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The synergistic effect of prosociality and physical attractiveness on mate desirability

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Abstract

Mate selection requires a prioritisation and joint evaluation of different traits present or absent in potential mates. Herein, we focus on two such traits – physical attractiveness and prosociality – and examine how they jointly shape impressions of overall desirability. We report on two related experiments which make use of an innovative methodology combining large samples of raters and target persons (i.e., stimuli) and information on targets' behaviour in economic games representing altruistic behaviour (Experiment 1) and trustworthiness (Experiment 2), two important facets of prosociality. In accordance with predictions derived from a cognitive perspective on mate choice and Sexual Strategies Theory, the results show that the impact of being prosocial on an individual's overall desirability was increased further by them also being physically attractive, but only in long-term mating contexts. Furthermore, we show that men's mate preferences for certain prosocial traits (i.e. trustworthiness) were more context-dependent than women's due to differential evolutionary pressures for ancestral men and women.

Keywords: Prosociality, physical attractiveness, mate choice, sexual strategies theory, synergistic interaction

The synergistic effect of prosociality and physical attractiveness on mate desirability

Mating can be considered one of the most fundamental motives underlying human cognition and behaviour (Kenrick, Griskevicius, Neuberg, & Schaller, 2010; Kenrick, Neuberg, Griskevicius, Becker, & Schaller, 2010). All stages of courtship and mating pose important challenges, but identifying desirable mates presents a crucial first task on the way to successful reproduction. But how do humans arrive at overall judgments of desirability when there are various different characteristics of potential mates to be considered and integrated?

According to Miller's and Todd's (1998) cognitive perspective on mate choice, cues of a potential mate's underlying qualities are not simply linearly aggregated to form overall evaluations of desirability, but rather these qualities can reinforce or undermine each others' contributions to overall desirability judgments. For example, assuming that the lack of one indispensable quality could easily be offset by the abundance of some other desirable quality would not make sense from an evolutionary point of view, and may prove to be extremely maladaptive (Miller, & Todd, 1998). Therefore, if a potential mate fails to meet a certain threshold concerning an important criterion trait (e.g., physical attractiveness), there will be little chance to compensate, even if the

threshold of another criterion (e.g., kindness) is met or surpassed. Likewise, meeting or surpassing several criteria at once (e.g., being both physically attractive and kind), may be worth more than the sum of its parts and result in a positive synergistic effect on overall desirability.

Some evidence of such a synergistic combination of desirable traits comes from Jensen-Campbell, Graziano, & West, (1995), who demonstrated that dominance cues positively affected the dating desirability of male targets only if they were simultaneously presented as highly agreeable, whereas dominance had no effect on the desirability of less agreeable men. Similarly, Lundy, Tan, and Cunningham, (1998) showed that women rated humorous men as more desirable as partners for a serious long-term relationship or marriage than non-humorous men, but only if they were also physically attractive. For a short-term relationship, however, humour had no significant effect on men's desirability, regardless of their physical attractiveness. A recent study by Farrelly, Clemson, and Guthrie (2016) found that men who were both attractive and altruistic were particularly desirable as long-term partners, whereas being altruistic hardly mattered in short-term contexts.

The present research will further test Miller's and Todd's (1998) cognitive perspective on mate choice by focusing on physical attractiveness and two different facets of prosociality as crucial factors in

the desirability of potential partners, namely altruistic behaviour and trustworthiness. Also, drawing from Sexual Strategies Theory (Buss & Schmitt, 1993), we will take account of the possibility that the hypothesized synergistic effects may be contingent upon the temporal context of mate choice, i.e., whether it is short- or long-term mating. Furthermore, the present research will address the question of whether both men and women are prone to evaluate a potential partner's characteristics in such a way that specific traits interact synergistically to shape overall perceptions of desirability. Finally, we will examine specific sex differences regarding the relative importance of trustworthiness in short- and long-term mate choice. Consequently, the present research will help shed light on the question of how perceptions of different qualities are integrated and jointly shape perceptions of overall desirability in women's and men's short- and long-term mate choices.

The reason for investigating prosociality as one criterion trait is that there has been an extensive body of recent literature suggesting that prosociality may serve an adaptive purpose in mate choice (e.g. Miller, 2000, 2007), due to the reliable signals that a prosocial act can send to potential mates (Gintis, Smith, & Bowles, 2001; Zahavi, 1975). Subsequently, there is now a large and growing body of empirical evidence that supports this theory. For instance, studies have found that

individuals increase their prosocial behaviour in mating scenarios, such as when being observed by potential mates (Bhogal, Galbraith, & Manktelow, 2016b; Farrelly, Lazarus, & Roberts, 2007; Iredale, Vugt, & Dunbar, 2008; Tognetti, Berticat, Raymond, & Faurie, 2012; Tognetti, Dubois, Faurie, & Willinger, 2016) and also when competing with others (Raihani & Smith, 2015; Tognetti et al., 2016). Prosociality is also positively linked to mating success (Arnocky, Piché, Albert, Ouellette, & Barclay, 2016) and the likelihood of entering a relationship (Stavrova & Ehlebracht, 2015) as well as there being evidence of assortative mating for prosociality among partners (Tognetti, Berticat, Raymond, & Faurie, 2014). Furthermore, it has also been shown that prosocial individuals are consistently considered more desirable than their non-prosocial counterparts (Barclay, 2010; Farrelly, 2011, 2013; Guo, Feng, & Wang, 2015; Moore et al., 2013; Oda, Okuda, Takeda, & Hiraishi, 2014; Oda, Shibata, Kiyonari, Takeda, & Matsumoto-Oda, 2013; Phillips, Barnard, Ferguson, & Reader, 2008). Due to female choice being a stronger selection force due to differences in parental investment (Trivers, 1972), the majority of this research has concentrated on showing the importance of prosociality in women's mate choice (e.g. Bhogal et al., 2016; Farrelly, 2011; Van Vugt & Iredale, 2013). However, studies that examined both sexes showed prosociality to be important in men's mate

choice as well (e.g. Farrelly, 2013; Moore et al., 2013, Stavrova & Ehlebracht, 2015).

Further in-depth investigations are necessary to reveal more of the specific role of prosociality in mate choice, and a better understanding of the combined effects of prosociality and physical attractiveness will help achieve this aim. For example, attention has been paid to the temporal context of prosocial traits in mate choice, in other words whether it is more important for short or long-term mating, in order to aid our understanding of what precisely prosocial traits are predominantly signalling. This is because sexual strategies theory (Buss & Schmitt, 1993) suggests that both men and women may under some circumstances maximize their reproductive success by engaging not only in stable long-term relationships, but also in short-term sexual liaisons. For men, such short-term sexual encounters with fertile women may considerably increase their number of offspring while involving only minimal investment. For women, short-term mating may provide opportunities to acquire high quality genes to be inherited by their offspring. Long-term mating, on the other hand, allows men and women to mutually invest in their joint offspring, ultimately increasing the offspring's odds of survival and reproductive fitness (Buss, & Schmitt, 1993).

