# The Role of Overconfidence in Romantic Desirability and Competition

**Sean C. Murphy[1], William von Hippel[1], Shelli L. Dubbs[1],
Michael J. Angilletta Jr.[2], Robbie S. Wilson[1], Robert Trivers[3],
and Fiona Kate Barlow[4]**

## Abstract

Four studies and a computer simulation tested the hypothesis that people who are overconfident in their self-assessments may be more successful in attracting mates. In Study 1, overconfident people were perceived as more confident in their dating profiles, and this perceived confidence predicted increased romantic desirability. Study 2 revealed that overconfident people also tend to be perceived as arrogant, which counteracts the positive effects of perceived confidence. However, Study 3 revealed that overconfidence might confer an advantage in intrasexual competition, as people were less likely to compete with overconfident individuals by virtue of their perceived confidence and arrogance. Study 4 showed that overconfident raters were also more likely to choose to compete for romantic partners. In Study 5, agent-based modeling incorporating the coefficients from these studies suggested that overconfidence facilitates mate acquisition in the presence of intrasexual competition.

## Keywords

overconfidence, evolutionary psychology, confidence, mating, intrasexual competition

Received August 10, 2014; revision accepted April 26, 2015

Choosing and attracting the right romantic partner are two of the most critical challenges in human life. Not only are good relationships a key to happiness (Zimmermann & Easterlin, 2006), our romantic partners also influence the survival and success of any children we might have, through the care they provide and the heritable qualities they pass on. For these reasons, mate choice is of paramount importance.

But finding and projecting the right qualities are not trivial tasks. Many traits that people value highly in a partner, such as intelligence, kindness, and competence (Buss & Barnes, 1986), are not directly visible and thus must be inferred from relevant behaviors. Although different traits have their own behavioral signatures, the self-confidence that an individual portrays can indicate the presence of a number of desirable traits. Because people have access to more information about themselves than anyone else does, their assessment of their own qualities, expressed through their self-confidence, may be a useful indicator for judging their quality as a potential partner.

Consistent with this possibility, the literature in psychology suggests that people interpret confidence as an indicator of quality in a variety of interpersonal settings. Self-confident individuals behave in a manner that differentiates them from diffident individuals, and humans and other animals are adept at detecting this difference (Arnott & Elwood, 2009; Maynard-Smith & Harper, 2003). The effects of confidence are also broad, as individuals look to confidence to help them choose people for numerous positions, from leaders (Shamir, House, & Arthur, 1993) through to service providers (de Jong, de Ruyter, & Wetzels, 2006). Confidence is also a determinant of social influence; confident people are believed more, and their advice is more likely to be followed than people who lack confidence (Penrod & Cutler, 1995). Finally, both men and women say they prefer a partner who is at least as confident as they are (Buunk, Dijkstra, Fetchenhauer, & Kenrick, 2002).

Such findings suggest that people interpret others' confidence as reflecting genuine ability, assuming that confident people have qualities that warrant their confidence. Although

[1]University of Queensland, Brisbane, Australia
[2]Arizona State University, Tempe, USA
[3]Biosocial Research Foundation, New Brunswick, NJ, USA
[4]Griffith University, Brisbane, Queensland, Australia

**Corresponding Author:**
Sean C. Murphy, School of Psychology, University of Queensland, St Lucia, Queensland 4072, Australia.
Email: seanchrismurphy@gmail.com

this may often be true, it is also the case that people might take advantage of this widespread perception to claim to be more than they are. In short, if self-confidence is interpreted as a signal of internal qualities, one way to impress potential partners would be to strengthen our belief in ourselves by becoming overconfident. If overconfident people have an overly positive self-view and behave in a manner that is consistent with this view, they may portray a level of confidence that *appears* to stem from an accurate self-assessment, rather than an unrealistic one. In this manner, overconfidence could provide an interpersonal advantage (Trivers, 2011; von Hippel & Trivers, 2011).

