics varied in the five variants. In variant A, the levels of the characteristics were described verbally but in a different way than in Study 1. We rephrased the description used in Study 1 to make sure that our previous results were not merely a byproduct of the phrasing we had used. In Study 1, the characteristics were described as "less", "average", or "very much". Here, in variant A, we described the degrees as "lower than average", "average", or "higher than average". In variants B–E, the three levels were indicated by stars (the number of full stars indicated the level of the characteristic, as in a system often used in customer reviews, cf. Table 3). For an overview of the variants, see Table 3. For an example task from the study, see Table 4.

(Insert Table 3. about here)

(Insert Table 4. about here)

Research questions

The main research question was to test whether the participants prefer the Threshold vignettes over the Additive ones irrespectively of the variation in quality of the potential partners.

We also tested whether participants are sensitive to the different operationalizations of low, medium, and high levels in characteristics across the 5-star variants (variants C, D, and E, cf. Table 3). In particular, we wanted to see if the participants indicate different overall desirability ratings depending on whether the "low" level is defined at 1, 2, or 3 stars out of 5

and whether the "high" level was 4 or 5 stars. We expected that vignettes with "low" level set to 1 out of 5 stars are viewed as less desirable than those where the "low" level is set to 3 out of 5 stars. We also tested whether the total number of stars given to the particular vignettes affected the ratings of the Threshold and Additive vignettes across the variants. For example, the Threshold vignettes in variant E have 17 stars in total (5+4+4+4), 14 stars in Variant C, and only 13 stars in Variant D. One can similarly compare the Additive vignettes: 18 stars in total in Variant D, 16 stars in variant C, and 14 stars in variant D (see Table 3). These comparisons also helped us check the validity of the manipulations: if the participants interpreted the vignettes as we intended, we expected it to be reflected in the overall ratings.

Methods

Participants

A total of 1,506 participants, aged 18–73 (M_{age} = 26.67, SD = 8.29, 64.9% female) took part in at least one of the five variants of the study. For details of the participants in the variants of the study, see Table 5. There was no age difference between the sexes, neither difference in age between the variants, nor significant interaction between sex and variant (sex: $F(1,1496) = 0.535$, $p = .465$; variant: $F(4,1496) = 0.716$, $p = .581$; sex × variant: $F(4,1496) = 0.827$, $p = .508$). The variants also did not statistically significantly differ in the sex ratio of participants ($X^2(4) = 1.041$, $p = .903$, $V = 0.026$). Participants were recruited on a Hungarian Facebook "gossip group", the Pesten Hallottam, which has over 430,000 members.

(Insert Table 5. about here)

Measures and Procedure

We used the same eight vignettes as in Study 1 with four characteristics (Warmth, Attractiveness, Status, and Intellect) which could reach three levels. The variants differed in the description of the three levels. Variant A used a verbal description "lower than average", "average", and "higher than average". Variant B presented the potential partners as having 1, 2, and 3 stars out of 3 stars that could be achieved for each characteristic. Variant C used 1, 3, and 5 stars, variant D used 2, 3, and 4 stars, and variant E 3, 4, and 5 stars out of 5 stars to indicate low, medium, and high levels, respectively[2]. Participants were asked to rate the

[2] Further, we conducted a subsequent follow-up study as a sixth variant to replicate the study in a symmetric fashion. For stimuli, we used 1-2-3 stars out of 5 stars maximally (i.e., ★☆☆☆☆, ★★☆☆☆, ★★★☆☆) to indicate low, medium, and high levels of each characteristic. Otherwise, in every detail the vignettes were constructed the same way as in the previous studies. The participants were recruited half year later than the

desirability of the candidates described by the vignettes using a 0–10 Likert-type scale, and indicate whether they would consider a long-term relationship with the person described in the vignette (yes/no). The order of the vignettes and of the characteristics was randomized. Participants were randomly assigned to one of the five variants. Participants further rated their ideal partner on the same seven factors as in Study 1 and provided their demographic data (sex, age, education, sexual orientation, and relationship status).

Data analysis

We compared the overall desirability of the four pooled Threshold vignettes with the overall desirability of the four pooled Additive vignettes using paired samples t-tests separately for each sex and across the five variants of the study. Further, we performed repeated measures ANOVAs to compare mean desirability of the eight individual vignettes separately for each sex and each variant. To check the validity of the manipulations, the 1-3-5, 2-3-4, and 3-4-5 stars variants (i.e., variants C, D, and E) were compared with ANOVAs across sex and across each individual vignette (cf. Research questions section). Individual desirability ratings of each vignette were thus compared between the three variants for each sex. Chi-square tests were used to analyze the yes/no answers in the same way as in Study 1.

Results

Comparing the Additive and Threshold vignettes

The pooled Threshold vignettes obtained significantly higher overall ratings than the pooled Additive vignettes and this held for both sexes and all five variants. The only exception was the 2-3-4 stars variant in men, where the difference was not statistically significant but followed the same trend as the other variants (Figure 4a and 4b for male and female results, respectively; Supplementary Table S5 and Figure S1 for results across vignettes). The most desirable vignette was the Additive vignette low in Status in all the variants of the study and for both men and women, except for women in the 1-2-3 stars variant (variant B) where the Threshold vignette high in Warmth was the most preferred.

(Insert Figure 4. about here)

participants in Study 2. Men (N = 104) were in average 7.15 years older in the sixth variant of the study than in the first 5 variants. Women (N = 263) were on average 5.48 years older in the sixth variant of the study than in the first 5 variants. Thus, we tested their desirability ratings both in the whole sixth sample without adjustment for age and controlled for age. See results in the Supplement.

We further investigated the acceptability of the potential partners using the yes/no answers (Supplementary Table S6). The pattern of the yes/no answers was qualitatively similar to the desirability ratings. The Threshold vignettes were more frequently preferred than the Additive vignettes by both men and women in all five variants. Similarly to the desirability ratings, the most frequently accepted vignette was the Additive vignette low in Status, and this held for both sexes and in all five variants. The only exception was the 1-2-3 stars variant (out of maximum 3 stars, B variant), where the Threshold vignette high in Warmth and medium in Attractiveness, Status, and Intellect was accepted by women the most frequently (Figure 5; and Supplementary Table S6 and Figures S2 and S3 across vignettes).

(Insert Figure 5. about here)

Comparing the Additive vignettes across variants

To see how the low level of the characteristics affected the desirability ratings (i.e., having 1, 2, or 3 stars out of 5), we compared the Additive vignettes from variants C, D, and E. The overall desirability ratings of the pooled Additive vignettes did differ across the three variants ($F(2,904) = 224.626$, $p < 0.001$, $\eta_p^2 = 0.332$). Sex also had a significant but small main effect on the desirability ratings ($F(1,904) = 9.877$, $p = 0.002$, $\eta_p^2 = 0.011$) with men giving on average higher ratings. The interaction between sex and variant types was not statistically significant ($F(2,904) = 1.781$, $p = 0.169$, $\eta_p^2 = 0.004$). In particular, variant C (5+5+5+1 stars) was rated the lowest, followed by variant D (4+4+4+2 stars), while variant E (5+5+5+3 stars) received the highest desirability ratings (Figure 6, Supplementary Table S7). A similar pattern emerged in the comparison of the individual Additive vignettes but with significant vignette-variant interaction ($F(6,2712) = 22.403$, $p < 0.001$, $\eta_p^2 = 0.047$, Figure 6). The only exception was the Additive vignette with low Status, which did not differ significantly between the variants C and D, and which vignette was rated relatively high within each variant (Figure 6; Supplementary Table S7).

(Insert Figure 6. about here)

Comparing the Threshold vignettes across variants

The overall desirability ratings of the pooled Threshold vignettes across the C (3+3+3+5 stars), D (3+3+3+4 stars), and E (4+4+4+5 stars) variants followed the order expected on the basis of the total number of stars in each vignette ($F(2,904) = 106.510$, $p < 0.001$, $\eta_p^2 = 0.191$, cf. Research questions). In particular, the overall desirability rating of the Threshold vignettes in variant D (3+3+3+4 stars) was the lowest, followed by variant C (3+3+3+5 stars), while

variant E (4+4+4+5 stars) had the highest desirability rating (Figure 7; Supplementary Table S8). The main effect of sex was not significant ($F(1,904) < 0.001$, $p = 0.998$, $\eta_p^2 < 0.001$), nor was its interaction with the variant types ($F(2,904) = 0.799$, $p = 0.450$, $\eta_p^2 = 0.002$).

The individual Threshold vignettes did, however, evince a significant interaction with the variant types ($F(2,904) = 3.025$, $p = 0.049$, $\eta_p^2 = 0.007$). Ratings of the vignettes high in Warmth and high in Intellect showed a similar pattern as the pooled vignettes, but the vignettes high in Attractiveness and high in Status did not differ between variants C and D. Nevertheless, variant E was, as expected, the highest rated in each vignette (Figure 7).

(Insert Figure 7. about here)

Ideal partner preferences

The ideal partner ratings had a significant main effect of sex ($F(1,1441) = 193.833$, $p < 0.001$, $\eta_p^2 = 0.119$) and factors ($F(6,8646) = 867.839$, $p < 0.001$, $\eta_p^2 = 0.376$), as well as significant interaction between the rated factors and sex ($F(6,8646) = 121.729$, $p < .001$, $\eta_p^2 = 0.078$). There was no significant main effect nor interaction with the variants of the study. Bonferroni-type post hoc tests comparing the mean importance of the seven factors revealed that Status was the lowest rated factor in both sexes (Table 2).

Discussion

All five variants of Study 2 showed that participants of both sexes tended to prefer the Threshold vignettes over the Additive ones. Importantly, the yes/no questions yielded highly similar results. Nevertheless, we also detected some noticeable differences between the vignettes. Specifically, the Additive vignette low in Status and high in Warmth, Attractiveness, and Intellect was the most preferred of all eight vignettes in all five variants (except for women in variant B). In other words, status did not seem to matter much to our participants. This was further supported by ratings of ideal partner preferences, where Status was the lowest rated factor. These results are in line with those of Study 1 and likewise suggests that participants were sensitive to violations of thresholds but not if the characteristic in question was not of high importance.

Participants also showed sensitivity to the level of threshold violation. In other words, they significantly preferred the Additive vignettes with less severe threshold violation (where the low characteristic had 2 or 3 stars out of 5) to those with more severe violation (1 star out of 5). Participants' responses were also sensitive to the overall sum of characteristics in the

Threshold vignettes where all thresholds have been met: the most preferred Threshold vignettes were those with 17 stars in total, while vignettes with just 14 or 13 stars were less preferred. In other words, differences in overall desirability across the three comparable variants followed different patterns in the Additive and Threshold vignettes. In the Additive vignettes, desirability depended on how low the "low" characteristic was, while in the Threshold vignettes, desirability was more dependent on how many stars the candidate had in total. Nevertheless, both of the theoretical models affected the vignettes' desirability ratings.

General Discussion

The main goal of this study was to compare whether people tend to prefer mates with the highest overall score (Additive model) or individuals who pass a certain minimal level of acceptability in all rated characteristics (Threshold model). To describe potential partners, we used vignettes with varying levels of individual characteristics. Overall, our studies show that people are sensitive to violations of mate choice thresholds, i.e., minimum levels of certain key characteristics in a potential partner. Nevertheless, the desirability of the potential partners also correlated both with the overall sum of the characteristics and with the severity of the threshold violation (i.e., with what counted as low level of the characteristic). Aside from that, the importance of the particular characteristics was also reflected in the overall evaluation of the vignettes: when a characteristic was perceived as not very important – as was the case with Status – low value of that characteristic was not perceived as violation of a threshold.

Integration models

A recently proposed complementary approach to understanding mating decisions relies on computer simulations. Conroy-Beam and Buss (2016) in their pioneering work employed simulated agents programmed to choose a partner in a described way and then to reproduce. In total, they compared seven mate choice models: Aspiration, Euclidean, Polynomial regression, Random, Simple regression, Threshold Euclidean, and Threshold regression (for details, see Conroy-Beam & Buss, 2016). They found that after over two hundred generations, the Euclidean model dominated in most populations. The Euclidean model predicts that the most desirable partner should be the one who is the closest (measured in Euclidean "straight line" distance) to the ideal partner in a multidimensional space where individuals evaluate their potential and ideal partners. In a subsequent study, further models were included into their comparisons. They created three profiles with high Euclidean mate value and the same number of median and low mate value profiles and rated them for a short- and long-term relationship

potential. Participants also rated their ideal partners on 23 traits along which the profiles were presented. Euclidean distance was still found to be the best fitting and best predicting model among Manhattan distance, Chebysev distance, Profile correlation, Profile valence, and Traditional regression (Conroy-Beam & Buss, 2017). In their study, Profile valence was defined as equivalent to the Additive model we used in the present paper. Further, Conroy-Beam and colleagues (2019) managed to replicate in 45 countries the result that Euclidean distance model fits human mate choice best. Interestingly, though, a recent study found that the Weighted Additive model – a model that assigns the characteristics different weights depending on their importance – performed the best among Euclidean, Take-the best, Aspiration, and Correlational models (Brandner et al., in press).

For decades, researchers had been struggling to find a way of reliably expressing differences in the profile of the ideal versus actual partner (i.e., with ways of testing fulfilment of aspirations) or self and actual partner (i.e., with ways of testing homogamy). It turns out that coordinate space measures express profile differences more effectively than any previous approaches: such as the level of difference along different characteristics or profile similarity correlations within couples (cf. Eastwick et al., 2014; Kenny et al., 2006). For example, Kučerová, Csajbók, and Havlíček (2018) calculated Manhattan distance between the ideal and actual partner to express profile differences between them. This way, they successfully showed the effects of profile differences without relying on the traditionally used, less expressive measures.

The study of Conroy-Beam and Buss (2016), which relied on the use of agents, differed from the present research in yet another important aspect. Agents made sequential decisions about each threshold and stopped once they found a violation. Miller and Todd (1998) suggest that the screening of potential partners is indeed based on a sequential assessment. In other words, characteristics are assessed one by one at a time and once a characteristic meets a threshold, the assessment process moves to another characteristic. They base their assumption on the fact that some characteristics are not apparent at first sight: for instance, the assessment of personality (as opposed to physical appearance) requires some level of familiarity. Nonetheless, it should be noted that sequentiality is not an intrinsic property of the Threshold model of mate choice. Further, it remains unclear whether mate choice decisions are indeed strictly sequential. The sequential model assumes that humans cannot infer certain types of information based on the limited amount of data that can be gathered in a short meeting. Research on the formation of first impression challenges this view (Ambady et al., 2000; Borkenau et al., 2004; Neumann et al., 2009), while other scholars suggest that sequential mate

search is costly and parallel courtship would provide a strategic advantage (e.g., Conroy-Beam & Buss, 2017; Simao & Todd, 2002).

Nonlinear desirability rating

The main assumption of the simple Threshold model is that individuals who fail to satisfy a certain value in a key characteristic are excluded from the pool of potential partners. For example, Conroy-Beam and Buss (2016) in their agent-based model set the decision-making rules of the Threshold model so as to exclude potential partners who fall below the threshold on any characteristic, assigning them a desirability rating of zero. As a consequence of this rule in their model runs, agents who followed the Threshold model went extinct. Our data, however, shows that such approach might be an oversimplification. Our participants often rated vignettes that violated a threshold value considerably lower – but they did not necessarily exclude them altogether. This indicates that instead of applying a "hard threshold", their assessments might best be captured by a "non-linear model". To reiterate, a "hard threshold", as defined by Conroy-Beam and Buss (2016), eliminates individuals who fall below the threshold (Figure 8a). A "non-linear model", on the other hand, implies that individuals below a certain break point in a characteristic do suffer a significant disadvantage but are not necessarily evaluated as having zero desirability. As a result, they are not necessarily excluded from the pool of potential candidates (Figure 8b). Importantly, the disadvantage is higher than when having a value above the break point. To use again our student grading metaphor, our participants would have let the student pass, albeit with a disproportionally worse grade.

Non-linear rating of attractiveness has been observed in several characteristics. For example, attractiveness of female lumbar curvature was found to be in an inverse linear relationship with an optimum value of 45.5 degrees (Lewis, Russell, Al-Shawaf, & Buss, 2015). Similarly, Waist-to-Hip ratio in women follows a reversed U-shape curve of perceived attractiveness around the optimum value of 0.7 (e.g., Streeter & McBurney, 2003). Skrinda et al. (2014) showed that in young men, vocal attractiveness and body height are likewise in a non-linear relationship, while Gignac and Starbuck (2018) found with respect to intelligence and easygoingness that the 90th percentile of the characteristics functioned as a threshold peak in desirability and above it, ratings significantly decreased. On the other hand, the turning point in all these examples turned around the optimal value (the value with the highest ratings), while our break point is not the optimal value. It is a point where desirability slopes steepen.

(Insert Figure 8. about here)

Dealbreakers

As noted above, the majority of previous research on mate choice focused on mate preferences (i.e., characteristics people value in their potential partners). More recently, however, it has been shown that people may put more emphasis on the absence of undesirable characteristics. Jonason et al. (2015) call such traits as "dealbreakers" and show that people tend to systematically avoid such traits in the potential partners. In accordance with the error management theory (Haselton & Buss, 2000), Jonason et al. have also shown that people consider negative traits more seriously than the positive ones. The rationale behind it is that the reproductive costs of a poor mate choice decision are asymmetrically higher than the costs of missing out on a good mate choice opportunity. One may wonder how the concept of dealbreakers (i.e., negative traits) differs from having low value on a positive trait. Is, for instance, being rated 1 on a 5-point scale of physical attractiveness the same as being "ugly"? Results of the study on dealbreakers (Jonason et al., 2015) suggest that people give significantly lower evaluations to those otherwise desirable candidates who have a negative trait. These findings are in line with the results of our study, which suggest that violations of thresholds could be conceptually similar to the notion of dealbreakers.