Subsequently, prosocial traits have been shown to be valued more for long-term mating (e.g. Barclay, 2010; Farrelly, Clemson, & Guthrie, 2016; Farrelly, 2013) and there appears to be no effect of fertility on preferences for altruistic short-term partners (Farrelly, 2011; Oda et al., 2014). This therefore suggests that prosociality acts predominantly as a signal of an individual's quality as a partner and/or parent. However other findings suggests no difference in the effects of prosocial behaviour for short or long-term mating opportunities (Arnocky et al., 2016; Guo et al., 2015). These latter findings suggest further investigation of the temporal mating context when researching prosociality is warranted.

Moreover, it appears meaningful to examine the effects of physical attractiveness alongside prosociality. Markers of health, fertility and genetic quality are perceived as physically attractive (e.g., Fink & Penton-Voak, 2002; Gangestad & Scheyd, 2005; Grammer & Thornhill, 1994; Kościński, 2008; Little, Jones, & DeBruine, 2011; Rhodes, 2006). Hence, both women and men generally exhibit pronounced preferences for physically attractive partners (Buss, 1989b; Li, Bailey, Kenrick, & Linsenmeier, 2002). Yet, while physical attractiveness appears to be of particular importance in short-term mating (Li, 2007; Li & Kenrick, 2006; Regan, 1998; Regan, Levin, Sprecher, Christopher, & Gate, 2000), most

people appear to be willing to (at least partially) trade off physical attractiveness against other important qualities (such as kindness) in long-term mating (Li et al., 2002). Therefore the pattern of its desirability when combined with prosociality across different mating contexts will provide valuable evidence as to whether the latter is predominantly a signal of good genes or good partner/parenting quality. In other words, if prosociality is a signal of good partner/parenting quality as has been suggested previously (Farrelly, 2011, 2013; Farrelly et al., 2016; Oda et al., 2014) then its desirability across mating contexts will follow a different pattern to the desirability of a signal of good genetic quality such as physical attractiveness.

To operationalise prosociality, the current research will employ two economic games, the dictator game and the trust game, which are intended to represent different facets of prosociality. The former involves the opportunity for one player to donate a part of their funds to another player and is therefore akin to charitable donations or generosity, which can be considered a standard indicator of altruistic behaviour (e.g. Farrelly et al., 2007; Iredale et al., 2008; Moore et al., 2013; Tognetti et al., 2014). The trust game however, represents a different facet of prosociality, namely that of trustworthiness (Berg, Dickhaut, & McCabe, 1995; Evans & Revelle, 2008; Glaeser, Laibson, Scheinkman, & Soutter,

2000). In particular, a trustee has to decide whether to return some funds to a trustor, who has previously sent some of their funds in the hope of receiving a larger amount in return.

Therefore the current research presents the findings of two related experiments that look at the potential synergistic effects of physical attractiveness and two facets of prosociality: altruistic behaviour, as measured by the dictator game (Experiment 1), and trustworthiness, as measured by the trust game (Experiment 2).

Experiment 1: Physical Attractiveness and Altruistic Behaviour

This first experiment examines how physical attractiveness interacts with altruistic behaviour to affect the desirability of men as potential short or long-term partners for women. Unlike previous research (e.g., Barclay, 2010; Farrelly, 2011, Farrelly et al., 2016), we avoided using vignettes depicting hypothetical scenarios to reduce any ambiguity that their use may present to the reader. Indeed, some behaviours in past research could be considered as generosity, for example buying a homeless person a sandwich, but others, for example rescuing a child from a river, might perhaps be more akin to heroism or bravery (Farthing, 2005; Kelly & Dunbar, 2001). In contrast, providing information about a stimulus person's alleged behaviour in a dictator game appears comparatively less ambiguous and is highly credible in the context of an experiment.

After all, from the perspective of a study participant, it appears plausible that a researcher could have actually obtained information about stimulus persons' behaviour in a dictator game, whereas hypothetical vignettes often lack this credibility.

In experimental psychology and economics, the dictator game, first employed by Kahneman, Knetsch, and Thaler (1987), has been established as a standard procedure for measuring altruism (and egoism) on a behavioural level (e.g. Eckel & Grossman, 1996; Forsythe, Horowitz, Savin, & Sefton, 1994; Hoffman, McCabe, & Smith, 1996). Giving in dictator game experiments appears to be positively related to trait agreeableness in the Big-Five model and the honesty-humility dimension in the HEXACO-model of personality (Ben-Ner, Kong, & Putterman, 2004; Ben-Ner, Kramer, & Levy, 2008; Ben-Ner, Putterman, Kong, & Magan, 2004; Hilbig & Zettler, 2009). Furthermore, Benz and Meier (2008) demonstrated in two experiments that charitable giving in experimental settings was positively correlated with charitable giving in field settings before and after the respective experiments. By providing information on targets' behaviour in a dictator game, this experiment was thus able to manipulate information on targets' generosity in a more controlled and credible manner than specific hypothetical personality profiles or vignettes, which may inadvertently differ in other dimensions

than the one intended to be manipulated. As a result, Experiment 1 will test the following hypotheses:

Hypothesis 1: Women prefer altruistic men over egoistic men.

Hypothesis 2: Women's preferences for altruistic behaviour are more pronounced in long-term choices than in short-term choices.

Hypothesis 3: There will be an interaction between physical attractiveness and altruistic behaviour, whereby there will be a synergistic effect on the desirability of men who possess high levels of both traits. Furthermore, this synergistic effect will be greater in long-term mating contexts than short-term ones.

Methods[1]

Stimulus material and ratings of physical attractiveness. A total of 77 male students from a Dutch university were videotaped sitting in front of a white wall while introducing themselves. The videos were cut into silent 20-second clips with a ten-second transition in which the identification number of the upcoming video was displayed. On the basis of these clips, 25 female judges with a mean age of 23.60 years (*SD* = 2.75) from a German university rated the physical attractiveness of male targets on a seven-point Likert-type scale ranging from "not attractive at

[1] Study materials as well as the raw data for both Experiments 1 and 2 are openly available via the Open Science Framework (Farrelly, 2017).

all" to "very attractive" (*M* = 2.25, *SD* = 0.88). Because the ratings reached adequate inter-rater reliability (*ICC* = .95), averaged ratings could be used as indicators of physical attractiveness in the analysis.

Participants and procedure. Participants were 75 female students from a German university with a mean age of 22.61 years (*SD* = 3.42), who were approached on campus and agreed to participate on a prescheduled date. No participants had to be excluded due to wrongly answered control questions. The experiment was conducted in a medium-sized lecture hall with separate runs for several groups of raters. Participants were seated facing the projection surface with an appropriate distance between one another.

All relevant information (except for the video clips) was provided in written form to each participant via questionnaire. First, all participants read the description of an anonymous one-shot binary dictator game. The dictator was said to be endowed with €10 by the experimenter and confronted with the decision of whether to split the money equally and send €5 to an anonymous receiver or to keep the whole €10 while sending nothing to the receiver. After filling out a set of four control questions concerning potential monetary outcomes of the interaction for both parties, participants were informed that they would rate the desirability of various male target persons who had taken part in the

dictator game described above and who would be presented on the screen.