In line with this reasoning, evidence suggests that over-confident people seem more competent, even over relatively long time frames. Most notably, Anderson, Brion, Moore, and Kennedy (2012) found that overconfident individuals were perceived as more competent in group tasks and had more influence in group decision making. Indeed, overconfidence swayed the judgments of others to a greater extent than did *actual* competence. Lamba and Nityananda (2014) further found that peers judged individuals who were overconfident in their ability to achieve high course grades as being more capable of achieving those grades. In both lines of research, the initial benefits of overconfidence were retained after more than a month of acquaintance.

It remains an open question, however, whether overconfidence improves people's romantic prospects. The research cited above suggests that overconfidence is an interpersonal strategy that helps people sell themselves to others—and there is no more important sales pitch than the one we make when trying to attract a romantic partner. But mating is very different from the domains previously investigated. Because of its evolutionary importance, potential romantic partners are likely to receive more and different scrutiny than potential clerks or bosses—making failure more likely if overconfidence is unconvincing. Nevertheless, if overconfident people come across as more than they are despite this scrutiny, it would be an additional and strong incentive for individuals to be at least somewhat overconfident. Any edge in attracting a romantic partner would carry with it substantial adaptive advantage. The goal of the current studies was to test whether overconfidence does in fact help people succeed in romantic endeavors.

## Study 1

Study 1 investigated whether overconfident individuals are perceived as more confident by observers, in turn leading them to be judged as more desirable. To test this possibility, one group of participants completed a measure of overconfidence and then wrote dating profiles. A second group of participants rated these profiles for their confidence and desirability as romantic partners.

## *Method*

*Participants.* *Authors* were recruited online through Amazon's Mechanical Turk (Mturk) for a study that involved writing a short dating profile. Authors were heterosexual North Americans (*n* = 196; 53.8% female, 59.5% aged 25 years or older).[1] Authors received US$1 for their participation.

*Raters* were North Americans (*n* = 63; 58.7% female, 65.1% aged 25 years or older) recruited through Mturk to rate profiles that matched their sexual orientation (53 participants identified as heterosexual, 4 as homosexual, and 6 as bisexual).[2] Bisexual raters were assigned opposite gender profiles. Raters received US$0.50 for their participation.

### *Procedure and measures*

*Overconfidence*. To measure overconfidence, authors completed the Overclaiming Questionnaire (OCQ; Paulhus, Harms, Bruce, & Lysy, 2003). This questionnaire measures overconfidence through the tendency to *overclaim*, or claim knowledge that one does not have. The OCQ consists of 150 items. Participants are told the items are being pre-rated for relevance in a future study and asked to rate how familiar they are with each item, on a scale ranging from 0 (*not familiar at all*) to 4 (*extremely familiar*). One in every five items is a non-existent foil (e.g., "ultra-lipids," "sentence stigma") and thus the extent to which participants rate familiarity with these bogus items reflects a tendency to overclaim. Over-confidence (operationalized here as overclaiming) was measured with a statistical index known as *c*, or response bias, calculated as per Paulhus and colleagues (2003). This index roughly corresponds to the mean of the hit and false alarm rates[3] (Stanislaw & Todorov, 1999). Response bias represents how readily participants claim familiarity with items, regardless of their existence, and it correlates with other measures of overconfidence, such as overly positive self-ratings of IQ (Paulhus et al., 2003).

*Accuracy*. Because cultural knowledge varies, accuracy on the OCQ was calculated to control for participants' ability to distinguish existing from bogus cultural items. Accuracy was calculated by subtracting the standardized false alarm rate from the standardized hit rate.