The ways in which combinations of positive and negative information affect decision making have been in the focus of interest in social psychology for a long time (e.g., Anderson, 1965b; Hamilton & Huffman, 1971; Hodges, 1974; Vonk, 1993). Interestingly, however, little research on such trade-offs in the context of mate choice has been done so far. Well-defined trade-off models that would directly investigate simultaneous presence of socially desirable and undesirable characteristics at varying levels would provide insight into how positive and negative characteristics interact to form the overall picture of a potential partner. For example, Fletcher et al. (2004) had shown that when participants are forced to compromise, the results of a trade-off between attractiveness, status, and warmth depend on sex and relationship context. Interestingly, male participants would happily accept a beautiful but cold partner for a casual date, but most would not choose such person for a long-term relationship. Overall, these results indicate that research on trade-offs would deserve much closer attention.

Importance of the characteristics

As elucidated above, the relative importance of the individual characteristic affected the overall desirability of the vignettes. This was the most obvious in the case of Status, where the Additive vignette that was low in Status but high in all other characteristics was the most highly rated vignette. We can speculate that this was due to the low importance of Status in a potential partner. At first sight, this seems to contradict predictions stemming from the evolutionary

theory, which view Status as being of key importance especially in female mate choice (Buss & Schmitt, 1993). One could argue that the low value of Status is a consequence of cultural and historical specifics of our target population. In Hungary, like in other post-Communist countries, the perception of wealth is often associated with corruption and grey economy rather than with effort, hard work, or extraordinary abilities (Kreidl, 2000). Nevertheless, a closer look to other mate preference literature show similar pattern in numerous countries with different histories, including Brazil, the Czech Republic, Hungary, Latvia, New Zealand, Portugal, and the USA (Buss & Barnes, 1986; Csajbók & Berkics, 2017; Flegr et al., 2019; Fletcher et al., 1999; Katsena & Dimdins, 2015; Neto et al., 2012; Regan et al., 2000). Participants in all these studies (which used various tools to assess mate preferences) considered status as the least important of the measured characteristics. One could further argue that this effect is limited to young adults, which often form the core of samples with which mate preference research works. That does not, however, seem to be the case: low rating of status does not seem limited to younger age cohorts.[3] On the other hand, it might be status- and sex-dependent, however, in a positive direction (i.e., not women having lower status but women with higher status prefer men having higher status, cf. footnote 2). Nonetheless, low significance of status in mate choice could be due to insufficient variability. Li and colleagues (2013), for instance, found that potential partners with very low status were frequently rejected by the participants (who were university students) in their study. It is plausible that with large enough variation, participants indeed become more acutely aware of the full possible range of the characteristics, which is otherwise outside the pool of potential partners they commonly consider.

The relative importance of the individual mate choice factors has been researched in detail (e.g., Buss, 1989; Csajbók & Berkics, 2017). Given that no two mate choice factors have the same weight and not all are prioritized and viewed as necessary in a potential partner, it seems that the simple Additive model is an extreme oversimplification of mate choice process. The underlying assumption of the Additive model is that all characteristics in the model have the same weight and the simple sum of their scores thus captures the overall value of the

[3] In our previous study (this citation is blinded), we asked our participants about their minimum standards in seven factors of mate preferences. An unpublished result on 11,206 male and 4,814 female heterosexual participants (aged 18–76) was that the minimal importance of Status did not correlate over $r = 0.06$ with age, own status, and education in men. It did weakly correlate with self-rated own status in women ($r = 0.139$; $p < 0.001$) in a positive direction, which is in line with the theory of homogamy but does not support the assumption of higher preference for partner's status due to lower own status. All in all, the low relative preference for Status is not a likely consequence of the sample characteristics (cf. bias in psychological research stemming from data frequently collected from university students).

potential partner sufficiently well. However, a Weighted Additive model takes into account the relative importance of each characteristic (cf. Brandner et al., in press).

Limitations and future directions

We made conscious effort to perform our studies in a way that would have high ecological validity. This is why we used vignettes instead of scales. Nevertheless, the study was conducted online, which meant we were unable to supervise and directly observe the participants. Moreover, the proportion of male and female participants was unbalanced, although the multiple variants of both studies functioned as a replication and the converging results thus confirm the reliability of the ratings in both sexes.

Further, an obvious limitation of the present research is that we compared only two – albeit highly influential – mate choice models. As noted above, Conroy-Beam and Buss (2016) found strong evidence in support of the Euclidean (straight-line distance) model of mate choice. When calculating the Euclidean distance between the vignettes and the ideal preferences (with the conversion of the vignettes' stars into a 1 to 7 scale), we found that the Additive vignettes are indeed farther from the ideal preferences in straight-line distance than the Threshold vignettes. However, the desirability ratings of the individual vignettes with the vignettes' Euclidean distance from the ideal preferences correlated only on average at $r = -0.23$ (ranging between $r = -0.52$ and $r = -0.05$; Supplementary Table S8). This comparison is not ideal though, as the comparison of the importance of a characteristic in an ideal partner with the level of a characteristic in a potential partner is not evident (cf. Gerlach et al., 2019).

Further theoretical and empirical research would greatly benefit from the creation of a well-defined pool of additional models, for example the Weighted Additive, Weighted Euclidean, Assortative, and Trade-off models. Moreover, the translation of mate choice models into actual mate choice data, an area that became highly influential in recent years, also deserves more attention. Previous criticism realistically pointed out that existing research lacks ecological validity (Eastwick et al., 2014). We suggest that better understanding of various mate choice models (and their possible interaction) would result in better predictions of actual mate choice. For the moment being, however, we merely suggest that people are sensitive to the violation of thresholds in a potential partner but also take into consideration the potential partner's overall quality.

Traditionally, mate choice research has been conducted with an underlying assumption that individuals with the highest overall score of desirable characteristics should be perceived as the most desirable (cf. Additive model). This assumption failed to take into account the relative significance of the characteristics, which might be so low as to violate a minimal

threshold (cf. Threshold model). In the current study, we compared the Additive and Threshold models of mate choice with manipulated vignettes. The Additive vignettes had higher overall score than the Threshold vignettes, but each had a characteristic on which the candidate scored low, thus violating a mate preference threshold. In contrast, the Threshold vignettes had lower overall score than the Additive vignettes, but all their characteristics were balanced, and none violated any threshold. Two studies were performed with a total of six variants of the study, involving over 1,700 participants to test whether the Additive or the Threshold vignettes depict more desirable potential partners. All six variants of the study concluded that the Threshold vignettes that do not violate any thresholds were more desirable according to the participants. Nonetheless, the relative importance of the particular characteristics also influenced the desirability ratings. Moreover, as long as all the characteristics met their thresholds, the vignettes with higher overall sum were evaluated as more desirable than the vignettes with lower overall scores. Research on further mate choice models is needed and would aid our understanding of actual human mate choice.

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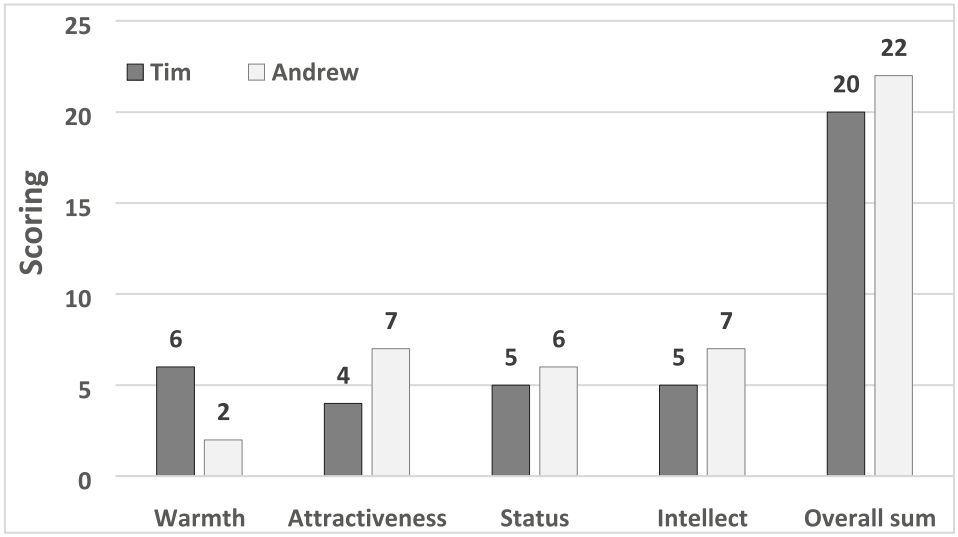


Figure 1. Hypothetical evaluation of two potential partners

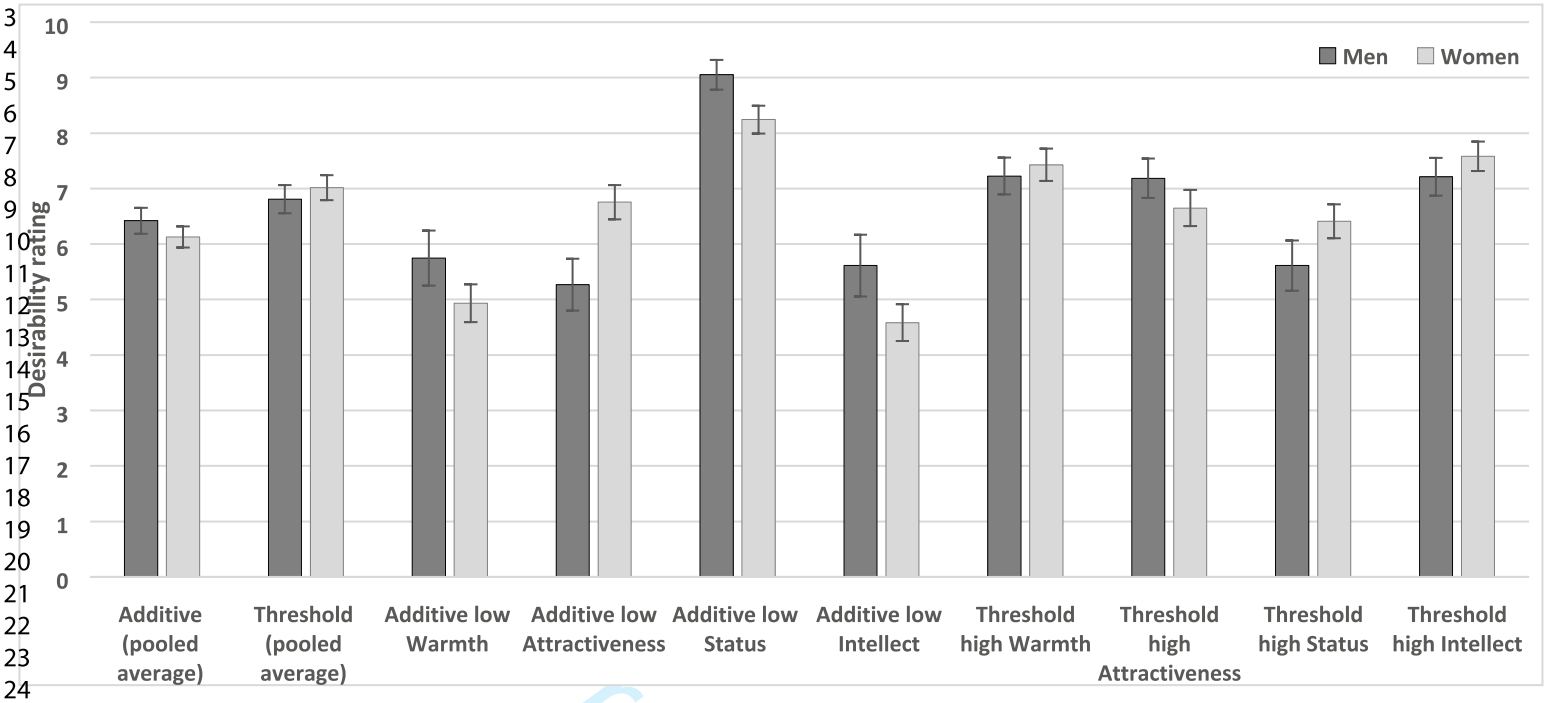


Figure 2. Mean ratings of the pooled and individual vignettes in men and women. Error bars denote 95% confidence interval of the mean.

MATE PREFERENCE INTEGRATION

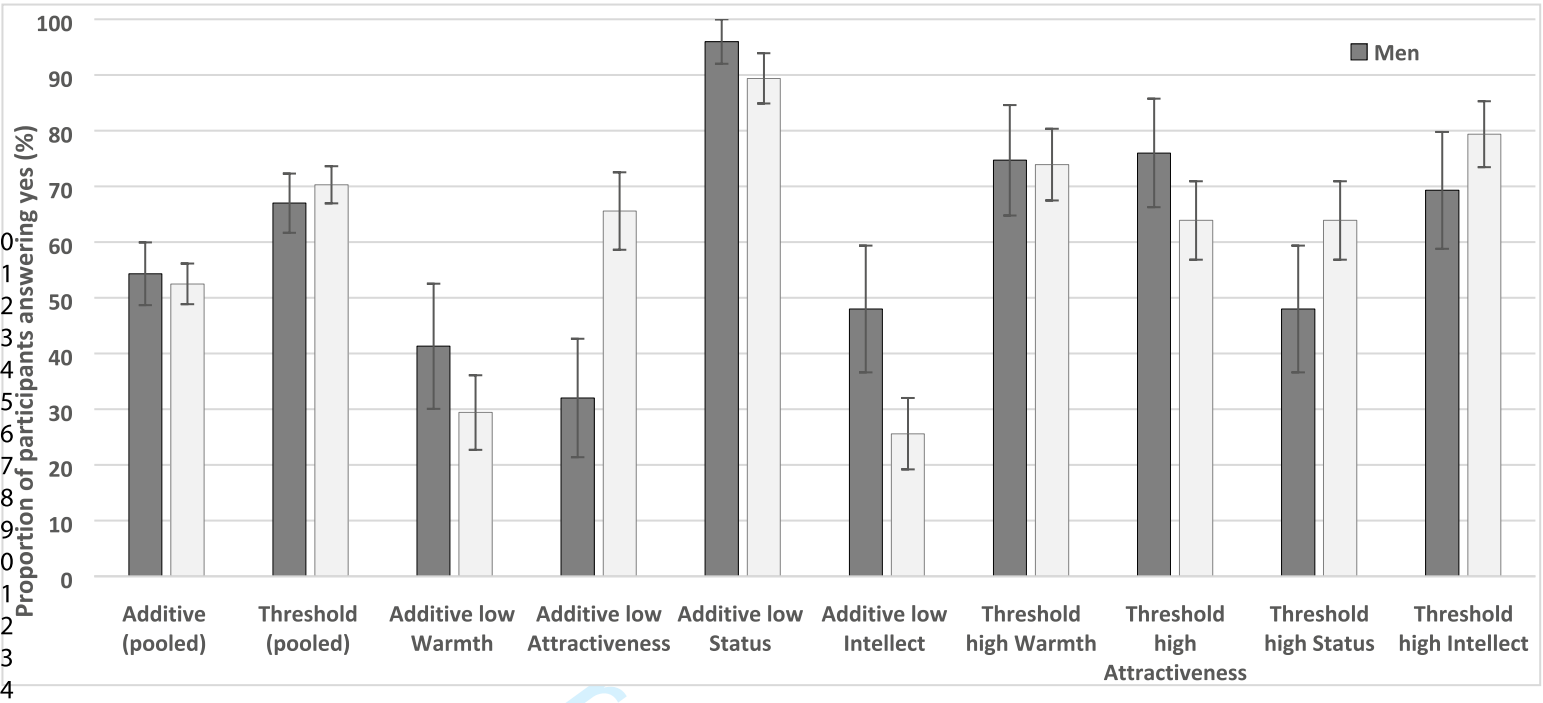


Figure 3. Proportion of men and women who would accept the described partner for a long-term relationship, presented in relative count (%). Error bars denote 95% confidence intervals of the proportion.