Half of the participants were asked to rate each target person's desirability as a short-term sexual partner (i.e., "for a short-term sexual affair, where sexuality is in the foreground for both partners and where feelings don't play a role"). The other half were asked to rate each target person's desirability as a long-term romantic partner (i.e., "for a long-term relationship, where both partners are faithful and highly emotionally connected to each other, and where both partners invest heavily in a permanent relationship"). This means that any given rater judged the desirability of all the target persons presented on screen invariantly as either short- or long-term partners. Additionally, for each target person, participants were provided with information on the target's decision in the dictator game outlined above. The information about the target persons' behaviour was presented in a randomized way, with one half of the participants being informed that a given target person had split the money and one half of the participants being informed that the same target person had kept the money. The written descriptions of the target persons' behaviour in the dictator game were matched with the corresponding video clips using identification numbers, which were announced on screen prior to each clip. Thereby, participants were able

to integrate their perceptions of the targets' physical attractiveness and behaviour in the dictator game accordingly and to develop an overall desirability rating. All desirability ratings were captured on seven-point Likert-type scales ranging from "very unattractive" to "very attractive".[2]

To summarize, 77 male stimuli (target persons) with various levels of physical attractiveness were randomly presented either as altruists or as egoists and were rated on the dimension of desirability as either short-term or long-term partners. Altruism varied within stimuli and within participants and mating context varied within stimuli but between participants. After completion of the video-based rating procedure, participants answered some questions concerning their basic socio-demographic data and were then thanked for their participation and dismissed.

Results and Discussion

To account for the fact that information about stimuli's behaviour in a dictator game and mating context varied randomly within stimuli and between participants, we estimated a mixed regression model, which treated both participants and stimuli as random effects (Judd, Westfall, &

[2] Please note that we used the German word "attraktiv" to capture ratings of desirability in our experiments. The concept of "Attraktivität" extends beyond mere physical attractiveness in the German language, and corresponds – especially if put into context – to the English concept of "desirability", as it represents an overall, integrated evaluation. To properly differentiate between (exogenously rated) physical attractiveness and the raters' own integrated perceptions of overall desirability, we will use the English word "desirability" whenever we refer to the raters' own integrated perceptions.

Kenny, 2012). The unit of analysis was a participant by stimulus observation, with each row of data representing the general desirability rating given by a participant on a specific stimulus (dependent variable). Stimulus' altruistic behaviour (egoistic vs. altruistic), z-standardized physical attractiveness score (as provided by exogenous raters), and respective mating context (short-term vs. long-term) served as independent variables. The estimated model included three fixed effects (altruism, mating context and physical attractiveness) and three two-way (altruism x mating context, altruism x physical attractiveness, physical attractiveness x mating context) and one three-way (altruism x mating context x physical attractiveness) interactions. Following Barr et al. (2013), we included all random effects (intercepts and slopes) allowed by the design: by-subject and by-stimulus random intercepts, by-subject random slopes of altruism and physical attractiveness (mating context could not be specified as random as it varied between, not within subjects) and by-stimulus random slope of altruism and mating context (physical attractiveness could not be specified as random because each stimulus had a unique attractiveness score, equivalent to a between-subjects variation).

The analyses were conducted using the R package lme4 (Bates et al., 2015). Before starting to the test our hypotheses in chronological order,

we first examined the effect of mating context on ratings of desirability. The temporal context of mate choice (i.e., short-term vs. long-term) showed no significant effect on overall desirability ratings, $F(1, 73) = 1.38$, $p = .24$, indicating that, on average, desirability ratings were no more or less generous in short-term than in long-term mating.

In the following, we systematically tested our hypotheses concerning the relevance of attractiveness and altruistic behaviour in women's short-term and long-term mate choices (see Table 1):

Hypothesis 1 stated that women would prefer altruistic over egoistic men. As predicted, displays of altruism (as indicated by dictator game behaviour) showed a considerable effect on desirability ratings, $F(1, 73) = 56.30$, $p < .001$, meaning that, on average, altruistic targets were judged to be significantly more desirable ($M = 2.26$, $SD = 1.50$) than egoistic targets ($M = 1.92$, $SD = 1.30$).

Hypothesis 2 stated that preferences for altruistic behaviour would be more pronounced in long-term than in short-term mate choices. Indeed, there was a significant interaction between altruism and mating context, $F(1, 73) = 11.82$, $p < .001$. A simple effect analysis showed that altruistic behaviour played a more important role in overall desirability of men as long-term ($b = .51$, $p < .001$) than as short-term partners ($b = .19$, $p = .002$). As long-term partners, altruistic targets were considered

significantly more desirable (*M* = 2.42, *SD* = 1.51) than egoistic targets (*M* = 1.91, *SD* = 1.523), whereas, in short-term partners, the effect of altruistic behaviour shrank considerably but did not disappear completely (*M* = 2.11, *SD* = 1.48 vs. *M* = 1.92, *SD* = 1.37).

Regarding physical attractiveness, we observed that attractive men were generally preferred, F (1, 129) = 206.62, $p < .001$, irrespective of the given mating context, F (1, 73) = 0.05, p =.82.

Hypothesis 3 stated that there would be an interaction between physical attractiveness and altruistic behaviour, whereby there will be a synergistic effect on the desirability of men who possess high levels of both traits, and that this would be greater for long-term mating. Indeed, there was a significant interaction between dictator game behaviour and physical attractiveness, F(1, 248) = 26.18, $p < .001$, which was further accentuated by a significant three-way interaction between dictator game behaviour, physical attractiveness and mating context, F(1, 5469) = 6.53, p = .01. This means that in the context of long-term mating, the impact of altruistic behaviour on ratings of desirability was higher for attractive than for unattractive targets ($b_{altruism*attractiveness}$ = .21, $p < .001$), whereas in a short-term mating context, the effect of altruistic behaviour was almost equally weak for attractive as for unattractive targets ($b_{altruism*attractiveness}$ = .07, p = .07), see Figure 1.

The findings support all three hypotheses. For the final hypothesis it was found that, in a short-term mating context, both altruistic behaviour and physical attractiveness influence desirability ratings independently (with altruistic behaviour being considerably less important than it is in long-term mating). However, in the context of long-term mating, the impact of altruistic behaviour on desirability ratings was not only stronger than in short-term mating but was also more pronounced among physically attractive targets, indicating a synergistic effect of these two traits but only for long-term partners. This pattern of results suggests that in long-term mating, where both physical attractiveness and altruistic behaviour appear to exceed a certain threshold of importance, being highly altruistic and highly attractive at the same time has a stronger effect on overall desirability than the sum of individual contributions of each trait would predict. In other words, regarding overall judgments of their desirability as long-term partners, physically attractive men benefit comparatively more from exhibiting altruistic behaviour than their less attractive peers.