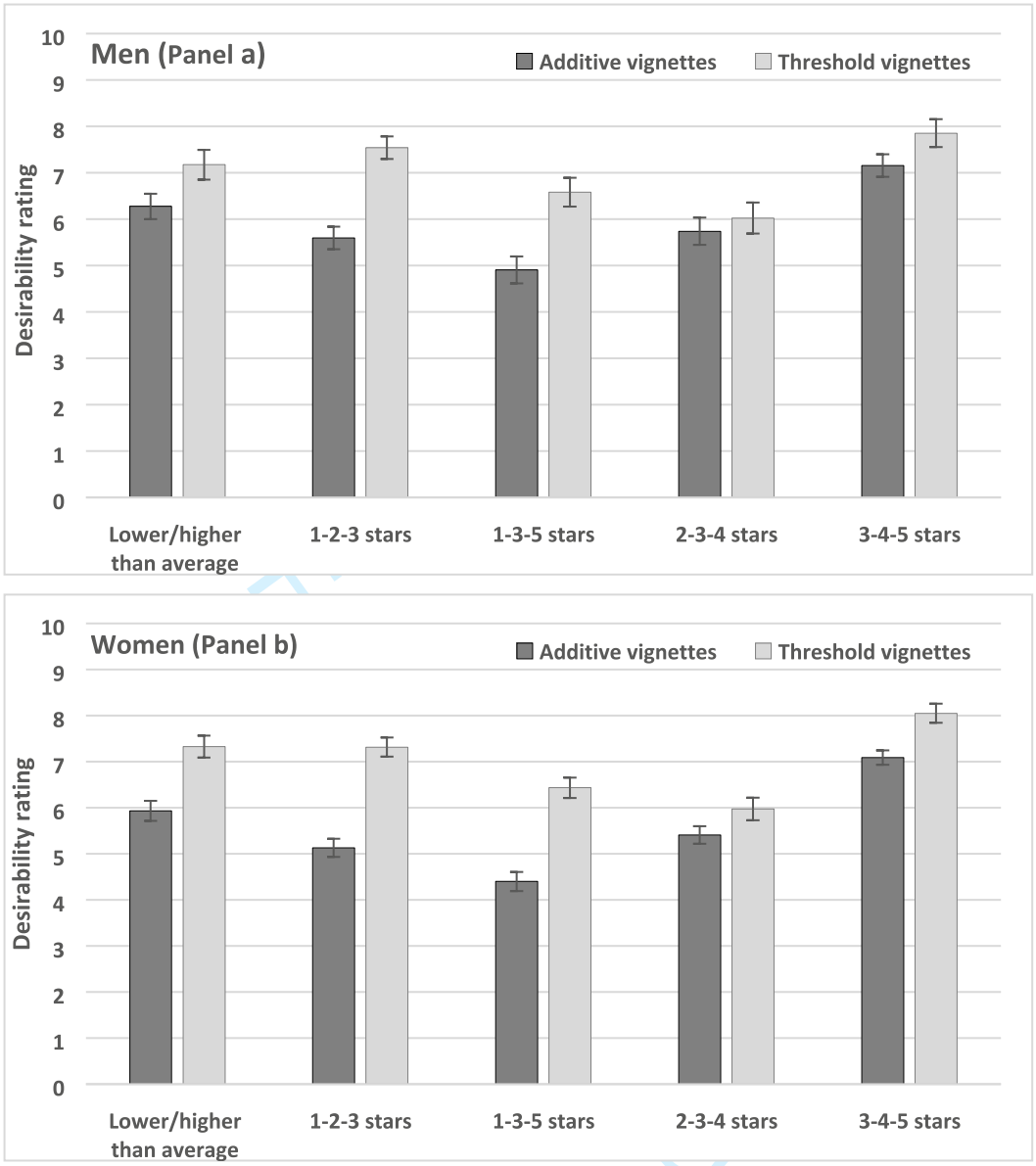


Figure 4. Average desirability ratings of the Additive and Threshold vignettes across the five variants of the study in men (Panel a) and women (Panel b). Error bars denote 95% confidence interval of the mean.

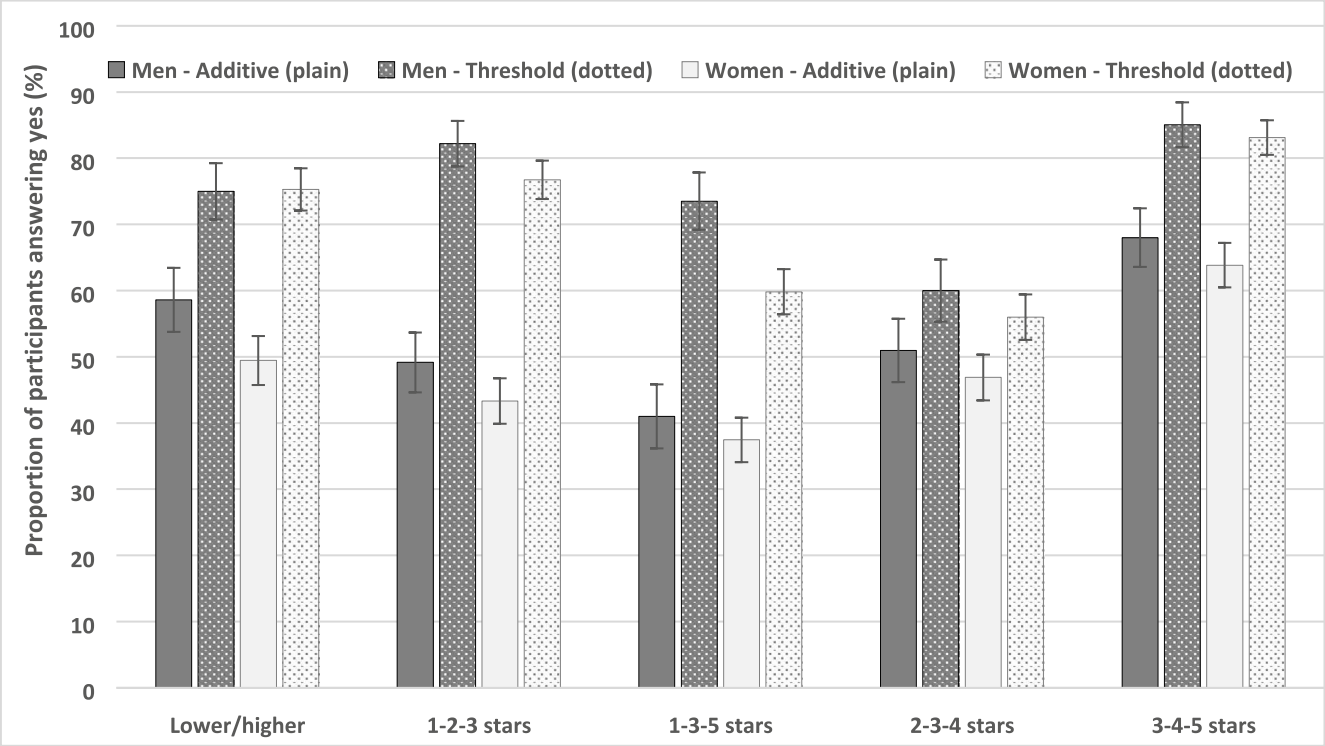


Figure 5. The proportion of male (grey) and female (white) participants who would accept the described partner for a long-term relationship across the five variants, presented in relative count (%). The individual vignettes are pooled for the Additive (plain) and the Threshold (dotted) vignettes. Error bars denote 95% confidence interval of the proportions.

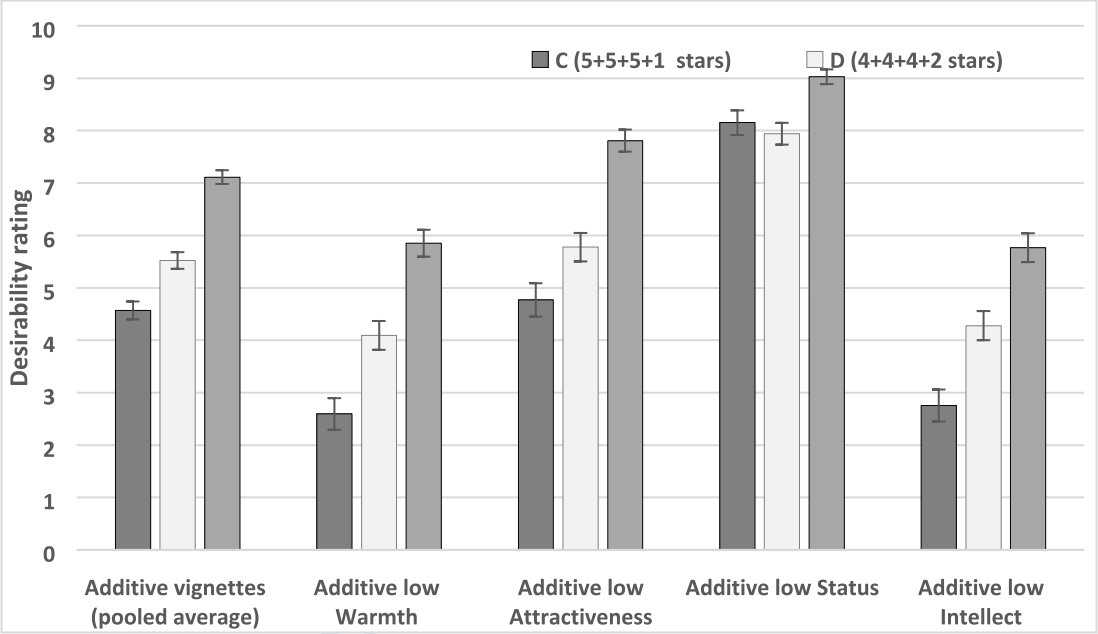


Figure 6. Mean ratings of all Additive vignettes pooled and of each individual Additive vignette across the three variants (i.e., 5+5+5+1 stars, 4+4+4+2 stars, and 5+5+5+3 stars, or C, D, and E variants, respectively). Error bars denote 95% confidence interval of the mean.

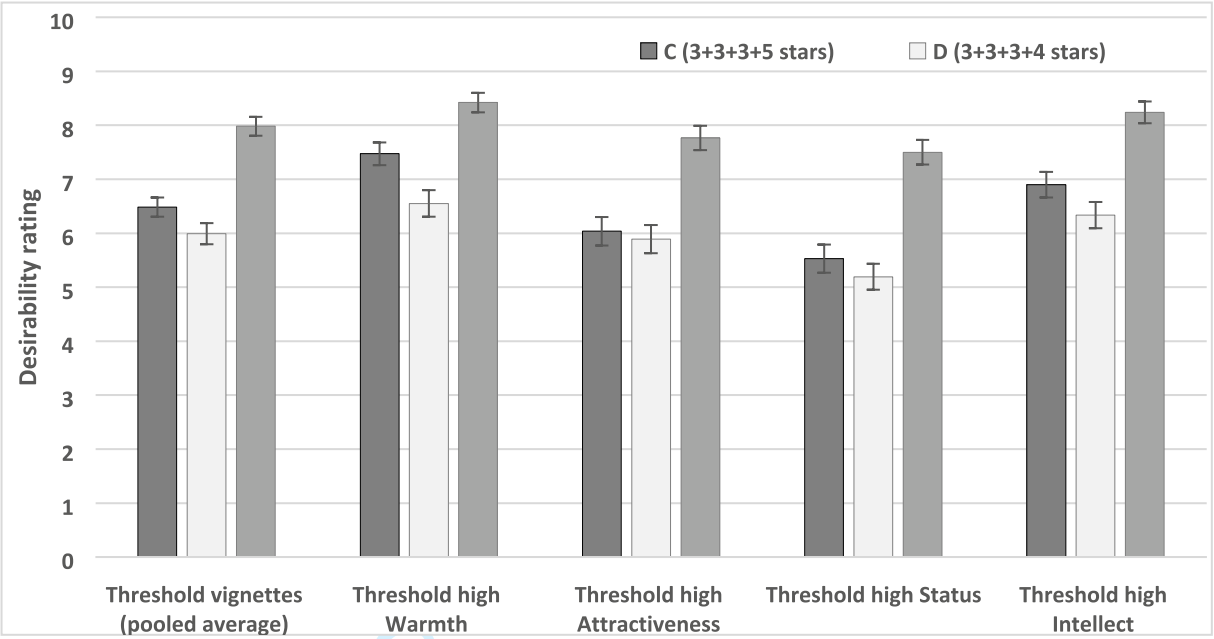


Figure 7. Mean ratings of all Threshold vignettes pooled and mean ratings of each individual Threshold vignette across the three variants (i.e., 3+3+3+5 stars, 3+3+3+4 stars, and 4+4+4+5 stars, or variants C, D, and E, respectively). Error bars denote 95% confidence interval of the mean.

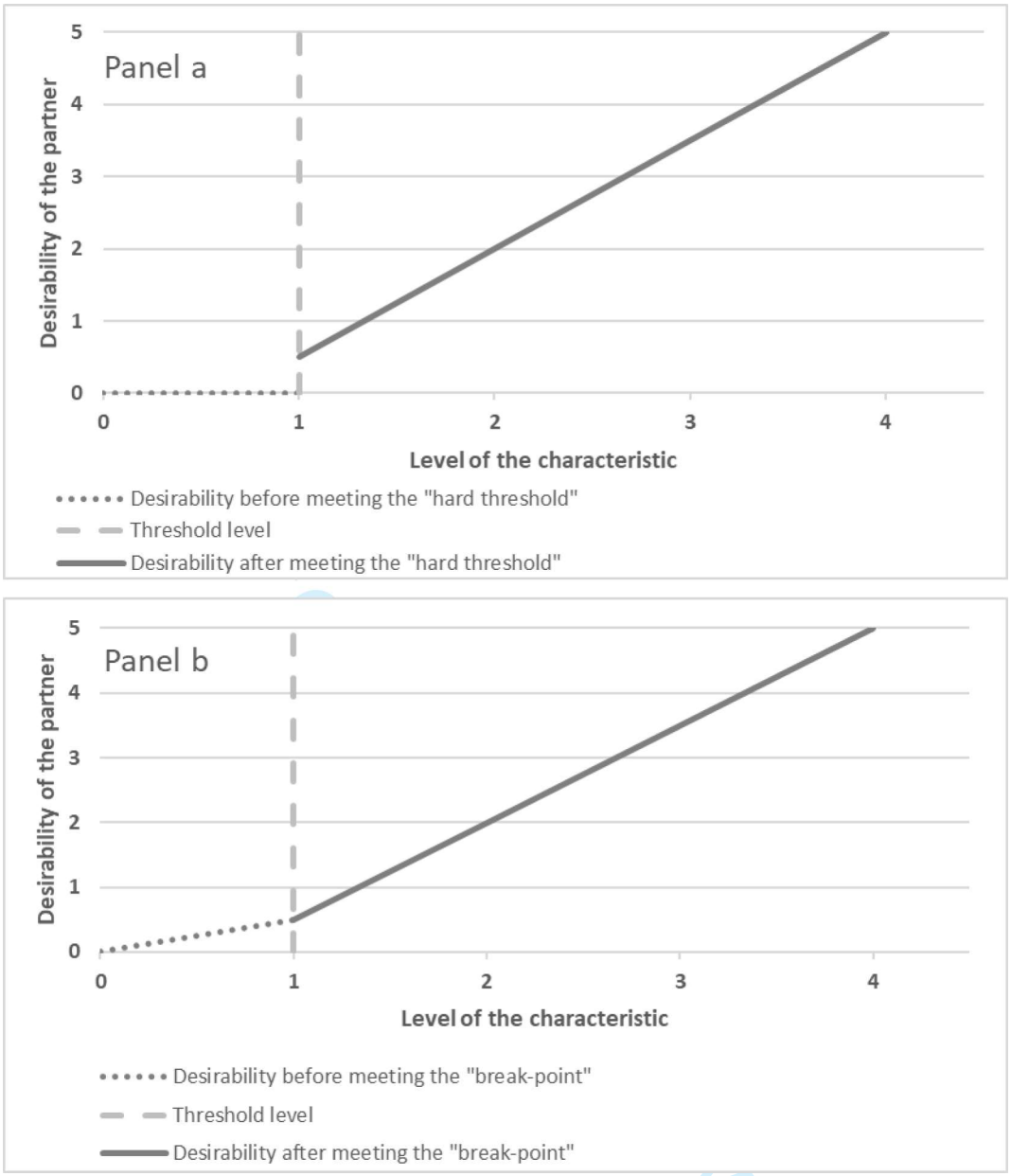


Figure 8. Hypothetical desirability evaluation of a potential partner according to the 'hard threshold' model (panel a) and the 'break-point' model (panel b)

Table 1

List of labels used to tag each vignette describing a potential partner

Label of the vignettes	**Level of the characteristics**			
Additive vignettes	**Warmth**	**Attractiveness**	**Status**	**Intellect**
Additive low Warmth	**low**	high	high	high
Additive low Attractiveness	high	**low**	high	high
Additive low Status	high	high	**low**	high
Additive low Intellect	high	high	high	**low**
Threshold vignettes	**Warmth**	**Attractiveness**	**Status**	**Intellect**
Threshold high Warmth	**high**	medium	medium	medium
Threshold high Attractiveness	medium	**high**	medium	medium
Threshold high Status	medium	medium	**high**	medium
Threshold high Intellect	medium	medium	medium	**high**

Table 2
Ideal partner ratings in men and women in Study 1 and Study 2

		Study 1	Study 2
Sex		**Mean (95% CI)**	**Mean (95% CI)**
Men	Warmth	6.23_{a} (6.05; 6.41)	6.32_{a} (6.24; 6.40)
	Attractiveness	5.64_{ab} (5.40; 5.88)	5.44_{b} (5.35; 5.53)
	Status	3.35_{c} (3.05; 3.65)	3.18_{c} (3.05; 3.31)
	Intellect	5.79_{ab} (5.58; 6.00)	5.83_{d} (5.74; 5.92)
	Passion	5.49_{bd} (5.23; 5.75)	5.53_{b} (5.42; 5.64)
	Stability	4.93_{de} (4.67; 5.19)	5.31_{b} (5.21; 5.41)
	Dominance	4.29_{e} (4.04; 4.54)	4.67_{e} (4.55; 4.79)
Women	Warmth	6.52_{a} (6.40; 6.64)	6.52_{a} (6.47; 6.57)
	Attractiveness	5.01_{b} (4.86; 5.16)	4.90_{b} (4.83; 4.97)
	Status	4.24_{c} (4.05; 4.43)	4.38_{c} (4.30; 4.46)
	Intellect	6.32_{a} (6.19; 6.45)	6.13_{d} (6.07; 6.19)
	Passion	5.68_{de} (5.52; 5.84)	5.82_{ef} (5.75; 5.89)
	Stability	5.46_{bd} (5.30; 5.62)	5.66_{e} (5.59; 5.73)
	Dominance	5.89_{e} (5.73; 6.05)	5.92_{f} (5.86; 5.98)

Note. Subscripts denote mean differences between the factors within each sex. Similar subscripts denote non-significant differences, different subscripts indicate significant differences within each study ($p < 0.001$). CI = confidence interval.

Table 3
The rating system used in the five variants of Study 2

Variant	Low level	Medium level	High level
A (text)	Lower than average	Average	Higher than average
B 1-2-3	★☆☆	★★☆	★★★
C 1-3-5	★☆☆☆☆	★★★☆☆	★★★★★
D 2-3-4	★★☆☆☆	★★★☆☆	★★★★☆
E 3-4-5	★★★☆☆	★★★★☆	★★★★★

Table 4

Illustration of a vignette used in variant C (1–3–5 stars) of Study 2: The vignette should be desirable according to the Additive model because it is low in Warmth but High in Attractiveness, Status, and Intellect.

Imagine you are single. You are attending a friend's party. The atmosphere is friendly. At some point, you find yourself chatting with a man/woman/someone[1] who seems interested in you. During the meeting, you form a certain impression.
Love and care ★☆☆☆☆
Beauty and attractive body ★★★★★
Financial and social status ★★★★★
Intelligence and education ★★★★★
How desirable would you find this person for a long-term relationship? 0 – not at all 1 2 3 4 5 6 7 8 9 10 – very much
Would you start a long-term relationship with such a person? Yes / No

Note. [1] The sex of the potential partner described in the vignette was adjusted according to the sex which the participant prefers in a partner. Bisexual participants obtained the description of meeting "someone" without indicating the gender.

Table 5
Number of participants in Study 2 across the five variants

Variant	Men	Women	Mean age of men (SD)	Mean age of women (SD)	Total
A Lower/higher than average	99 (35.9%)	177 (64.1%)	26.24 (7.76)	26.65 (8.55)	276
B 1-2-3 stars (out of 3 stars)	118 (36.9%)	202 (63.1%)	27.14 (10.06)	27.54 (9.84)	320
C 1-3-5 stars	100 (33.2%)	201 (66.8%)	26.60 (6.63)	26.00 (7.78)	301
D 2-3-4 stars	105 (34.4%)	200 (65.6%)	26.95 (8.05)	26.87 (8.05)	305
E 3-4-5 stars	107 (35.2%)	197 (64.8%)	27.45 (8.82)	25.68 (6.58)	304
Total	529 (35.1%)	977 (64.9%)	26.89 (8.39)	26.55 (8.24)	1,506

Note. SD = standard deviation.

Appendix: Supplementary materials

4.1 Appendix 1

Supplementary materials for Csajbók & Berkics, 2017 (section 3.1)

Supplementary material for the paper 'Factor, factor, on the whole, who's the best fitting of all? - Facto
evolutionary hypotheses, and the Ideal Standards Model in a large Hungarian sample'
1) Table overviewing 23 previous research articles on factors of mate preferences
2) List of traits used in Study 2

Supplementary table 1: *Main characteristics of the found studies dealing with ideal factors*

	Study	**Context**	**N. and nationality of participants**	**Number of items & source**	**Type of used analysis[1]**	**N. of factors**	**Labels of facto**
1	Buss & Barnes (1986)	ideal long-term	184 (92 couples), (US)[2]	76 (Marital Preference Questionnaire, Gough, 1973)	not specified (+ varimax)	9	kind-considerat intelligent, relig status, likes chil and easygoing-a
2	Kenrick, Sadalla, Groth &Trost (1990)	presumed partner	93 (US)	24 (13 from Buss & Barnes, 1986, and another 11 added by the authors)	PCA[3] (+ varimax)	5	status, attractive family orientati
3	Goodwin & Tang (1991)	romantic partner or platonic friend	48 Chinese and 40 British	15 (Goodwin, 1990)	not specified (+ varimax)	3	sensitivity, extra kindness/consid
4	Simpson & Gangestad (1992)	romantic partner	473 (US)	15 (Romantic Partner Attributes, e.g. Buss & Barnes, 1986)	PCA (+ varimax)	2	personal/parenti attractiveness/so
5	Parmer (1998)	potential marriage partner	166 African American	21 (18 from Hill, 1945, 2 from Allgeier, 1990, 2 by the author, 1 had to be excluded)	not specified	3	social stratificat variables
6	Fletcher, Simpson, Thomas & Giles (1999)	ideal long-term partner and relationship	320 from New-Zealand	49 partner phrases, 30 relationship expressions (empirically selected)	PCA (+ oblique) CFA	3	warmth-trustwo and status-resou AND intimacy-loyalty CFA: Warmth-I Intimacy-Loyalt and Vitality-Sta
7	Regan, Levin, Sprecher, Christopher & Cate (2000)	short-term and long-term (pooled)	561 (US)	23 (from their previous studies)	PCA (+ varimax)	5	social status, so desirable, simila outgoing person

8	Rowatt, DeLue, Strickhouser & Gonzalez (2001)	short-term and long-term	168 (US)	42 (from Buss & Barnes, 1986; Simpson & Gangestad, 1992; Kenrick, Sadalla, Broth & Trost, 1990)	PCA (+ oblique)	long: 8 short: 8	fidelity, depend values, creativit attractiveness ar contexts)
9	Ellis, Simpson & Campbell (2002)	how difficult to find a partner like this	454 US	41(items referring to the Big Five, physical attractiveness and physical prowess)	PCA (+ varimax) CFA	6	agreeable/comm potential, physic stability, surgen
10	Fletcher, Tither, O'Loughlin, Friesen & Overall (2004)	ideal long-term, ideal short- and long-term	200 and 198 New-Zealand	17 (Ideal Standards Scale, Fletcher et al., 1999)	CFA CFA	long-term:3 short- and long-ter m:3	warmth-trustwo and status-resou
11	Shackelford, Schmitt & Buss (2005)	probable marriage	3168 (from 37 countries)	18 (Hill, 1945)	PCA (+ varimax)	4	love vs. status/r good looks/heal desire for home/ similar religion
12	Overall, Fletcher & Simpson (2006)	partner, ideals, consistency, and regulation	200 + 62 couples (NZ)	17 (shortened from Fletcher et al, 1999)	CFA	3	warmth-trustwo status-resources
13	Fletcher, Boyes, Overall & Kavanagh (2006) (unpublished, cited by Fletcher & Overall, 2007)	what can they give as partners	200 NZ	60 (empirically selected)	EFA + CFA	6	caring, open, se
14	Furnham (2009)	not specified (desirability)	250 (mixed from the UK)	14 (not specified from where)	not specified (+ varimax)	5	physical, cognit and outgoingnes
15	Kline & Zhang (2009)	partner preference	102 US and 101 Chinese	59 (38 empirically selected and 21 from Toro-Morn & Sprecher, 2003)	PCA (+ oblique)	US: 4 Chinese: 5	warmth-trustwo status and physi sample) AND filial piety, socia attractiveness, s authenticity (on

16	Gerdvilyte & Abhyankar (2010)	ideal and real partner	272 Indian women	31 (not specified)	PCA (+ varimax)	ideal: 5	family, tradition future, recognis resources; intim exciting
17	Boxer (2012)	future spouse	2522 American	83 (49 from Fletcher et al, 1999, others not specified)	CFA (on the 49 items of ISM[4]) PCA (+ varimax or oblique, on 83 items)	CFA: 3 PCA: 13	warmth-trustwo and status-resou AND trustworthiness, intelligence, soc sexuality, vitalit status and a 'ge
18	Neto, da Conceição Pinto & Furnham (2012)	potential long-term romantic partner	187 Brazilian and 215 Portuguese	18 (14 from Furnham, 2009)	PAF[5] (+ varimax)	Brazilian :4 Portugue se:4	physical attracti and resources (c
19	Schwarz & Hassebrauck (2012)	desired partner (importance of traits)	21245 single Germans	82 (based on a German PhD thesis)	PCA (varimax)	12	kind/understand intellectual, wea attractive, cultiv creative/domest
20	Jonason, Webster & Gesselman (2013)	short- and long-term	401 US	20 (e.g. from Buss, 1989; Jonason, Raulston, & Rotolo, 2012; Li et al., 2002)	PCA (+ oblique) CFA	long: 3 short: 3 CFA: 3 and 3	attractiveness, i status (long-ter AND attractiveness, i physical traits (s
21	Fletcher, Kerr, Li & Valentine (2014)	self, partner, and ideal	100 NZ students	12 (shortened from Fletcher et al, 1999)	EFA + CFA	3	warmth-trustwo and status-resou
22	Katsena & Dimdins (2015)	self-rating and ideal romantic partner	223 Latvian	53 (from e.g. Fletcher et al., 1999; Buss, 1989; Clark et al., 2005; Cottrell et al., 2007; Furnham, 2009)	PAF (+ promax) CFA	PAF: 5 CFA: 5	warmth/trustwo intelligence, soc attractiveness
23	Atari & Jamali (2016)	long-term preferences of women	300 Iranian women for EFA and 100 women for CFA	45 --> 39 --> 26 (empirically selected and both theoretically and statistically supervised characteristics)	PAF (+varimax)	EFA: 5 CFA: 5	kindness/depend attractiveness/se and education/in

Note. [1]rotation type is presented in the brackets, [2](US) = no specification, but presented by authors from the US, [3]PCA = principal components analysis, factoring

Supplementary table 2
Lists of included characteristics translated to English

Final trait list	Frequency of mentioning in long-term preferences	Frequency of mentioning in short-term preferences	Final trait list	Frequency of mentioning in long-term preferences	Frequency of mentioning in short-term preferences
trustworthy	21	2	creative	3	0
has good humour	19	13	able to compromise	3	0
understanding	18	0	balanced	3	0
faithful	13	0	nice	3	2
kind	10	7	good conversation partner	3	4
attractive	9	17	accepting	3	0
honest	9	0	playful	2	0
intelligent	9	4	good social status	2	0
open	8	2	good financial status	2	0
joyful	6	4	nurturing	2	0
sporty	6	2	interesting personality	2	0
has high standards	6	0	cooperating	2	0
family centred	6	0	encouraging	2	0
loving	5	0	well-groomed	2	5
patient	5	0	active	2	0
smart	5	0	determined	2	0
caring	4	0	inquiring	2	0
passionate	4	5	sexy	0	4
helpful	4	0	discrete	0	4
romantic	4	2	adventurous	0	5
independent	4	0	good in bed	0	5
gentle	4	0	exciting personality	0	5
attentive	4	5	entertaining	0	2
hard-working	4	0	fascinating	0	2
devoted	4	1	has good body	0	2
has good job	2	0	hot	0	2
has good salary	2	0	sensual	0	2
supporting	3	0	has strong sexual aura	0	2
beautiful	3	2	daring	0	2
calm	3	0	brave	0	2
well-educated	3	0	sexually experienced	0	2
self-confident	3	2			

Note. N = 60 (Study 1)

4.2 Appendix 2

Supplementary materials for Kučerová, Csajbók, & Havlíček, 2018 (section 3.2)

Supplementary material
Coupled individuals adjust their ideal mate preferences according to their actual partner

Supplementary Table 1
Results of Principal Components Analysis of the 42 characteristics

Characteristic	Status/ Resources	Warmth/ Trustworthiness	Vitality	Physical Attractiveness
Ambitious	**.696**			
Professionally successful	**.686**		.383	
Well-educated	**.646**			
Practical	**.632**			
Assertive	**.618**		.316	
Intelligent	**.600**			
Self-confident	**.557**			
Healthy	**.497**			.327
Active	**.495**			
Hardworking	**.495**		**.417**	
Emotionally stable	**.486**			.310
Outgoing	**.452**		.327	
Hygienic	**.445**			.364
Responsible	**.444**	**.417**		
Well-organized	**.435**			
Likes kids	.342			.335
Empathic		**.771**		
Perceptive		**.735**		
Understands me well		**.729**		
Kind		**.698**		
Open-minded		**.681**		
Has good sense of humor		**.582**		
Honest		**.565**		.360
Relaxed		**.538**		
Cooperative		**.522**		
Devoted to me		**.511**		.385
Creative		**.492**		
Generous	.310	**.483**	.394	
Calm under pressure	**.472**	**.477**		
Guilt free		**.446**		.392
Physically strong			**.749**	
Physically able to protect me			**.716**	
Future earning potential	**.471**		**.653**	
Able to take charge of a group	**.453**		**.568**	
Athletic			**.459**	.307
Bold	**.402**	**.409**	**.459**	
Efficient	.399	**.405**	**.443**	
Loyal				**.688**
Sexually appealing				**.590**
Physically attractive			.310	**.576**
In love with me				**.565**
Faithful (religiously)				

Note. Characteristics in bold are submitted to the prospective studies. Factor loadings greater than .4 are shown in bold. Factor loadings smaller than .3 are suppressed.

Supplementary Table 2
Cronbach's alphas of the four factors in the individual samples

		Status/ Resources	**Warmth/ Trustworthiness**	**Vitality**	**Physical Attractiveness**
Study 1	Ideal partner: Czech-speaking sample (singles)	.704	.769	.754	.817
Study 2	Ideal partner: English-speaking sample (singles)	.770	.829	.755	.826
	Ideal partner: English-speaking sample (coupled)	.770	.847	.797	.831
	Actual partner: English-speaking sample (coupled)	.805	.757	.750	.901

4.3 Appendix 3

Supplementary materials for Csajbók, Havlíček, Demetrovics, & Berkics, 2019 (section 3.3)

SUPPLEMENTARY MATERIAL

Contents

1. A full description of analyses in Study 1 with psychometric details

1.a. Instruments:

The Mate Value Scale (MVS; Edlund & Sagarin, 2014) was translated into Hungarian. The goal was to measure participants' perceptions of their own mate value (see also Csajbók & Berkics, 2017; for the Hungarian version of the scale, see Supplementary material). The scale consists of four items (all measuring in a single direction) which are rated on an anchored Likert scale from 1 to 7. Internal consistency of the scale in our sample was good ($\alpha = .86$).

The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965; Hungarian version: Sallay, Martos, Földvári, Szabó, & Ittzés, 2014) consists of 10 items rated from 1 to 4, half of which are reverse-scored. This scale has an excellent internal consistency (in our sample, $\alpha = .91$). Consistently with previous research, the scale displayed a bifactorial structure with one general factor and two methodological factors for the straight and reversed items, respectively (Hyland, Boduszek, Dhingra, Shevlin, & Egan, 2014; McKay, Boduszek, & Harvey, 2014; Urbán, Szigeti, Kökönyei, & Demetrovics, 2014).

The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; Hungarian version: Martos, Sallay, Désfalvi, Szabó, & Ittzés, 2014) is a five-item Likert scale. All the items are straight and rated from 1 to 7. In our sample, this instrument had good internal consistency ($\alpha = .86$).

The short version of the UCLA Loneliness Scale (ULS; Peplau & Cutrona, 1980; Hungarian version: Bőthe, Tóth-Király, & Orosz, in prep) is an eight-item, 4-point Likert scale with two reversed items and excellent internal consistency in our sample ($\alpha = .91$).

The revised Sociosexual Orientation Scale (SOI-R; Penke & Asendorpf, 2008; Hungarian version: Meskó, Láng, Kocsor, & Rózsa, 2012) measures people's attitudes, behaviours, and desires regarding casual sex. The scale consists of nine items in three correlated factors, all of which had a good internal consistency in our sample. Three items measure attitudes about casual sex ($\alpha = .81$), three items measure behaviour such as the number of different/casual partners ($\alpha = .82$), and three items measure the desire for, like fantasising about such sexual interactions ($\alpha = .88$).

1.b. Data analysis

First, only the four Mate Value Scale items (Partial Model 1), then the Mate Value Scale and the Rosenberg Self-Esteem Scale items together (Partial Model 2), and finally all of the items of the instruments above (Full Model) were entered into CFA models of increasing complexity in Mplus 7 as indicators, while the measured constructs functioned as latent variables or factors on which their respective indicators loaded. For the Mate Value Scale, the Satisfaction with Life Scale, and the short version of the UCLA Loneliness Scale this was fairly straightforward, since these instruments measure one-dimensional constructs in a simple way. For the revised Sociosexual Orientation Scale, three latent variables represented the three factors: two with three items each, the third (factor Behaviour) with just two items because item 2 was omitted due to a strong inter-item correlation ($r > .80$). For the Rosenberg Self-Esteem Scale, the abovementioned bifactorial structure was specified: all ten items loaded on a general self-esteem factor which was allowed to correlate with all other constructs. At the same time, however, the items also loaded on either of the two methodological factors (one for the five positively

worded items, the other for the five negatively worded ones). These methodological factors were constrained so as to be uncorrelated to each other and to all other constructs.

All models were fitted to the whole sample. Subsequently, measurement invariance was tested across sex. For Partial Models 1 and 2 (MVS only, and MVS+ Rosenberg Self-Esteem Scale, respectively) a Maximum Likelihood (ML) estimator was used. Due to a non-normal distribution of some of the Sociosexual Orientation Scale items, Maximum Likelihood Robust (MLR) estimator was used for the Full Model. Of the fit indices, CFI was considered to be the most important, because TLI and especially RMSEA are sensitive to model parsimony, imposing a penalty on models with a low df (see Brown, 2006, pp. 83–86). However, for the sake of comparing configural, metric, and scalar models, these indices are also included. Models and loadings in Figure 1 (in the article).