Experiment 2: Physical attractiveness and Trustworthiness

The second experiment follows a similar procedure to that of Experiment 1, however behaviour in the trust game, considered here to be a reliable measure of trustworthiness (Berg et al., 1995; Evans & Revelle, 2008;

Glaeser et al., 2000), was used. The trust game has been used previously in research into the role of prosocial traits in mate choice (Bhogal, Galbraith, & Manktelow, 2016a; Tognetti et al., 2014). Arguably, finding a loyal and trustworthy partner may be even more important than finding a partner who is merely generous. A potential partners' trustworthiness, as a defining feature of a good character, may be of comparatively little importance in short-term but supremely relevant in long-term mating for both sexes (Fletcher et al., 2004; Scheib, 2001). For ancestral women it was crucial to find dependable partners who were willing to invest substantial time and resources for an extended period of time, as falling for a man who promised to support a woman and her children but failed to live up to that promise may have proven fatal. Likewise, ancestral men needed to identify faithful women who would not engage in extramarital affairs with other men to reduce the risk of unwittingly investing time and resources in the rearing of another man's children. Therefore, we examined the joint effects of trustworthiness and physical attractiveness on the desirability of both men and women with regard to different mating contexts in Experiment 2.

However, although the desirability of prosocial behaviours is generally proposed to be higher in long-term relationships for both men and

women (Farrelly, 2013), there may be subtle yet important differences when it comes to trustworthiness that necessitate examining ratings of its desirability in both men and women separately. It has been suggested that women may differentiate less clearly between short- and long-term mating contexts than men when selecting partners. For example, Buss and Schmitt (1993) argued that women sometimes engage in short-term mating to evaluate men as prospective long-term partners. In addition, women frequently justify casual sex based on the hope that the sexual relationship may lead to a long-term romantic relationship (Li & Kenrick, 2006) and tend to rate love and emotional intimacy as the most compelling reasons to have an extramarital affair (Glass & Wright, 1985). Furthermore, evolutionary key functions of ancestral women's short-term mating strategies may have involved obtaining resources (Symons, 1979) and physical protection (Smuts, 1985), thus making finding trustworthy short-term partners critical. Moreover, women's pronounced fear of sexual aggression (Buss, 1989a) may render them very attentive to cues of a man's trustworthiness, even when assessing short-term sexual partners. Men, on the other hand, are not assumed to derive benefits such as protection and resources from having a short-term relationship with a trustworthy woman and are less prone to believing that a sexual affair may evolve into a committed relationship (Li, & Kenrick, 2006). In long-term mating,

however, men may react particularly strongly to displays of trustworthiness (or lack thereof), which might reflect an evolutionary pressure to minimize paternity uncertainty. As noted above, unwittingly investing time and resources in another man's offspring is an evolutionary worst-case scenario for men. Indeed, men have been shown to exhibit stronger preferences for faithfulness and sexual loyalty (Buss & Schmitt, 1993) and to display higher levels of sexual jealousy than women (Buss, Larsen, Westen, & Semmelroth, 1992). Therefore, it appears plausible that men's preferences for trustworthiness are more dependent on the given mating context than women's preferences.

Furthermore, we expect a replication of the synergistic effect of physical attractiveness and prosociality observed in Experiment 1. As attractiveness appears to be quite important in both short- and long-term mating and trustworthiness should be of particular importance in long-term mating, we assume that this effect will most likely occur in long-term mate choice (as found in Experiment 1) and probably pertain to both male and female targets.

Therefore, Experiment 2 tests the following hypotheses:

Hypothesis 1: Trustworthiness will be more desired overall than untrustworthiness.

Hypothesis 2: Trustworthiness will be desired more strongly in long-term than in short-term mate choice.

Hypothesis 3: The desirability of trustworthiness will be affected by mating context more strongly for men than for women.

Hypothesis 4: There will be an interaction between physical attractiveness and trustworthiness, whereby there will be a synergistic effect on the desirability of potential mates who possess high levels of both traits. Following the results of Experiment 1, this is predicted to be present in long-term mating contexts only.

Methods

Pretest of stimulus materials.

***Targets' physical attractiveness*.** In addition to the 77 male students from Experiment 1, a further 74 female participants from a Dutch university were videotaped sitting in front of a white wall while introducing themselves to the camera for use in this experiment. As before, the videos were cut into silent 20-second clips with ten-second transitions displaying identification numbers between clips. 25 female (see Experiment 1) and 15 male (new for Experiment 2) judges from a German university (age ranged between 19 and 32 years, *M* = 23.83, *SD* = 3.25), rated the physical attractiveness of opposite-sex targets

using a seven-point Likert-type scale ranging from “not attractive at all” to “very attractive” (male targets: *M* = 2.25, *SD* = 0.88; female targets: *M* = 3.00, *SD* = 1.13). Because attractiveness ratings given by both male (*ICC* = .96) and female (*ICC* = .95) raters reached adequate levels of inter-rater reliability, ratings were averaged across raters and used as indicators of physical attractiveness in the subsequent analysis.

Targets’ trustworthiness. Perceptions of trustworthiness were randomly manipulated by informing participants of each target’s alleged decision as a trustee in a one-shot binary trust game, as has been used previously in research (Dunning, Anderson, Schlösser, Ehlebracht, & Fetchenhauer, 2014; Eckel & Wilson, 2004; Fetchenhauer & Dunning, 2009; Snijders & Keren, 2001). The game was described as follows: Person A (the trustor) was given €5 by the experimenter and could freely decide whether to send these €5 to Person B (i.e., the trustee) or to keep the €5 and exit the interaction. In the latter case, Person A would walk away with €5, while Person B would receive nothing. In the former case, however, the experimenter would raise the amount sent by an additional €15, so Person B would receive a total of €20. Person B would then have to decide, whether to walk away with the €20 and send nothing back to Person A, or to send €10 back to Person A, so both Person A and Person B would leave the interaction with €10 each.

To ensure that behaviour in the trust game is indeed perceived as a cue to trustworthiness on a trait level, we asked a sample of 45 female and 20 male students from a German university, who were aged between 20 and 37 years (M = 23.14, SD = 3.35), to judge the extent to which a number of different characteristics, including trustworthiness, applied to an opposite-sex target person who had participated in the trust game in the role of Person B. In a between-subjects experimental design, participants were told that the target person had either decided to send €10 back to Person A or to keep the whole €20. Ratings of individual traits were gathered on seven-point Likert-type scales ranging from "does not apply at all" to "does fully apply."

A two-way ANOVA was conducted using the raters' sex and Person B's behaviour as independent variables and the rating of the target person's trustworthiness ("Person B is trustworthy") as the dependent variable. The results indicated that targets who allegedly decided to send €10 back to Person A were judged to be significantly more trustworthy (M =5.63, SD = 1.26) than targets who were reported to having kept the whole €20 (M = 2.73, SD = 1.36), $F(1, 61) = 61.44$, $p < .001$. Neither the effect of raters' sex, $F(1, 61) = 0.84$, $p = .36$, nor the interaction between raters' sex and Person B's behaviour, $F(1, 61) = 0.60$, $p = .44$, were significant.

The results suggested that both female and male raters are able to use targets' behaviour as trustees in a binary trust game as a basis for inferences regarding trustworthiness on a trait level.