1.c. Results

In the pooled model, the fit of Partial Model 1, i.e. the four MVS items only, was less than desirable (see the fit indices in Table A1). However, when measurement invariance was tested across sex, the metric model had an acceptable fit to the data, except for the RMSEA. The scalar model still had an acceptable CFI and TLI, but the drop in CFI was, compared to the metric model, way beyond the recommended cut-off value of -.010 (Chen, 2007). By relaxing the intercept of item 2 ('Overall, how would members of the opposite sex rate your level of desirability as a partner on the following scale?'), at least partial scalar invariance could be established. In this case, the intercept was somewhat higher for females (4.793) than for males (4.381). Such a minor bias in this single item does not, however, have a major effect on sex differences in Mate Value Scale, because females tend to score higher on the other three items as well (cf. Study 2).

Table A1

Model fit and invariance of the Partial Models 1 and 2, and the Full Model

Model	χ^2 (df)	CFI	TLI	RMSEA [90% CI]	$\Delta\chi^2$ (df)	ΔCFI	ΔTLI	ΔRMSEA
Partial Model 1 with sex invariance (only MVS items)								
Pooled	114.422(2)	.947	.842	.223 [.189-.259]				
Configural	109.481(4)	.951	.854	.216 [.182-.252]				
Metric (loadings)	112.226(7)	.952	.917	.163 [.137-.190]	2.745(3)	.001	.063	-.053
Scalar (intercepts)	178.394(10)	.922	.907	.173 [.151-.195]	66.167(3)	-.030	-.010	.010
Scalar (partial)[1]	129.224(9)	.945	.926	.154 [.131-.178]	16.998(2)	-.007	.009	-.009
Partial Model 2 with sex invariance (Rosenberg and MVS scales)								
Pooled	433.066(66)	.960	.945	.070 [.064-.076]				
Configural	479.680(132)	.962	.948	.068 [.062-.075]				
Metric (loadings)	519.488(152)	.960	.952	.065 [.059-.072]	39.808(20)	-.002	.004	-.003
Scalar (intercepts)	633.458(162)	.949	.943	.072 [.066-.078]	113.970(10)	-.011	-.009	.007
Scalar (partial) [1]	583.483(161)	.954	.948	.068 [.062-.074]	63.995(9)	-.006	-.004	.003
Full Model with sex invariance								
Pooled	1733.037(529)	.940	.933	.045 [.043-.047]				
Configural	2218.085(1058)	.942	.935	.044 [.041-.147]				
Metric (loadings)	2293.237(1094)	.940	.935	.044 [.042-.047]	75.169(36)	-.002	.000	.000
Scalar (intercepts)	2514.515(1120)	.930	.926	.047 [.044-.049]	230.646(26)	-.010	-.009	.003
Scalar (partial) [1]	2466.782(1119)	.933	.929	.046 [.044-.049]	173.545(25)	-.007	-.006	.002

Note 1. Partial scalar invariance was assessed by relaxing the intercept of one item (MVS2).

Partial Model 2 included the ten items of the Rosenberg Self-Esteem Scale as well as the four MVS items, thus removing the penalty imposed by the RMSEA formula. This made this fit index more relevant for model evaluation. Partial Model 2 had acceptable fit for the pooled sample as well as the configural and metric models when invariance across sex was tested. Scalar invariance, on the other hand, could again be established only partially, by relaxing the intercept of the aforementioned item 2 of the Mate Value Scale. The intercept was again higher for females (4.793) than for the males (4.368). In this model, mate value and self-esteem correlated at r = .657.

Finally, the Full Model included all the scales listed in the Measures section (i.e., MVS, SWLS, SOI-R, Loneliness, and RSES). Since items 2 and 3 in the SOI-R had a correlation of r > .80, item 2 ('With how many different partners have you had sexual intercourse on one and only one occasion?') was removed to avoid redundancy. The Full Model fit the data acceptably in the pooled sample and had scalar invariance across sex because the decrease in fit indices did not exceed the recommended cut-off values (Chen, 2007). However, the partially invariant model was also tested, relaxing the intercept of MVS item 2, which was again higher for the female participants (4.793) than for the males (4.371).

Despite the minor bias in item 2 of the Mate Value Scale, inter-factor correlations for convergent and discriminant validity were tested across sex on the full scalar model (i.e., without relaxing item 2), because differences in results comparing the relaxed and unrelaxed models were negligible. As seen from Table A2, the latent variable for MVS had a medium to strong correlation with self-esteem, life satisfaction, and loneliness (in this ascending order) in both the male and female subsample. Mate value had only a weak, if any, correlation with sociosexual orientation, the strongest being the link between mate value and the behavioural factor of the SOI-R. The means of the latent variables differed between the sexes in self-esteem and two of the SOI-R factors: males had a somewhat higher self-esteem (M = .159), a much more positive attitude about casual sex (M = .853), and a much higher level of desire for casual sex (M = .926; all male means are standardised values with female means set at zero). The two sexes did not differ significantly in the latent mean of the Mate Value Scale items (male M = -.093). Albeit still minor, this was the only notable difference between the partial and full scalar models: when the intercept of Mate Value Scale item 2 was relaxed, the latent Mate Value Scale means of the two sexes became practically identical (male M = .005).

Table 2 (from the article)

Inter-factor correlations and mean differences

	1.	2.	3.	4.	5.	6.	7.	Male mean
1. MVS	–	.651***	.513***	-.391***	.183***	.164***	-.022	-.093
2. RSES	.631***	–	.671***	-.605***	.105*	.104*	-.121**	.159*
3. SWLS	.549***	.688***	–	-.593***	-.004	.063	-.181***	-.029
4. Loneliness	-.502***	-.647***	-.633***	–	-.064	.003	.300***	-.116
5. SOI behaviour	.308***	.209***	.138**	-.200***	–	.653***	.355***	.060
6. SOI attitude	.123	.123	.040	-.016	.399***	–	.486***	.853***
7. SOI desire	-.103	-.140*	-.121*	.234***	.105	.440***	–	.926***

Note. All variables are latent variables of the full scalar model tested in Mplus 7. Correlations in the female subsample are above the diagonal, correlations for males below it. The means for all factors in the female subsample are standardised to zero, male means are standardised values.

*** p < .001 ** p < .01 * p < .05

2. A full description of the CFAs in Study 2 with psychometric details

2.a. Instruments

A full description is given in the article.

2.b. Data analysis

First, only the four MVS items (Simple Model), and then the four MVS as well as the 23 minimum standards items (Full Model) were entered into CFA models in Mplus 7 as indicators. The measured constructs were latent variables or factors on which their respective indicators loaded: one factor for the MVS items, and seven factors for the minimum standards items. The seven factors of minimum standards were warmth, emotional stability, physical appearance, sexual passion, social status, intellect, and dominance (for details, see Csajbók & Berkics, 2017).

First, both models were fitted to the whole sample. Then measurement invariance in the Simple Model was tested across the demographic variables used for comparisons. First, we tested invariance across sex and sexual orientations. Then, for heterosexual participants only, invariance was tested across age groups, education, socioeconomic status (SES), and relationship status. For the Simple Model (MVS only) ML estimator was used. Similarly, as in Study 1, CFI was considered to be the most important of the fit indices, but TLI and RMSEA are also included for the sake of comparing configural, metric, and scalar models (cf., our discussion of the topic in Study 1). Due to a non-normal distribution of some of the minimum standards items, MLR estimator was used for the Full Model. In this model, invariance was tested across sex only, because the purpose of adding the minimum standards items was to analyse the Mate Value Scale in a more complex model with better RMSEAs. In the Full Model, only heterosexual participants were included because in some of the non-heterosexual groups the sample sizes were low. Models and loadings in Figure 2 (in the article).

2.c. Results: model fit and invariance

The Simple Model with the four Mate Value Scale items fits the data in the pooled sample well (see Table 3 in the article) with the exception of a poor RMSEA, which is, however, known to perform badly in very simple models (for a model consisting of four indicators loading on one factor, just like in our case, see Kenny, Kaniskan, & McCoach, 2015). Scalar invariance was established across all but one of the demographic variables, since drops in the CFI were within the recommended cut-off value of -.010 (Chen, 2007), while TLI and RMSEA had even improved. Mate Value Scale means can therefore be compared across sex and sexual orientation, age, education, and relationship status. For socioeconomic status, partial scalar invariance was established after relaxing the intercept of item 4 (‘Overall, how good of a catch are you?’). The intercept was the lowest for participants with a low socioeconomic status (4.409), followed by that of the average (4.553), above-average (4.720), and way-above-average socioeconomic status (4.891).

The Full Model also had an acceptable fit to data, although scalar equivalence across sex could not be established, and in order to establish partial scalar invariance, we had to relax the intercept of one of the MVS items (‘Overall, how would members of the opposite sex rate your level of desirability as a partner on the following scale?’) as well as one of the

minimum standards items ('attractive'). This was the same item whose intercept had to be relaxed also in Study 1; for female participants, the intercept was higher (4.698) than for males (4.490), just as in Study 1. Fit indices and invariance in Table 3 (in the article).

3. Statistical details about MVS scores and demographics not included in the article

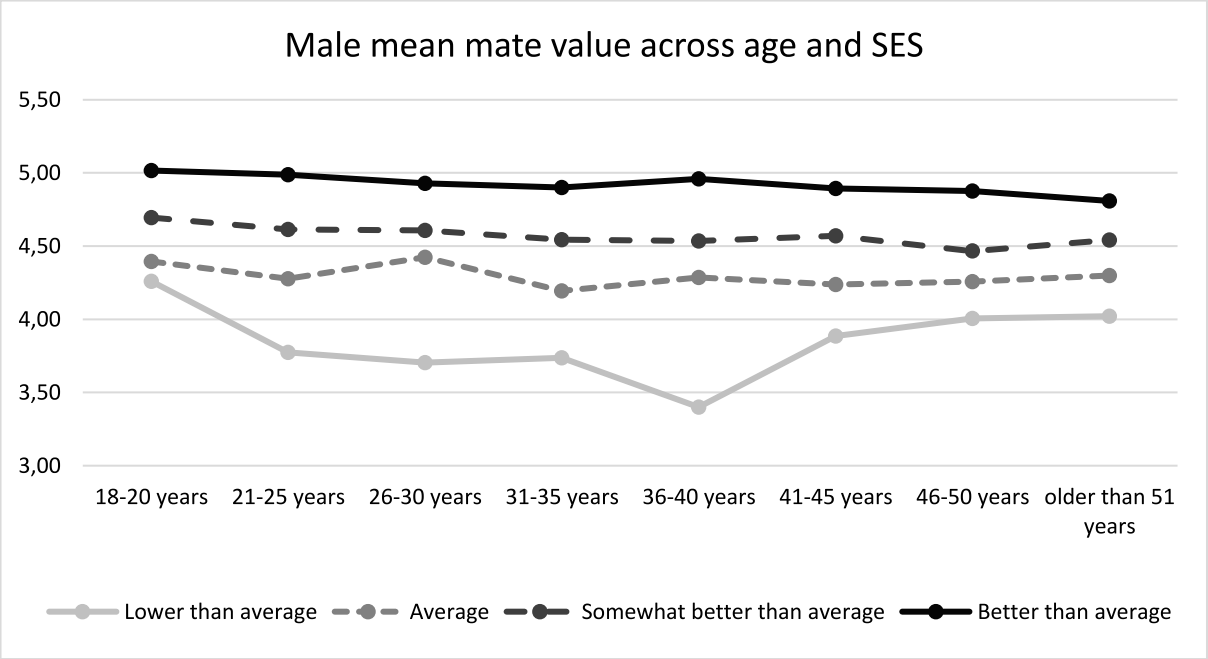
3.1. Mean mate value results on the first three items across age and SES (Tables and Figures are across sex)

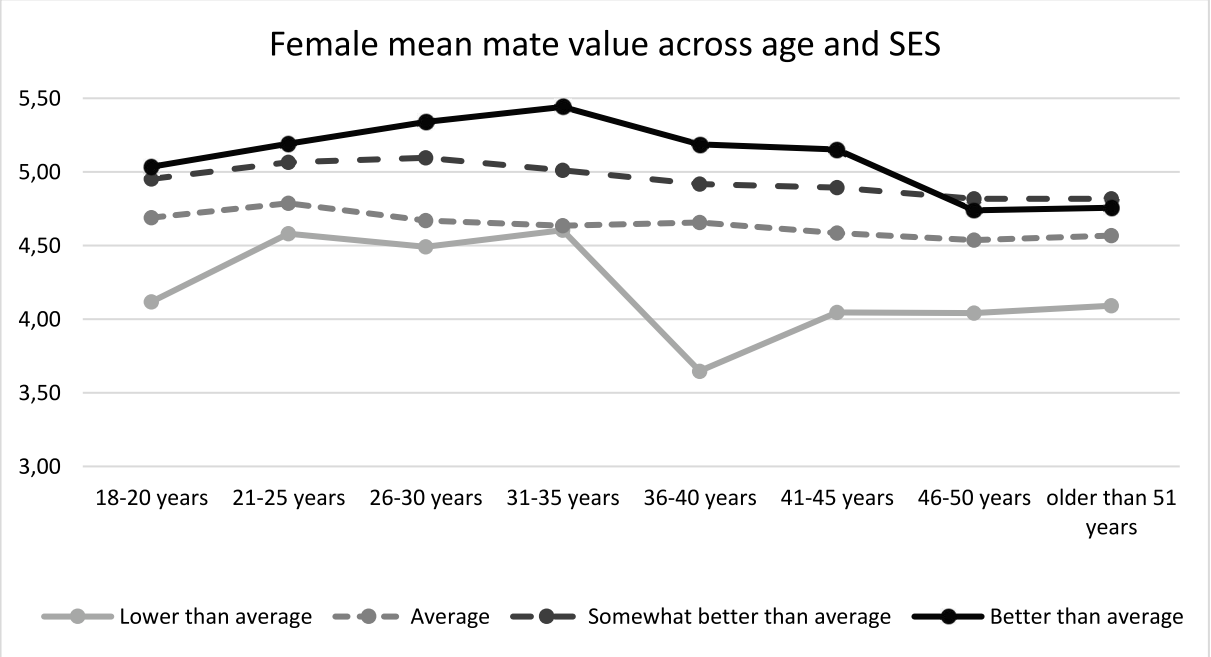
Table A2
Mean mate value results on the first three items among males across age and SES

Sex	Age Grouping	SES	N	Mean	SD
Male	18-20 years	Lower than average	40	4.26	1.30
		Average	236	4.39	1.32
		Somewhat better than average	369	4.69	1.15
		Better than average	216	5.02	1.28
	21-25 years	Lower than average	161	3.77	1.45
		Average	709	4.28	1.28
		Somewhat better than average	1223	4.61	1.17
		Better than average	608	4.99	1.06
	26-30 years	Lower than average	137	3.70	1.38
		Average	598	4.42	1.13
		Somewhat better than average	1255	4.61	1.13
		Better than average	651	4.93	1.14
	31-35 years	Lower than average	90	3.74	1.20
		Average	403	4.19	1.12
		Somewhat better than average	920	4.54	1.14
		Better than average	647	4.90	1.10
	36-40 years	Lower than average	89	3.40	1.39
		Average	433	4.29	1.06
		Somewhat better than average	838	4.54	1.06
		Better than average	636	4.96	1.02
	41-45 years	Lower than average	64	3.89	1.21
		Average	327	4.24	1.00
		Somewhat better than average	651	4.57	1.07
		Better than average	578	4.89	1.07
	46-50 years	Lower than average	51	4.01	1.04
		Average	244	4.26	1.05
		Somewhat better than average	397	4.47	1.08
		Better than average	317	4.87	.96
	older than 51 years	Lower than average	109	4.02	1.13
		Average	382	4.30	0.97
		Somewhat better than average	632	4.54	0.98
		Better than average	430	4.81	0.98

Table A3
Mean mate value results on the first three items among females across age and SES

Sex	Age Grouping	SES	N	Mean	SD
Female	18-20 years	Lower than average	31	4.12	1.38
		Average	194	4.69	1.14
		Somewhat better than average	279	4.95	1.14
		Better than average	139	5.04	1.14
	21-25 years	Lower than average	104	4.58	1.17
		Average	637	4.79	1.08
		Somewhat better than average	932	5.07	1.03
		Better than average	422	5.19	1.00
	26-30 years	Lower than average	59	4.49	1.33
		Average	448	4.67	1.16
		Somewhat better than average	699	5.10	1.05
		Better than average	389	5.34	1.15
	31-35 years	Lower than average	27	4.60	1.48
		Average	222	4.64	1.12
		Somewhat better than average	364	5.01	1.02
		Better than average	239	5.44	0.93
	36-40 years	Lower than average	17	3.65	1.06
		Average	173	4.66	1.12
		Somewhat better than average	263	4.92	1.07
		Better than average	154	5.19	1.00
	41-45 years	Lower than average	22	4.05	1.61
		Average	123	4.59	1.13
		Somewhat better than average	174	4.89	1.10
		Better than average	154	5.15	1.09
	46-50 years	Lower than average	16	4.04	1.23
		Average	95	4.54	1.19
		Somewhat better than average	113	4.82	1.15
		Better than average	69	4.74	1.12
	older than 51 years	Lower than average	11	4.09	1.17
		Average	94	4.57	1.18
		Somewhat better than average	125	4.82	1.02
		Better than average	59	4.76	1.25


Male mean mate value across age and SES
5,50
5,00
4,50
4,00
3,50
3,00
18-20 years
21-25 years
26-30 years
31-35 years
36-40 years
41-45 years
46-50 years
older than 51 years
Lower than average
Average
Somewhat better than average
Better than average


Female mean mate value across age and SES
5,50
5,00
4,50
4,00
3,50
3,00
18-20 years
21-25 years
26-30 years
31-35 years
36-40 years
41-45 years
46-50 years
older than 51 years
Lower than average
Average
Somewhat better than average
Better than average

3.2. Mean mate value results across sex, relationship status and satisfaction (singles analysed across number of sexual partners), with estimated results of ANCOVA on age

Table A4
Mean mate value results across sex, relationship status and satisfaction (singles analysed across number of sexual partners), with estimated results of ANCOVA on age

Relationship status / Satisfaction	**Sex**	**N**	**Observed Mean**	**SD**	**Estimated Mean[a]**	**Std. Error**
Single, Sex partners: 0	Male	388	3.35	1.46	3.23	0.05
	Female	72	3.65	1.34	3.53	0.12
Single, Sex partners: 1-4	Male	991	4.02	1.25	3.92	0.03
	Female	295	4.69	1.11	4.58	0.06
Single, Sex partners: 5-10	Male	758	4.52	1.12	4.46	0.04
	Female	361	4.96	1.03	4.88	0.05
Single, Sex partners: 11+	Male	907	4.95	1.02	4.93	0.03
	Female	382	5.09	1.03	5.07	0.05
In a relationship / Bad	Male	637	4.42	1.03	4.51	0.04
	Female	178	4.58	1.20	4.63	0.07
In a relationship / Average	Male	1422	4.64	0.97	4.69	0.03
	Female	495	4.90	1.08	4.89	0.04
In a relationship / Good	Male	3833	4.85	0.89	4.90	0.02
	Female	1322	5.09	0.98	5.05	0.03
In a relationship / Happy	Male	3271	5.04	0.91	5.05	0.02
	Female	1802	5.25	0.93	5.20	0.02
Divorced	Male	369	4.65	1.13	4.82	0.05
	Female	167	5.14	0.94	5.27	0.08

a. Age as a covariate appearing in the model is evaluated at the age of 33.93 years.