Main study.

Participants. For the main study, 154 German university students registered for a study of "attractiveness judgments" via email and were subsequently assigned to participate on a prescheduled date. Two participants were excluded from further analyses because they made mistakes answering at least one out of six control questions regarding the monetary outcomes of the trust game. Another eleven participants were excluded because they reported to be homo- (n = 3) or bisexual (n = 7) or did not indicate their sexual orientation (n = 1). The remaining sample of 141 heterosexual persons comprised 84 (59.6%) women and 57 (40.4%) men aged between 18 and 46 years (M = 24.17, SD = 4.08).

Procedure. The study employed a 2 (rater's sex: female vs. male) x 2 (target's trustworthiness: trustworthy vs. untrustworthy) x 2 (mating context: short- vs. long-term) between-subjects experimental design.

The experiment was conducted in several medium-sized lecture halls with separate runs for groups of male or female raters who first learned about the general features and consequences of the one-shot binary

trust game described above. Thereafter, participants answered six control questions concerning the potential monetary outcomes for Persons A and B. Finally, participants were informed that they were about to rate the desirability of opposite-sex target persons presented on the screen and that these target persons had participated in the trust game as Person B (i.e., the trustee).

Similar to Experiment 1, half of the participants were asked to rate the target persons' desirability as short-term sexual partners (i.e., "for a short-term sexual affair"). The other half of the participants were asked to rate the target persons' desirability as long-term romantic partners (i.e., "for a long-term relationship").

For each target person, raters were informed of the target's alleged behaviour in the trust game. Information was presented between subjects, i.e., half of the participants were informed that a given target person had send €10 back to Person A (i.e., behaved trustworthily), while the other half of the participants were informed that the very same target person had kept the whole €20 (i.e., behaved untrustworthily).

Overall desirability ratings were again gathered on seven-point Likert-type scales ranging from "very unattractive" to "very attractive."

After completion of the video-based rating procedure, participants answered questions concerning their basic socio-demographic data, were thanked and dismissed. Thirteen randomly selected participants were awarded with cash prizes ranging from €10 to €100 (1 x €100, 2 x €50, 10 x €10).

Results and Discussion

As in Experiment 1, a sample of participants evaluated a sample of stimuli, therefore, we used a mixed (multilevel) regression technique, which treated both raters and targets as random effects (Judd, Westfall, & Kenny, 2012). The unit of analysis was a rater by target observation. Each row of data represented the desirability rating given by a specific rater to a specific target (dependent variable), with mating context (short-term vs. long-term), rater's sex (female vs. male), target's standardized (separately within sexes) physical attractiveness score (as provided by exogenous raters), and target's trustworthiness (untrustworthy vs. trustworthy) as independent variables. The estimated model included four fixed effects (mating context, target's trustworthiness, rater's sex, and target's physical attractiveness), six two-way interactions, four three-way interactions, and one four-way interaction. Like in Experiment 1, we included all random effects (intercepts and slopes) allowed by the design: by-subject and by-stimulus random intercepts, by-subject

random slopes of trustworthiness and physical attractiveness and by-stimulus random slope of trustworthiness and mating context (sex could not be specified as random as it was a between-subjects factor for both raters and targets).

Our analysis of the fixed effects indicated that the four-way interaction was not significant, $F(1, 9992) = 1.59$, $p = .21$; therefore, we proceeded directly to analyzing the lower-order interactions (see Table 2).

Hypothesis 1 stated that trustworthy individuals would be rated more desirable than untrustworthy ones. This was supported, as there was a significant main effect of targets' trustworthiness, $F(1, 153) = 54.57$, $p < .001$.

According to *Hypothesis 2* trustworthiness would affect perceptions of desirability more strongly in long-term than short-term mate choice. A significant interaction between targets' trustworthiness and mating context showed this to be the case, $F(1, 136) = 23.08$, $p < .001$. That is, displays of trustworthiness more greatly impacted desirability ratings in the long-term context ($b_{trustworthiness} = 0.58$, $p < .001$) than the short-term context ($b_{trustworthiness} = 0.16$, $p = .001$).

Similarly to Experiment 1, we found a significant two-way interaction between physical attractiveness and mating context, $F(1, 138) = 10.84$, p

= .001, indicating that the impact of physical attractiveness on desirability ratings was stronger in the short-term ($b_{attractiveness}$ = 1.01, p < .001) than in the long-term ($b_{attractiveness}$ = 0.84, p < .001) mating context.

Hypothesis 3 stated that the degree to which trustworthiness affects perceptions of overall desirability would depend more strongly on the specific mating context for men than for women. This hypothesis was supported, as there was a marginally significant three-way interaction between targets' trustworthiness, mating context, and raters' sex, F(1, 136) = 3.61, p = .06. This interaction indicates that the temporal context of mate choice exerted a stronger influence on the impact of trustworthiness on judgments of overall desirability for male ($b_{trustworthiness*context}$ = 0.64, p < .001) than for female raters ($b_{trustworthiness*context}$ = 0.26, p = .01). Specifically, the impact of targets' trustworthiness on female raters' desirability ratings increased from relatively slight ($b_{trustworthiness}$ = 0.23, p = .001) in the short-term context to moderate in the long-term context ($b_{trustworthiness}$ = 0.49, p < .001), whereas for male raters, it increased from virtually non-existent in the short-term context ($b_{trustworthiness}$ = 0.04, p = .44) to relatively strong in the long-term context ($b_{trustworthiness}$ = 0.69, p < .001), see Figure 2. In summary, the results suggest that shifts in importance of trustworthiness

from short- to long-term mating contexts were indeed more pronounced for men than for women.

Additionally, we observed a similar pattern with regard to physical attractiveness: A significant three-way interaction between physical attractiveness, mating context, and raters' sex, $F(1, 138) = 5.06$, $p = .026$, indicated that targets' physical attractiveness underwent a more pronounced increase in importance when moving from long- to short-term mate choice for male ($b_{attractiveness*context} = -0.33$, $p < .001$[3]) than female raters ($b_{attractiveness*context} = -.0.06$, $p = .42$). This means that men's preferences were more strongly influenced by the given mating context regarding both trustworthiness and physical attractiveness.

Hypothesis 4 indicated that physical attractiveness and trustworthiness would have a synergistic effect on ratings of overall desirability for long-term partners. That is, the impact of trustworthiness on ratings of overall desirability should be stronger for physically attractive than less attractive targets. As expected, we found a significant interaction between targets' trustworthiness and physical attractiveness, $F(1, 157) = 16.08$, $p < .001$, which was qualified by a three-way interaction with mating context, $F(1, 9992) = 21.69$, $p < .001$, indicating that the

[3] The model including the random slope of attractiveness at the level of participants and the random slope of mating context at the level of stimuli simultaneously did not converge. The results are reported for the model with either of these random slopes.

emergence of a synergistic effect of attractiveness and trustworthiness on desirability ratings depended on the given mating context. Indeed, targets' trustworthiness impacted short-term desirability ratings regardless of their physical attractiveness ($b_{trustworthiness*attractiveness}$ = 0.01, p = .64), whereas in the long-term context, targets' trustworthiness and physical attractiveness mutually reinforced ($b_{trustworthiness*attractiveness}$ = 0.19[4], p < .001). Specifically, in long-term mating, targets' trustworthiness affected ratings of attractive targets ($b_{trustworthiness}$ = 0.76, p < .001) considerably more than of less attractive targets ($b_{trustworthiness}$ = 0.38, p < .001), see Figure 3. Hence, as predicted by Hypothesis 4, physical attractiveness and trustworthiness exerted a synergistic effect on ratings of overall desirability, albeit only in the long-term mating context.

General Discussion

In both experiments, clear evidence is provided for both altruistic behaviour (as measured by behaviour in the dictator game) and trustworthiness (as measured by behaviour in the trust game) being valued prosocial traits in human mate choice, in line with previous research. Furthermore, both characteristics were preferred more so in

[4] The model included random intercepts for raters and targets and random slopes of attractiveness and trustworthiness at the level of raters (the model additionally including a random slope of trustworthiness at the level of targets did not converge).

long-term partners, which is commensurate with the findings of existing research pointing at the particular value of prosociality in long-term relationships (Barclay, 2010; Farrelly, 2011, 2013; Farrelly et al., 2016; Oda et al., 2014; Stavrova & Ehlebracht, 2015), suggesting that prosociality acts predominantly as a signal of good partner/parenting quality to potential mates. Most importantly, both experiments provide evidence of a synergistic effect on the desirability of individuals who possess high levels of both prosociality and physical attractiveness in long-term mate choice. In other words, individuals who possess both traits were desired more than a purely additive model would predict. This synergistic effect is congruent with Miller's & Todd's (1998) cognitive perspective on mate choice and shows that different degrees of one trait may either increase or reduce the impact of another trait on overall desirability.

By jointly examining the effects of physical attractiveness and prosocial traits, the methodological approach used here avoids a major potential shortcoming of many previous studies, and is thus among the few studies that simultaneously manipulate multiple characteristics of potential mates and measure their joint impact on desirability across different contexts. Indeed, real-life mate choice most likely does neither entail a conscious ex-ante definition of certain standards concerning

various criteria, nor does it usually involve simultaneous choices between known alternatives (Miller, & Todd, 1998). Rather, at its most basic level, real-life mate choice is generally expected to operate on differences in attraction to specific potential partners possessing various individual strengths and weaknesses. Therefore, mate choice can be best understood as a process of sequential choice and general "screening" of potential partners in terms of their overall desirability as short- or long-term mates (Miller, & Todd, 1998). Consequently, manipulating the characteristics of potential partners and measuring the ensuing differences in perceived desirability appears to be an innovative methodological approach that can mirror how mate-choice decisions are made in the real world. Furthermore, by presenting a large and diverse sample of target persons to a large sample of raters, we respond to calls for increased sample sizes and enhanced statistical power in psychological research (Finkel, Eastwick, & Reis, 2015).

It is also interesting to observe that the synergistic effect was only present in the desirability of long-term partners in both experiments. As well as perhaps providing further evidence of the importance of prosocial traits for long-term mating, it can be interpreted in terms of the potential trade-offs humans make when choosing partners. When only one trait is present in a long-term partner, previous evidence suggests that

individuals will sacrifice physical attractiveness for prosocial traits (Farrelly et al., 2016; Fletcher, Tither, O'Loughlin, Friesen, & Overall, 2004; Li et al., 2002; Scheib, 2001). However when participants were presented here with potential long-term partners who simultaneously possessed both traits, this had a stronger effect on overall desirability than the mere sum of these traits' individual effects. This is because it is particularly in these long-term relationships that the combined benefits of good genes (as signalled by physical attractiveness) and good partner/parent qualities (as signalled by prosociality) can have the greatest adaptive benefit.

In terms of the proposed sex differences in the patterns of desirability for trustworthiness (Experiment 2), it was demonstrated that men adjusted their mate choice criteria more strongly to the given mating context than women did. This supports the proposed view that women appeared to judge the desirability of potential mates' trustworthiness in a less context-specific way than men, possibly because women appear to differentiate less clearly between short- and long-term strategies than men as well as using short-term mating to evaluate mates for potential long-term relationships (Buss, & Schmitt, 1993; Glass, & Wright, 1992; Li, & Kenrick, 2006), or even due to fear of sexual aggression from untrustworthy short-term partners (Buss, 1989a). Conversely to this, it is

less important for men to seek trustworthy partners for short-term mating as it is for long-term mating, as trustworthiness may signal faithfulness and sexual loyalty (Buss & Schmitt, 1993). This will be more desirable to men in long-term partners due to an adaptive need to avoid paternity uncertainty and the associated risks of being cuckolded.

As a potential limitation regarding the generalizability of our results, we must note that we recruited student samples with a relatively young mean age. However, we assume that people in their mid-twenties are a fairly good starting point for investigating mate choice criteria, because many relationships are formed in early adulthood and the consequences of these mating decisions may affect individuals' reproductive success throughout their whole adult lives.

Also, the findings of Experiment 1 (altruistic behaviour) were limited to only women's ratings, therefore a direct comparison with the findings of sex differences in Experiment 2 (trustworthiness) could not be achieved. This however is not a major limitation, as the specific sex differences mentioned above were hypothesised to be present for ratings of desirability across relationship lengths only for trustworthiness, and previous research (e.g. Farrelly, 2013) suggests that no such effect would be expected for other prosocial behaviours. Furthermore, the synergistic effects of physical attractiveness and prosociality observed in

long term mating contexts across both experiments was not further influenced by rater's sex in Experiment 2, suggesting it is common for men and women. However, this would of course be a promising area for further research. Indeed, while the results of Experiment 2 concentrated on testing whether men's preferences regarding trustworthiness and physical attractiveness are more context-dependent than women's preferences, it remains to be examined whether this pattern extends to altruistic behaviour or possibly even other prosocial traits as well. Also of value in future investigations is to incorporate raters' self-reported prosociality and/or physical attractiveness, to ascertain how these too may influence perceptions of desirability.

In summary, it can be stated that the current research has elucidated the way physical attractiveness and prosociality shape perceptions of desirability in individuals' short- and long-term mate choices. We have corroborated sexual strategies theory (Buss, & Schmitt, 1993) as a key concept governing preferential mate choice using an innovative methodology. Furthermore, we have gained first-hand insights into sex differences regarding the context-dependency of mate preferences for certain prosocial behaviours, which is a subject that might attract the attention of future research. Finally, our work has provided relevant empirical support for Miller's and Todd's (1998) cognitive perspective on

mate choice and confirmed that desirability resulting from the presence of multiple desirable characteristics can under some circumstances be more than the sum of its parts. Ironically, according to folk wisdom, possessing a good character may compensate for a lack of physical attractiveness. Unfortunately however, while our results show that prosociality can indeed increase individuals' desirability as a romantic partner, they also suggest that this is especially true for those who are already physically attractive in the first place.