3.3. Predictive (regression) models of mate value across sex

Table A5
Dependent variable: self-perceived mate value (MVS mean)

		Unstandardized		Standardized			Correlations		
Sex		**β**	**Std. error**	**β**	**t**	**Sig.**	**Zero-order**	**Partial**	**Part**
Male	(Constant)	5.296	.035		151.743	.000			
	Age	-.013	.001	-.147	-16.312	.000	-.050	-.143	-.129
	SES Lower than average	-.580	.041	-.118	-14.293	.000	-.161	-.125	-.113
	SES Average	-.260	.022	-.103	-11.772	.000	-.155	-.104	-.093
	SES Better than average	.334	.021	.141	16.294	.000	.219	.143	.129
	Edu. Primary	.081	.052	.013	1.570	.116	-.019	.014	.012
	Edu. Vocational	-.040	.038	-.009	-1.069	.285	-.046	-.009	-.008
	Edu. Higher education	.038	.020	.018	1.962	.050	.082	.017	.016
	Single, Sex partners: 0	-1.558	.052	-.251	-29.856	.000	-.229	-.255	-.237
	Single, Sex partners: 1-4	-.905	.035	-.227	-25.741	.000	-.192	-.222	-.204
	Single, Sex partners: 5-10	-.368	.038	-.082	-9.580	.000	-.048	-.084	-.076
	Single, Sex partners: 11+	.048	.035	.012	1.366	.172	.058	.012	.011
	In a relationship / Bad	-.357	.041	-.073	-8.750	.000	-.066	-.077	-.069
	In a relationship / Average	-.164	.029	-.048	-5.564	.000	-.028	-.049	-.044
	In a relationship / Happy	.144	.023	.059	6.361	.000	.173	.056	.050
	Divorced	.009	.053	.001	.178	.859	-.011	.002	.001
Female	(Constant)	5.532	.056		99.243	.000			
	Age	-.013	.002	-.123	-8.164	.000	-.082	-.113	-.107
	SES Lower than average	-.632	.072	-.119	-8.800	.000	-.121	-.121	-.115
	SES Average	-.300	.033	-.132	-9.157	.000	-.156	-.126	-.120
	SES Better than average	.197	.034	.082	5.740	.000	.155	.080	.075
	Edu. Primary	-.121	.078	-.021	-1.545	.122	-.008	-.021	-.020
	Edu. Vocational	.063	.094	.009	.673	.501	-.011	.009	.009
	Edu. Higher education	.039	.032	.018	1.228	.220	.024	.017	.016
	Single, Sex partners: 0	-1.454	.118	-.165	-12.305	.000	-.162	-.169	-.161
	Single, Sex partners: 1-4	-.455	.063	-.102	-7.223	.000	-.088	-.100	-.095
	Single, Sex partners: 5-10	-.167	.058	-.041	-2.894	.004	-.026	-.040	-.038
	Single, Sex partners: 11+	.006	.056	.001	.104	.917	.010	.001	.001
	In a relationship / Bad	-.393	.078	-.069	-5.045	.000	-.087	-.070	-.066
	In a relationship / Average	-.147	.051	-.042	-2.897	.004	-.049	-.040	-.038
	In a relationship / Happy	.111	.035	.051	3.210	.001	.137	.045	.042
	Divorced	.243	.082	.042	2.963	.003	.014	.041	.039

Note. SES = socioeconomic status; Edu = Education

4. The Hungarian version of the Mate Value Scale

The scale was first translated by two students majoring in psychology at Eötvös Loránd University (ELTE), then the translation was thoroughly reviewed by the last author of the paper. Finally, two former students already holding an MA in psychology but not specialising in the topic and not knowing the original version translated it back to English.

1. **Összességében hogyan értékelné magát párkapcsolati kívánatosság szempontjából?**

1	2	3	4	5	6	7
Kifejezetten nem kívánatos						Kifejezetten kívánatos

2. **Véleménye szerint hogyan értékelnék Önt az ellenkező nem tagjai párkapcsolati kívánatosság szempontjából?**

1	2	3	4	5	6	7
Kifejezetten nem kívánatos						Kifejezetten kívánatos

3. **A többi emberhez képest hogyan értékelné magát párkapcsolati kívánatosság szempontjából?**

1	2	3	4	5	6	7
Sokkal kevésbé kívánatos	Kevésbé kívánatos	Kicsit kevésbé kívánatos	Átlagos	Kicsit kívánatosabb	Kívánatosabb	Sokkal kívánatosabb

4. **Összességében mennyire tartja magát "jó fogásnak"?**

1	2	3	4	5	6	7
Nagyon rossz	Rossz	Inkább rossz	Átlagos	Inkább jó	Jó	Nagyon jó

4.4 Appendix 4

Supplementary materials for Csajbók, Berkics, & Havlíček, under review (section 3.4)

Supplement

Title: Integration of mate preferences: Meeting minimal thresholds is more important than the overall score

Personality and Social Psychology Bulletin

(author information is blinded)

Study 1

Methods

Participants

See footnote 1 in the main text about the description of the four versions of Study 1. A total of 522 heterosexual, Hungarian participants (68.9% women) aged 18–26 took part in the study. In Study $1_{Intellect}$, the sample included 75 men and 180 women, in Study $1_{Dominance}$, 23 men and 85 women, in Study $1_{Stability}$, 37 men and 43 women, and in Study $1_{Passion}$, 27 men and 52 women.

Supplementary Table 1
List of labels used to tag each vignette in the tables describing a potential partner

Label of the vignettes	**Level of the characteristics**			
Additive vignettes	**Warmth**	**Attractiveness**	**Status**	**Intellect**
Additive low Warmth	**low**	high	high	high
Additive low Attractiveness	high	**low**	high	high
Additive low Status	high	high	**low**	high
Additive low Intellect	high	high	high	**low**
Threshold vignettes	**Warmth**	**Attractiveness**	**Status**	**Intellect**
Threshold high Warmth	**high**	medium	medium	medium
Threshold high Attractiveness	medium	**high**	medium	medium
Threshold high Status	medium	medium	**high**	medium
Threshold high Intellect	medium	medium	medium	**high**

Results

Supplementary Table S2
Mean desirability ratings of the vignettes across the four versions of Study 1

		Warmth, Attractiveness, Status, **Intellect**	Warmth, Attractiveness, Status, **Dominance**	W Attra Status
Sex		**Mean (SD)**	**Mean (SD)**	**Me**
Men	**All Additive vignettes pooled**	6.42 (1.04)	6.55 (1.01)	6.3
	All Threshold vignettes pooled	6.81 (1.12)	6.66 (1.68)	6.8
	Paired samples t test: t(df)	-2.629(74)*	-0.294(22)	-2.1
	Cohen's d	0.303	0.062	
	Additive vignette, low in Warmth	5.75_{a} (2.20)	4.26_{a} (2.26)	4.7
	Additive vignette, low in Attractiveness	5.27_{a} (2.07)	5.30_{ab} (1.99)	5.0
	Additive vignette, low in Status	9.05_{b} (1.18)	8.83_{c} (1.27)	8.9
	Additive vignette, low in Int/Dom/Stab/Pas[1]	5.61_{ac} (2.46)	7.83_{bc} (1.92)	6.78
	Threshold vignette, high in Warmth	7.23_{d} (1.47)	7.43_{abc} (1.90)	7.84
	Threshold vignette, high in Attractiveness	7.19_{d} (1.57)	6.87_{abc} (1.98)	7.68
	Threshold vignette, high in Status	5.61_{a} (2.01)	5.57_{ab} (2.29)	6.0
	Threshold vignette, high in Int/Dom/Stab/Pas[1]	7.21_{cd} (1.51)	6.78_{ab} (1.70)	6.00
	Repeated measures ANOVA: F(df1, df2)	40.377(7,518)***	16.923(7,154)***	26.01
	η^2	0.353	0.435	
Women	**All Additive vignettes pooled**	6.13 (1.31)	6.48 (1.29)	6.2
	All Threshold vignettes pooled	7.02 (1.54)	6.66 (1.94)	7.1
	Paired samples t test: t(df)	-7.393(179)***	-1.072(84)	-3.5
	Cohen's d	0.552	0.117	
	Additive vignette, low in Warmth	4.93_{a} (2.34)	4.31_{a} (2.67)	4.4
	Additive vignette, low in Attractiveness	6.76_{bc} (2.12)	6.44_{b} (2.15)	5.86
	Additive vignette, low in Status	8.24_{d} (1.71)	7.93_{c} (1.80)	8.16
	Additive vignette, low in Int/Dom/Stab/Pas[1]	4.58_{a} (2.26)	7.24_{bc} (2.05)	6.51
	Threshold vignette, high in Warmth	7.43_{be} (2.00)	7.61_{c} (1.89)	7.95
	Threshold vignette, high in Attractiveness	6.65_{c} (2.23)	6.51_{b} (2.50)	7.56
	Threshold vignette, high in Status	6.41_{c} (2.08)	6.07_{b} (2.44)	6.19
	Threshold vignette, high in Int/Dom/Stab/Pas[1]	7.58_{de} (1.83)	6.44_{b} (2.40)	6.81

	Repeated measures ANOVA: F(df1, df2)	86.116(7,1253)***	31.516(7,588)***	19.30
	η^2	0.325	0.273	

Note. [1]Intellect, Dominance, Stability, or Passion (abbreviated Int/Dom/Stab/Pas) is employed as the fourth vignettes. Subscripts denote mean differences between the vignettes within each sex, within each version o denote nonsignificant differences, different subscripts indicate significant differences ($p < 0.001$, as indicate pairwise comparisons). SD = standard deviation. See the labels of the vignettes unfolded in Supplementary T

$p < .05$.

$p < .01$.

$p < .001$.

Supplementary Table S3

Frequency of participants considering the candidate described by the vignettes desirable for a long-term rela
the four versions of Study 1

		Warmth, Attractiveness, Status, **Intellect**	Warmth, Attractiveness, Status, **Dominance**	Warmth, Attractiveness, Status, **Stability**
Sex		**N (%)**	**N (%)**	**N (%)**
Men	**All Additive vignettes pooled**	163 (54.33)	54 (58.70)	82 (55.41)
	All Threshold vignettes pooled	201 (67.00)	63 (68.48)	99 (66.89)
	Chi-square test: χ^2(df)	21.770(1)***	4.080(1)*	8.814(1)**
	r	0.304	0.211	0.244
	Additive vignette, low in Warmth	31_{a} (41.3)	5_{a} (21.7)**	10_{a} (27.0)**
	Additive vignette, low in Attractiveness	24_{a} (32.0)**	7_{ab} (30.4)	9_{a} (24.3)**
	Additive vignette, low in Status	72_{b} (96.0)***	22_{c} (95.7)***	36_{b} (97.3)***
	Additive vignette, low in Int/Dom/Stab/Pas[1]	36_{ac} (48.0)	20_{c} (87.0)***	27_{bc} (73.0)**
	Threshold vignette, high in Warmth	56_{d} (74.7)***	18_{abc} (78.3)**	33_{b} (89.2)***
	Threshold vignette, high in Attractiveness	57_{d} (76.0)***	18_{bc} (78.3)**	27_{bc} (73.0)**
	Threshold vignette, high in Status	36_{ac} (48.0)	12_{abc} (52.2)	18_{ac} (48.6)
	Threshold vignette, high in Int/Dom/Stab/Pas[1]	52_{cd} (69.3)**	15_{abc} (65.2)	21_{ac} (56.8)
	Cochran's Q(df)	119.814(7)***	56.617(7)***	92.297(7)***
Women	**All Additive vignettes pooled**	378 (52.50)	213 (62.65)	93 (54.07)
	All Threshold vignettes pooled	506 (70.28)	221 (65.00)	123 (71.51)
	Chi-square test: χ^2(df)	108.972(1)***	0.827(1)	27.419(1)***
	r	0.389	0.049	0.399
	Additive vignette, low in Warmth	53_{a} (29.4)***	22_{a} (25.9)***	8_{a} (18.6)***
	Additive vignette, low in Attractiveness	118_{bc} (65.6)***	58_{bcd} (68.2)**	22_{ab} (51.2)
	Additive vignette, low in Status	161_{d} (89.4)***	72_{b} (84.7)***	38_{c} (88.4)***
	Additive vignette, low in Int/Dom/Stab/Pas[1]	46_{a} (25.6)***	61_{bcd} (71.8)***	25_{bc} (58.1)
	Threshold vignette, high in Warmth	133_{bc} (73.9)***	68_{bc} (80.0)***	36_{bc} (83.7)***
	Threshold vignette, high in Attractiveness	115_{b} (63.9)***	51_{cd} (60.0)	36_{bc} (83.7)***
	Threshold vignette, high in Status	115_{b} (63.9)***	47_{d} (55.3)	23_{abc} (53.5)

	Threshold vignette, high in Int/Dom/Stab/Pas[1]	143_{cd} (79.4)***	55_{bcd} (64.7)**	28_{bc} (65.1)**
	Cochran's Q(df)	304.970(7)***	101.500(7)***	74.595(7)***

Note. [1]Intellect, Dominance, Stability, or Passion (abbreviated Int/Dom/Stab/Pas) is employed as the four description of the vignettes. Subscripts denote proportional differences in 'yessing' between the vignettes, and within each study. Similar subscripts denote nonsignificant differences, different subscripts indi differences ($p < 0.001$, as indicated by Bonferroni type post hoc pairwise comparisons).

□ $p < .05$.

□□ $p < .01$.

□□□ $p < .001$.