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Table 1. *Mixed Regression Model with Desirability Ratings as the Dependent Variable for Experiment 1*

Fixed effects	*F*	*p*
Mating context	1.38	.24
Target's altruism	56.30	< .001
Target's attractiveness	206.62	< .001
Target's altruism x mating context	11.82	< .001
Target's attractiveness x mating context	0.05	.82
Target's altruism x target's attractiveness	26.18	< .001
Target's altruism x target's attractiveness x mating context	6.53	.01
Random effects at the level of raters	var	*SD*(var)
Intercept	0.26	0.51
Altruism slope	0.12	0.35
Attractiveness slope	0.08	0.29
Random effects at the level of targets	var	*SD*(var)
Intercept	0.07	0.27
Altruism slope	0.003	0.05
Mating context slope	0.004	0.06

Table 2. *Mixed Regression Model with Desirability Ratings as the Dependent Variable for Experiment 2*

Fixed effects	*F*	*p*
Mating context	0.33	.57
Rater's sex	46.28	< .001
Target's attractiveness	826.58	< .001
Target's trustworthiness	54.57	< .001
Mating context x rater's sex	1.88	.17
Mating context x target's attractiveness	10.84	.001
Mating context x target's trustworthiness	23.08	< .001
Rater's sex x target's attractiveness	28.30	< .001
Rater's sex x target's trustworthiness	0.00	.99
Target's attractiveness x target's trustworthiness	16.08	< .001
Mating context x rater's sex x target's attractiveness	38.71	< .001
Mating context x rater's sex x target's trustworthiness	5.06	.026
Mating context x target's attractiveness x target's trustworthiness	21.69	< .001
Rater's sex x target's attractiveness x target's trustworthiness	0.32	.57
Mating context x rater's sex x target's attractiveness x target's trustworthiness	1.59	.21
Random effects at the level of raters	var	*SD*(var)
Intercept	0.47	0.69
Trustworthiness slope	0.24	0.49

Attractiveness slope	0.10	0.32
Random effects at the level of targets	var	*SD*(var)
Intercept	0.04	0.20
Trustworthiness slope	0.03	0.18
Mating context slope	0.002	0.05

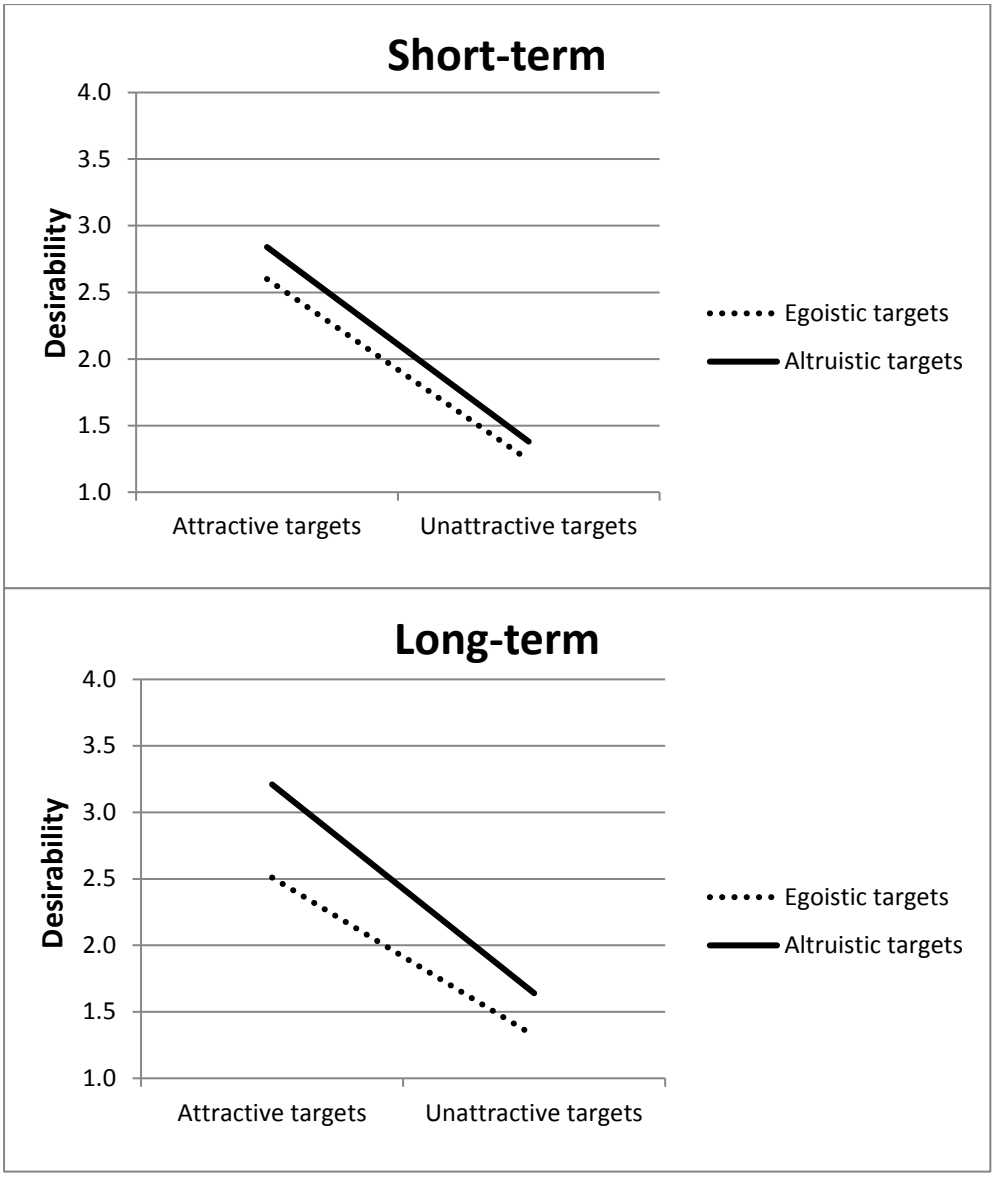

Figure 1. Desirability Ratings as a Function of Mating Context, Target's Physical Attractiveness, and Target's Altruism (Experiment 1)