Supplementary Table S4

Correlations between the ideal partner ratings and the vignettes' desirability ratings in men and women

		Ideal partner (importance) ratings			
Sex		**Warmth**	**Attractiveness**	**Status**	**Intellect**
Men	Additive vignette, low in Warmth	**-0.371****	0.208	0.076	0.123
	Additive vignette, low in Attractiveness	-0.157	**-0.569*****	0.206	0.093
	Additive vignette, low in Status	0.232*	0.050	**-0.576*****	0.128
	Additive vignette, low in Intellect	0.144	0.117	-0.044	**-0.631*****
	Threshold vignette, high in Warmth	**0.218**	-0.063	-0.086	-0.124
	Threshold vignette, high in Attractiveness	-0.020	**0.392****	-0.034	-0.248*
	Threshold vignette, high in Status	-0.269*	-0.036	**0.339****	-0.042
	Threshold vignette, high in Intellect	-0.245*	-0.242*	0.147	**0.340****
Women	Additive vignette, low in Warmth	**-0.304*****	0.174*	0.086	0.167*
	Additive vignette, low in Attractiveness	0.045	**-0.457*****	-0.153*	0.179*
	Additive vignette, low in Status	0.157*	-0.099	**-0.390*****	0.128
	Additive vignette, low in Intellect	0.155*	0.055	-0.008	**-0.234****
	Threshold vignette, high in Warmth	**0.293*****	-0.185*	-0.183*	-0.188*
	Threshold vignette, high in Attractiveness	0.087	**0.129**	0.020	-0.155*
	Threshold vignette, high in Status	0.030	-0.017	**0.212****	0.046
	Threshold vignette, high in Intellect	-0.125	-0.178*	0.024	**0.241****

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Supplementary Table S5

Mean desirability ratings of the vignettes across the 5+1 variants of Study 2

Variant label		**A**	**B**	**C**	**D**
		lower/higher than average	**1–2–3 stars (out of 3 stars)**	**1–3–5 stars**	**2–3–4 s**
Sex		**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (**
Men	**All Additive vignettes pooled**	6.28 (1.39)	5.60 (1.35)	4.91 (1.48)	5.74 (1
	All Threshold vignettes pooled	7.18 (1.63)	7.54 (1.35)	6.58 (1.57)	6.02 (1
	Paired samples t test: t(df)	-5.591(98)***	-12.202(117)***	-8.693(99)***	-1.926(1
	Cohen's d	0.562	1.123	0.867	0.18
	Additive vignette, low in Warmth	5.01_{a} (2.73)	4.47_{a} (2.76)	3.30_{a} (2.90)	4.46_{a} (2
	Additive vignette, low in Attractiveness	5.72_{a} (1.93)	4.80_{a} (2.59)	3.85_{a} (2.71)	5.02_{a} (2
	Additive vignette, low in Status	8.94_{b} (1.31)	8.95_{b} (1.50)	8.91_{b} (1.58)	8.65_{b} (1
	Additive vignette, low in Intellect	5.44_{a} (2.77)	4.18_{a} (2.79)	3.57_{a} (2.81)	4.84_{a} (2
	Threshold vignette, high in Warmth	7.49_{c} (2.08)	8.08_{c} (1.64)	7.27_{c} (1.93)	6.51_{c} (2
	Threshold vignette, high in Attractiveness	7.58_{c} (1.96)	7.55_{c} (1.96)	6.72_{c} (2.07)	6.38_{c} (2
	Threshold vignette, high in Status	6.32_{ad} (2.35)	6.70_{d} (1.98)	5.42_{d} (2.34)	4.91_{a} (1
	Threshold vignette, high in Intellect	7.31_{cd} (1.87)	7.83_{c} (1.76)	6.92_{c} (2.02)	6.29_{c} (2
	Repeated measures ANOVA: F(df1, df2)	49.650(7,686)***	95.351(7,819)***	89.355(7,693)***	59.689(7,
	η^2	0.336	0.449	0.474	0.36
Women	**All Additive vignettes pooled**	5.93 (1.47)	5.13 (1.43)	4.40 (1.52)	5.41 (1
	All Threshold vignettes pooled	7.32 (1.61)	7.32 (1.51)	6.44 (1.60)	5.98 (1
	Paired samples t test: t(df)	-12.309(176)***	-17.699(201)***	-15.842(200)***	-5.252(1
	Cohen's d	0.923	1.245	1.119	0.37
	Additive vignette, low in Warmth	4.37_{a} (2.70)	3.49_{a} (2.59)	2.24_{a} (2.48)	3.91_{a} (2
	Additive vignette, low in Attractiveness	6.77_{b} (2.32)	6.14_{b} (2.35)	5.23_{b} (2.73)	6.18_{bc} (2
	Additive vignette, low in Status	8.01_{c} (1.95)	7.61_{cd} (2.15)	7.78_{c} (2.17)	7.57_{d} (1
	Additive vignette, low in Intellect	4.56_{a} (2.49)	3.27_{a} (2.49)	2.35_{a} (2.53)	3.99_{a} (2
	Threshold vignette, high in Warmth	7.69_{cd} (1.90)	8.08_{c} (1.63)	7.57_{cd} (1.83)	6.57_{b} (2
	Threshold vignette, high in Attractiveness	7.05_{bd} (2.25)	6.87_{bd} (1.94)	5.70_{b} (2.42)	5.64_{ce} (2
	Threshold vignette, high in Status	6.80_{b} (2.22)	6.54_{b} (2.15)	5.58_{b} (2.29)	5.34_{e} (2

Threshold vignette, high in Intellect	7.76_{c} (1.78)	7.77_{c} (1.85)	6.89_{d} (2.15)	6.36_{b} (2
Repeated measures ANOVA: F(df1, df2)	98.478(7,1232)***	187.497(7,1407)***	207.905(7,1400)***	90.605(7,1
η^2	0.359	0.483	0.510	0.31

Note. Subscripts denote mean differences between the vignettes within each sex and within each variant. Similar subscripts den subscripts indicate significant differences ($p < 0.001$, as indicated by Bonferroni type post hoc pairwise comparisons). SD = sta

$^{+}$ $p < .1$.

□□□ $p < .001$.

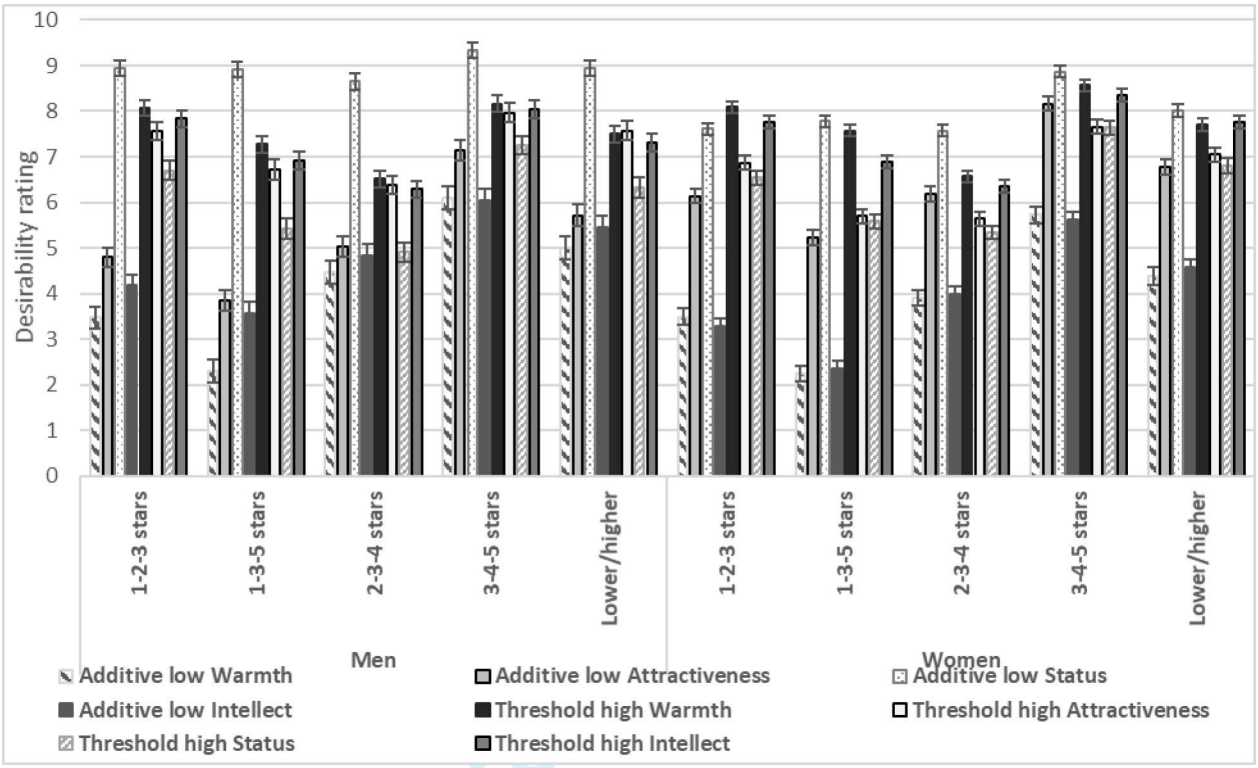


Figure S1. Mean ratings of the individual vignettes across sex and the five variants of the study. Error bars denote standard error of the mean.

Supplementary Table S6

Frequency of participants considering the candidate described by the vignettes desirable for a long-term relations

		A	B	C	D
		lower/higher than average	**1–2–3 stars (out of 3 stars)**	**1–3–5 stars**	**2–3–4**
Sex		**N (%)**	**N (%)**	**N (%)**	**N (%**
Men	**All Additive vignettes pooled**	232 (58.59)	232 (49.15)	164 (41.00)	214 (5
	All Threshold vignettes pooled	297 (75.00)	388 (82.20)	294 (73.50)	252 (6
	Chi-square test: χ^2(df)	56.902(1)***	352.311(1)***	216.917(1)***	14.325
	r	0.379	0.864	0.736	0.18
	Additive vignette, low in Warmth	34_{a} (34.3)**	35_{a} (29.7)***	20_{a} (20.0)***	31_{a} (29
	Additive vignette, low in Attractiveness	54_{abc} (54.5)	48_{a} (40.7)*	29_{a} (29.0)***	48_{ab} (4
	Additive vignette, low in Status	98_{d} (99.0)***	114_{b} (96.6)***	95_{b} (95.0)***	97_{c} (92
	Additive vignette, low in Intellect	46_{ab} (46.5)	35_{a} (29.7)***	20_{a} (20.0)***	38_{a} (36
	Threshold vignette, high in Warmth	78_{e} (78.8)***	106_{bc} (89.8)***	84_{bc} (84.0)***	71_{d} (67
	Threshold vignette, high in Attractiveness	85_{e} (85.9)***	95_{cd} (80.5)***	77_{c} (77.0)***	63_{bd} (6
	Threshold vignette, high in Status	60_{bc} (60.6)*	83_{d} (70.3)***	55_{d} (55.0)	47_{ab} (4
	Threshold vignette, high in Intellect	74_{ce} (74.7)***	104_{bc} (88.1)***	78_{c} (78.0)***	71_{d} (67
	Cochran's Q(df)	167.784(7)***	297.296(7)***	283.008(7)***	154.502
Women	**All Additive vignettes pooled**	350 (49.44)	350 (43.32)	301 (37.44)	375 (4
	All Threshold vignettes pooled	533 (75.28)	620 (76.73)	481 (59.83)	448 (5
	Chi-square test: χ^2(df)	254.131(1)***	505.225(1)***	167.737(1)***	27.780
	r	0.599	0.791	0.457	0.18
	Additive vignette, low in Warmth	35_{a} (19.8)***	35_{a} (17.3)***	14_{a} (7.0)***	37_{a} (18
	Additive vignette, low in Attractiveness	119_{bc} (67.2)***	123_{b} (60.9)**	98_{b} (48.8)	123_{bc} (6
	Additive vignette, low in Status	150_{d} (84.7)***	164_{cd} (81.2)***	168_{c} (83.6)***	169_{d} (84
	Additive vignette, low in Intellect	46_{a} (26.0)***	28_{a} (13.9)***	21_{a} (10.4)***	46_{a} (23
	Threshold vignette, high in Warmth	144_{bd} (81.4)***	179_{c} (88.6)***	160_{cd} (79.6)***	136_{b} (68
	Threshold vignette, high in Attractiveness	123_{bc} (69.5)***	139_{bd} (68.8)***	93_{b} (46.3)	97_{ce} (4
	Threshold vignette, high in Status	119_{c} (67.2)***	131_{b} (64.9)***	92_{b} (45.8)	85_{e} (42
	Threshold vignette, high in Intellect	147_{d} (83.1)***	171_{c} (84.7)***	136_{d} (67.7)***	130_{b} (65

Cochran's Q(df)	367.693(7)***	517.337(7)***	484.753(7)***	318.411

Note. Subscripts denote proportion differences in 'yessing' between the vignettes, within each sex and within each significant differences, different subscripts indicate significant differences ($p < 0.001$, as indicated by Bonferroni

* $p < .05$.
** $p < .01$.
*** $p < .001$.

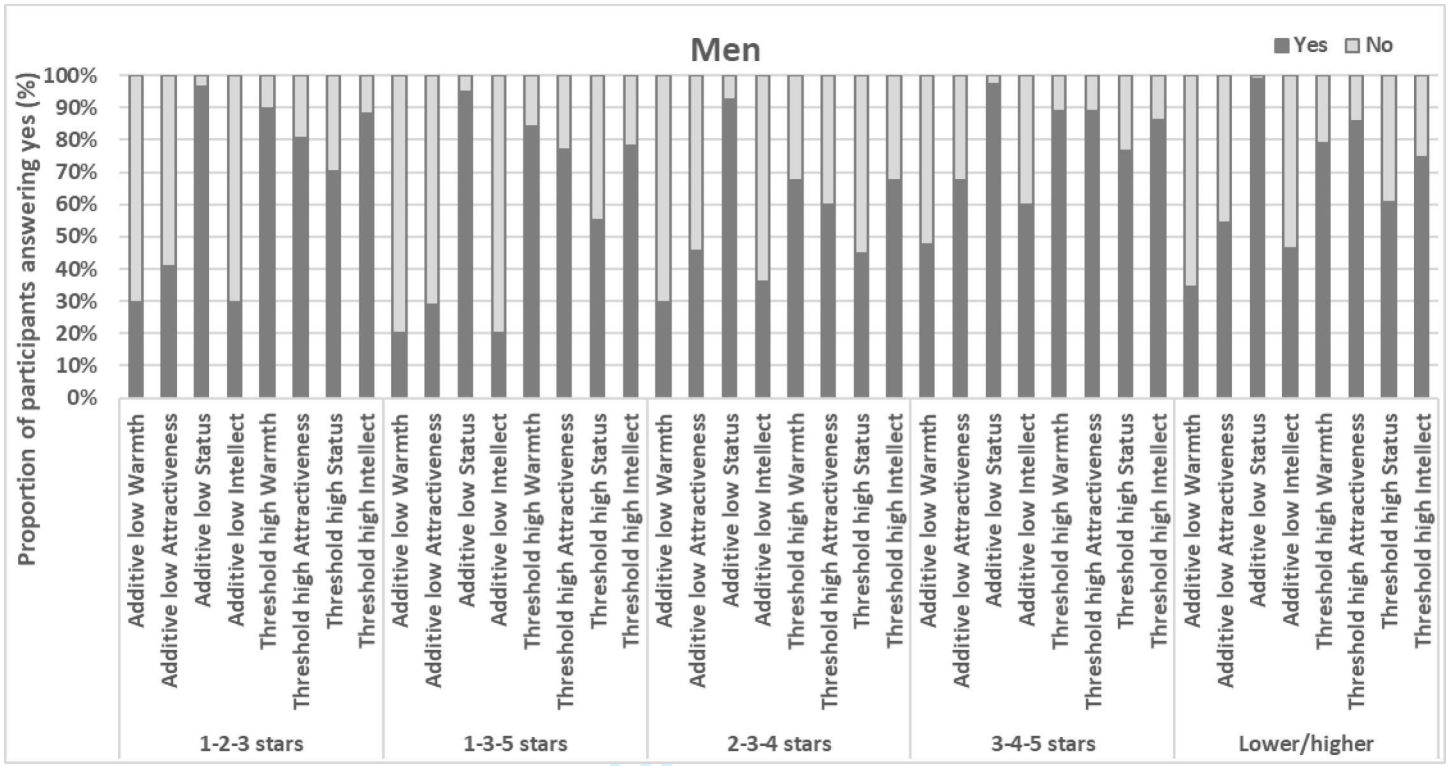


Figure S2. Men's willingness to accept the described partner for a long-term relationship across the five variants of the study, presented as a relative count (%).

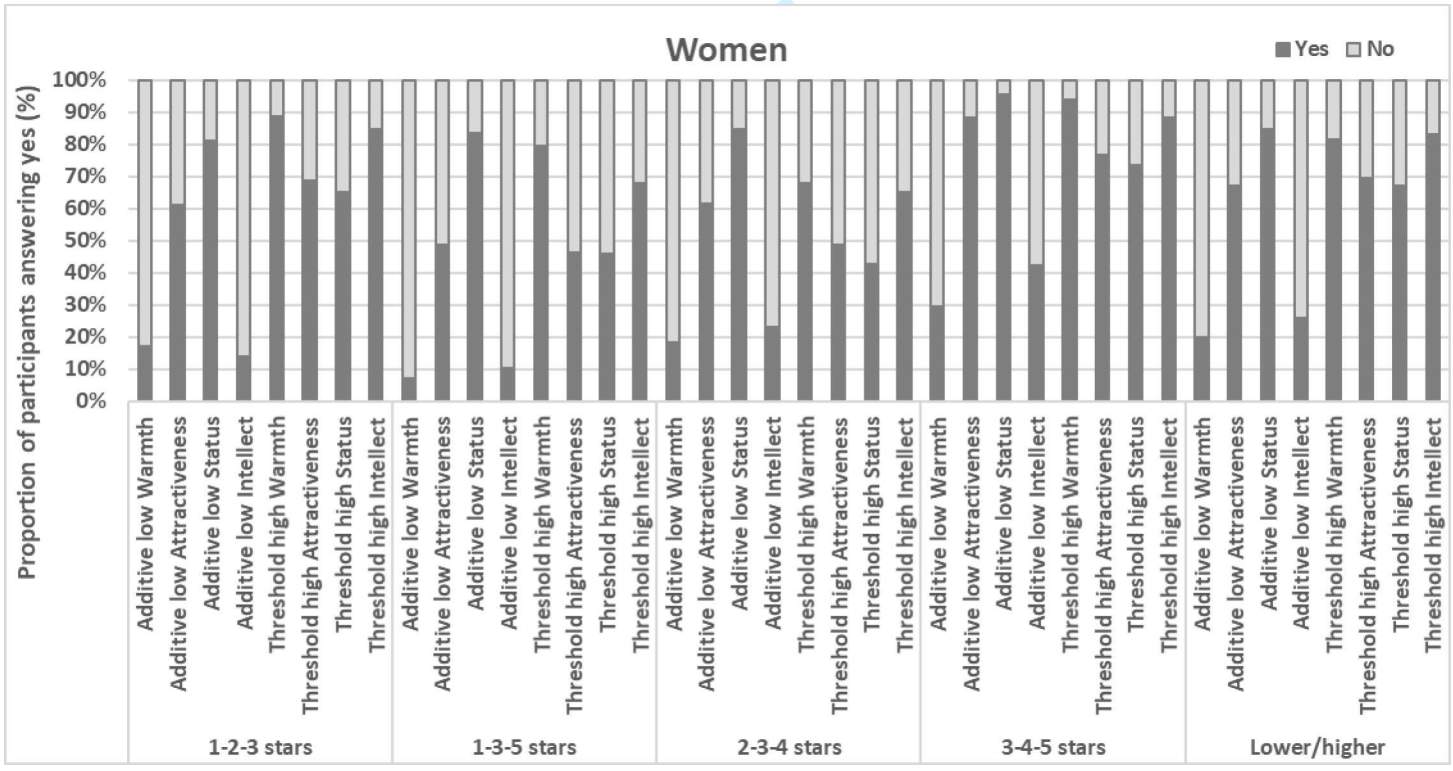


Figure S3. Women's willingness to accept the described partner for a long-term relationship across the five variants of the study, presented as a relative count (%).