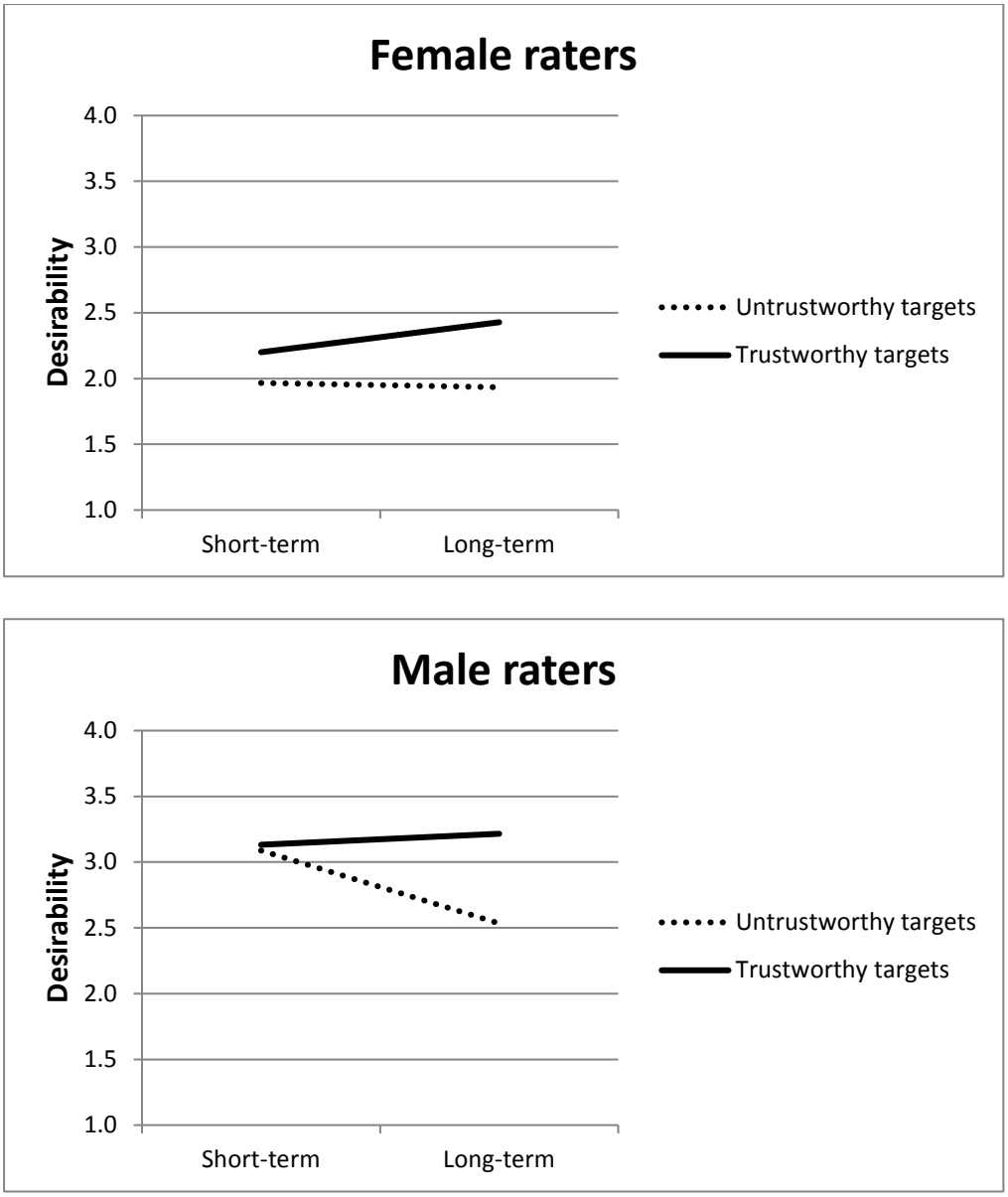

Figure 2. Desirability Ratings as a Function of Mating Context, Rater's Sex, and Target's Trustworthiness (Experiment 2)

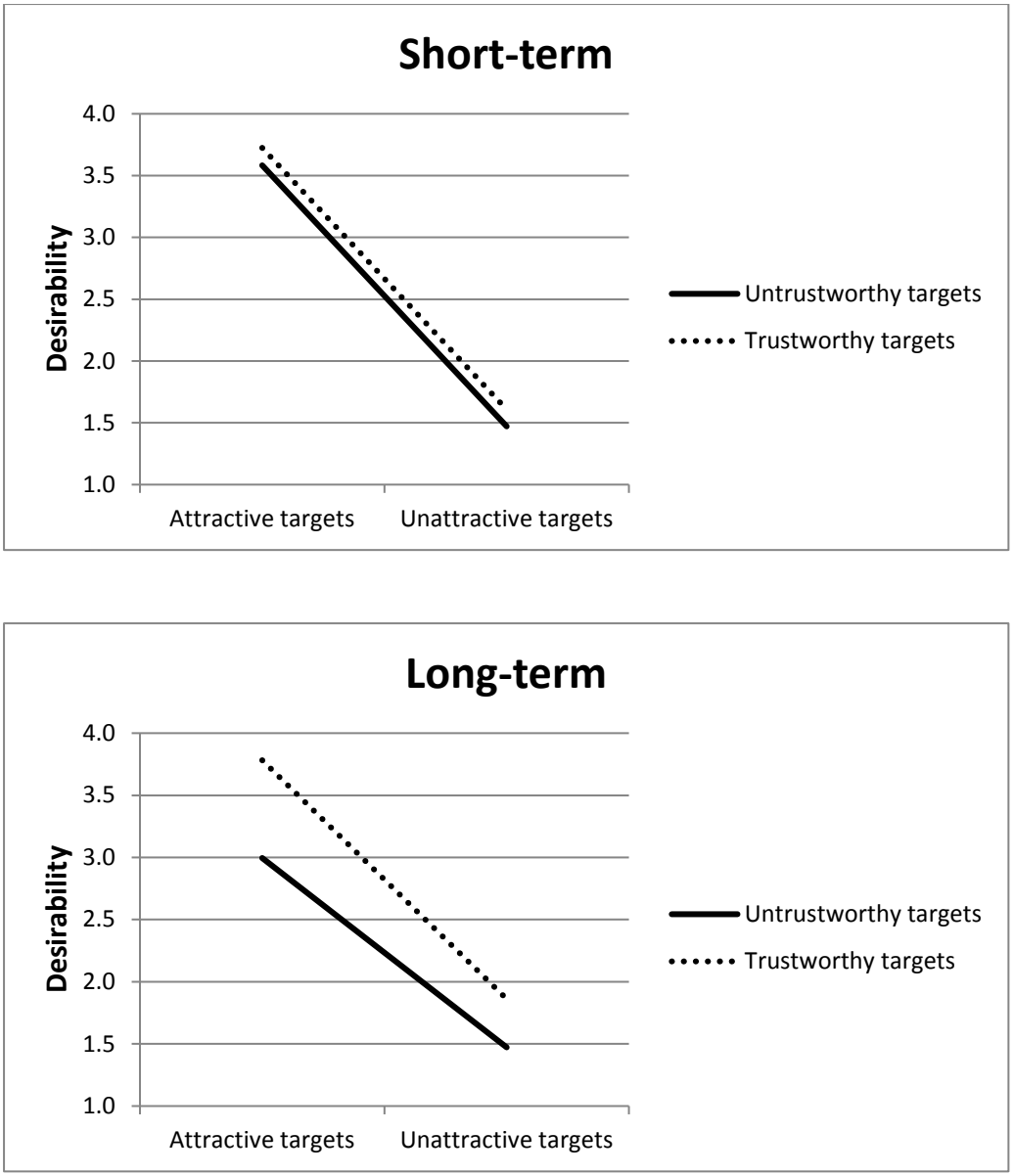

Figure 3. Desirability Ratings as a Function of Mating Context, Target's Physical Attractiveness, and Target's Trustworthiness (Experiment 2)