Supplementary Table S7

Mean desirability ratings of the Additive vignettes across variants C, D, and E of Study 2

Variant label		C	D	E
		1–3–5 stars	2–3–4 stars	3–4–5 stars
Sex		**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Men	**All Additive vignettes pooled**	4.91_{a} (1.48)	5.74_{b} (1.54)	7.16_{c} (1.27)
	Additive vignette, low in Warmth	3.30_{a} (2.90)	4.46_{b} (2.56)	6.09_{c} (2.48)
	Additive vignette, low in Attractiveness	3.85_{a} (2.71)	5.02_{b} (2.55)	7.15_{c} (2.14)
	Additive vignette, low in Status	8.91_{ab} (1.58)	8.65_{ab} (1.70)	9.33_{ac} (1.09)
	Additive vignette, low in Intellect	3.57_{a} (2.81)	4.84_{b} (2.52)	6.06_{c} (2.58)
Women	**All Additive vignettes pooled**	4.40_{a} (1.52)	5.41_{b} (1.36)	7.09_{c} (1.13)
	Additive vignette, low in Warmth	2.24_{a} (2.48)	3.91_{b} (2.37)	5.72_{c} (2.19)
	Additive vignette, low in Attractiveness	5.23_{a} (2.73)	6.18_{b} (2.28)	8.17_{c} (1.62)
	Additive vignette, low in Status	7.78_{a} (2.17)	7.57_{a} (1.81)	8.86_{b} (1.31)
	Additive vignette, low in Intellect	2.35_{a} (2.53)	3.99_{b} (2.44)	5.61_{c} (2.34)

Note. Subscripts denote mean differences between the three variants within each sex. Similar subscripts denote
different subscripts indicate significant differences ($p < 0.01$, as indicated by Bonferroni type post hoc pa
standard deviation.

□□ $p < .01$.

□□□ $p < .001$.

Supplementary Table S8

Mean desirability ratings of the Threshold vignettes across variants C, D, and E of Study 2

Variant label		C	D	E
		1–3–5 stars	2–3–4 stars	3–4–5 stars
Sex		**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Men	**All Threshold vignettes pooled**	6.58_{a} (1.57)	6.02_{b} (1.75)	7.86_{c} (1.59)
	Threshold vignette, high in Warmth	7.27_{a} (1.93)	6.51_{b} (2.15)	8.16_{c} (2.00)
	Threshold vignette, high in Attractiveness	6.72_{a} (2.07)	6.38_{a} (2.19)	7.96_{b} (1.81)
	Threshold vignette, high in Status	5.42_{a} (2.34)	4.91_{a} (1.98)	7.25_{b} (2.00)
	Threshold vignette, high in Intellect	6.92_{a} (2.02)	6.29_{a} (2.23)	8.05_{b} (1.93)
Women	**All Threshold vignettes pooled**	6.44_{a} (1.60)	5.98_{b} (1.77)	8.05_{c} (1.50)
	Threshold vignette, high in Warmth	7.57_{a} (1.83)	6.57_{b} (2.22)	8.56_{c} (1.37)
	Threshold vignette, high in Attractiveness	5.70_{a} (2.42)	5.64_{a} (2.35)	7.66_{b} (2.10)
	Threshold vignette, high in Status	5.58_{a} (2.29)	5.34_{a} (2.21)	7.63_{b} (2.03)
	Threshold vignette, high in Intellect	6.89_{a} (2.15)	6.36_{a} (2.15)	8.35_{b} (1.70)

Note. Subscripts denote mean differences between three variants within each sex. Similar subscripts denote n different subscripts indicate significant differences ($p < 0.05$, as indicated by Bonferroni type post hoc pair standard deviation.

□□□ $p < .001$.

Additionally, we also wanted to see if the participants gave qualitatively similar ratings in Study 2 as in Study 1 to the texted vignettes after adjusting the phrasing. We wanted to see if the 3-star variant was a direct translation of the texted version and resulted in qualitatively similar desirability ratings. Repeated measures ANOVA across sex with the 8 vignettes as repeated measures and the three variants as between-subjects effect suggested significant interaction between the variants and the vignettes' ratings (men: $F(14,2023) = 6.979$, $p < 0.001$, $\eta_p^2 = 0.046$; women: $F(14,3892) = 8.714$, $p < 0.001$, $\eta_p^2 = 0.030$). However, the pattern of the results was comparable between the three versions of the study (i.e., Study 1: 'lower/higher'; Study 2: 'lower/higher than average'; and Study 2 '1–2–3 stars') and the ratings followed similar patterns across the versions (Figure S4 and S5).

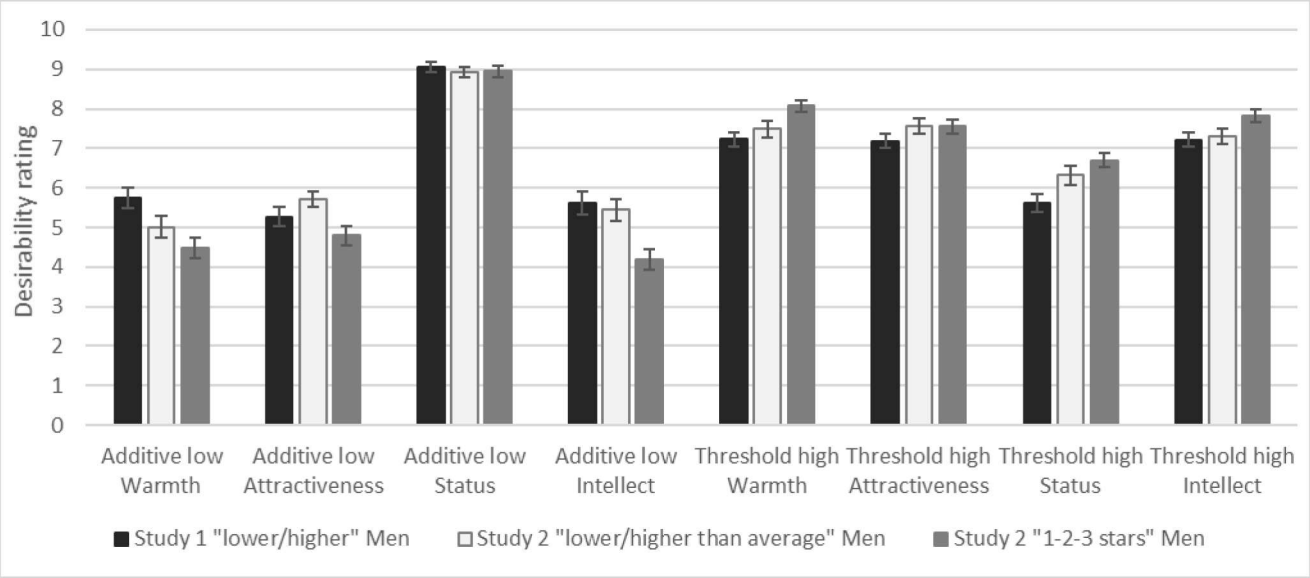


Figure S4. Mean ratings of the individual vignettes in men across the three versions of the study (Study 1: 'lower/higher'; Study 2: 'lower/higher than average'; and Study 2 '1–2–3 stars'). Error bars denote standard error of the mean.

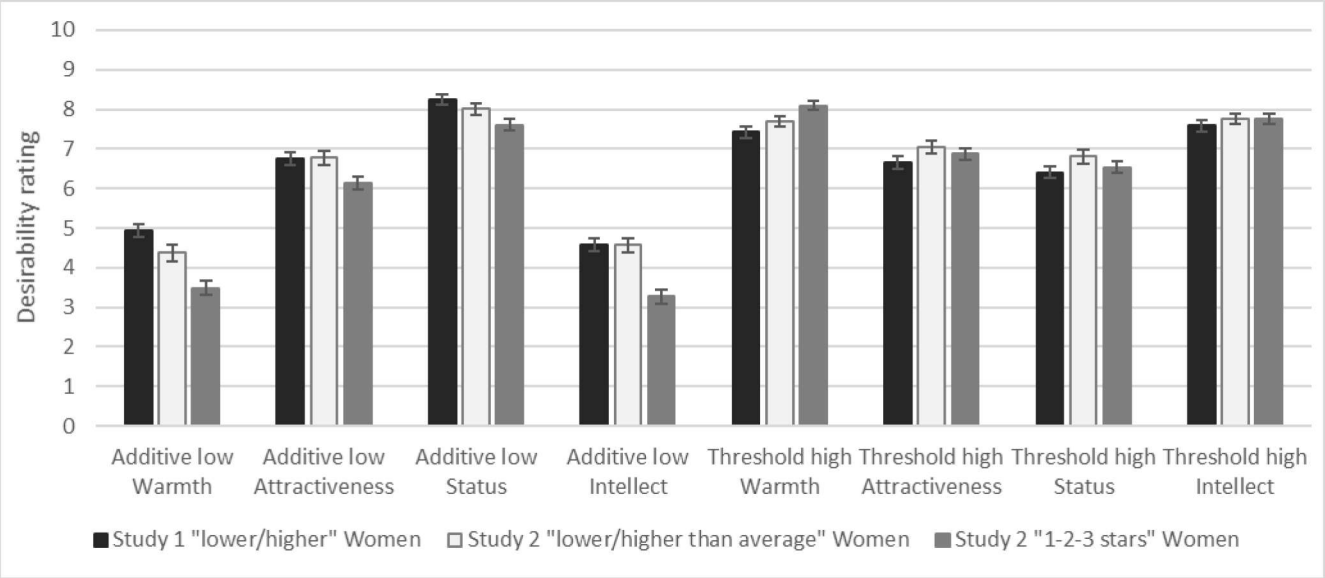


Figure S5. Mean ratings of the individual vignettes in women across the three versions of the study (Study 1: 'lower/higher'; Study 2: 'lower/higher than average'; and Study 2 '1–2–3 stars'). Error bars denote standard error of the mean.

See footnote 2 in the main text for details of this study. The sixth variant of the study, which used 1–2–3 stars out of the maximum of 5 stars yielded different pattern than the other five variants, but the underlying mechanisms producing this pattern may be similar. The average desirability rating of the Additive vignettes was higher than the average desirability of the Threshold vignettes in contrast to the other five variants of the study. The difference remained significant even after controlling for age. The overall desirability of the vignettes was, moreover, markedly low in comparison to the other five variants of the study, meaning the vignettes presented in the sixth variant were perceived as presenting very undesirable potential partners. The higher desirability of the Additive vignettes may be the result of the medium characteristics functioning as dealbreakers in the Threshold vignettes. As shown in the previous variants of Study 2, having just two stars out of the maximum of five functioned as a threshold violation of the relevant characteristic. The Threshold vignettes in the sixth variant of the study have three characteristics which are set to two stars out of five, with only one characteristic having three stars. In the Additive vignettes, only one characteristic has one star, while the other three characteristics have three stars out of a maximum of five. Therefore, contrary to the expectations stemming from the design of the vignettes (i.e., having three medium and one high-scoring characteristic in the Threshold vignettes in contrast with one low and three high characteristics in the Additive vignettes), the vignette ratings were determined by the absolute value of the characteristics and not by the relative performance of the characteristic within the vignette. That is, they did not consider that the overall vignette performs poorly, as also did the overall pool of the 8 vignettes. We assume the participants only watched that more characteristics violated a threshold in the Threshold vignettes than in the Additive vignettes. Thus, while these results may seem to contradict the overall preference for the Threshold vignettes, they in fact support it. Having three violations of thresholds is worse than having only one violation (Figure S6, Supplementary Tables S5 and S6).

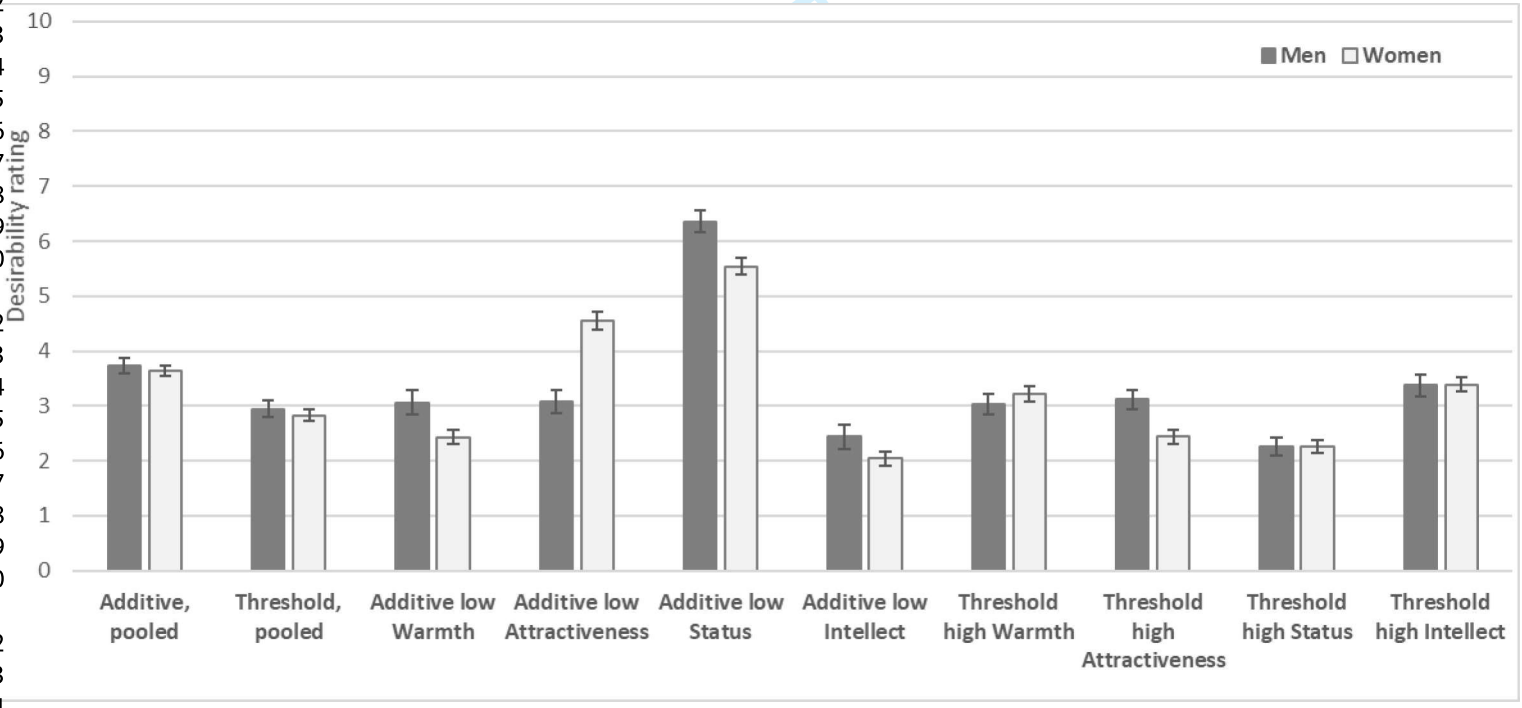


Figure S6. Mean desirability ratings of the Additive and Threshold vignettes, pooled and individually, across sex in the sixth variant of Study 2. Error bars denote standard error of the mean.

Supplementary Table S8

Correlations between the desirability ratings of the vignettes and the Euclidean distance between the vignettes' scores and the participants' partner ideals (higher distance means the vignette is farther from the partner ideals)

Variant	B	C	D	E
	1–2–3 stars	1–3–5 stars	2–3–4 stars	3–4–5 stars
Additive vignette, low in Warmth	-.280***	-.278***	-.165**	-.153**
Additive vignette, low in Attractiveness	-.435***	-.341***	-.420***	-.211***
Additive vignette, low in Status	-.481***	-.462***	-.235***	-.062
Additive vignette, low in Intellect	-.279***	-.176**	-.279***	-.234***
Threshold vignette, high in Warmth	-.220***	-.299***	-.205***	-.154**
Threshold vignette, high in Attractiveness	-.198***	-.246***	-.126*	-.169**
Threshold vignette, high in Status	-.048	-.255***	-.167**	-.156**
Threshold vignette, high in Intellect	-.175**	-.153**	-.104	-.076

* $p < .05$.
** $p < .01$.
*** $p < .001$.