*Dating profile measure*. After completing the OCQ, authors prepared dating profiles. Authors were asked to imagine themselves as romantically unattached and preparing a profile to attract members of the opposite sex, and to write a short dating profile that would give a prospective mate a better idea about them (see Simpson, Gangestad, Christensen, & Leck, 1999). The profiles were collected and filtered to remove those that contained less than 30 words, explicitly mentioned being in a current relationship, or did not appear to be genuine efforts to construct a dating profile (e.g., profiles plagiarized from online sources). Twenty-three profiles were removed in

**Table 1.** Means, Standard Deviations, and Zero-Order Intercorrelations for Study 1.

| | M (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. OCQ overconfidence | 0.00 (0.82) | — | | | | | | | | | |
| 2. Confidence | 2.90 (0.41) | .26*** | — | | | | | | | | |
| 3. Desirability | 2.31 (0.51) | .14 | .53*** | — | | | | | | | |
| 4. Social status | 2.24 (0.47) | .26*** | .62*** | .66*** | — | | | | | | |
| 5. Intelligence | 2.61 (0.49) | .22** | .47*** | .70*** | .73*** | — | | | | | |
| 6. Creativity | 2.52 (0.51) | .18* | .56*** | .57*** | .50*** | .62*** | — | | | | |
| 7. Humor | 2.12 (0.47) | .05 | .41*** | .48*** | .33*** | .25** | .47*** | — | | | |
| 8. Gender (male) | 0.46 (0.50) | .09 | −.02 | −.36*** | −.29*** | −.10 | −.01 | −.36*** | — | | |
| 9. Word length | 107.87 (61.13) | .17* | .41*** | .26*** | .37*** | .33*** | .31*** | .24** | −.03 | — | |
| 10. OCQ accuracy | 0.00 (0.82) | .02 | .27*** | .38*** | .29*** | .45*** | .43*** | .19* | .05 | .11 | — |

*Note.* OCQ = Overclaiming Questionnaire.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

this fashion (leaving a total of 173 usable profiles). All original wording and grammar were retained in the remaining profiles, which were then randomly assigned to raters who were sexually oriented toward the author's gender.

*Dating profile ratings.* Participants in the rater group ($n = 63$) were told that they would be rating paragraphs intended as brief self-descriptions, and were asked to use their intuition to make judgments about the authors. Raters were randomly assigned between 28 and 32 profiles to rate on two single-item measures: how *confident* the author seemed and how *desirable* as a dating partner he or she seemed.[4] Ratings were provided on a 4-point scale, from 1 (*not at all*) to 4 (*very*). The order of presentation of profiles was randomized.

## Results

For each author who wrote a dating profile, we averaged across all the scores that they were given by raters (each profile was assessed by an average of 11 raters) to create mean scores of how confident they seemed and how desirable raters found them. Means, standard deviations, and zero-order correlations for the variables of interest are presented in Table 1 (with authors as the unit of analysis).[5] Our primary hypotheses were tested with mediation using the *lavaan* package in R (version 3.1.0, as are all following analyses). As hypothesized, authors' overconfidence directly predicted (direct effect [*DE*]) how confident raters perceived them to be (*DE* = .26, $p < .001$) and indirectly predicted (indirect effect [*IE*]) how desirable raters found them through confidence as a mediator (*IE* = .14, $p = .001$). There was no direct effect of authors' overconfidence on how desirable they were seen in the presence of the mediated pathway (*DE* = .00, $p = .951$). Despite the significant mediated effect, there was also no zero-order relationship between overconfidence and desirability (see Table 1). In addition, gender of the author did not moderate the effects of overconfidence on confidence or desirability, or the effects of confidence on desirability.[6]

## Discussion

Consistent with predictions, overconfidence manifested itself in greater projected confidence. Despite the divergence between the two measures, people who claimed familiarity with things that did not exist were also perceived as more confident in their dating profiles. Overconfidence also showed the expected indirect association with desirability; to the extent that overconfident individuals were perceived as more confident, they were also perceived as more desirable.

Previous research has shown that self-confidence tends to be rated as more important by women than men (Buunk et al., 2002). Consequently, it might seem surprising that confidence was not more strongly associated with desirability for male authors in our sample. However, explanations for this gender difference hinge on men judging women on the basis of visible indicators such as physical attractiveness, whereas women rely more heavily on confidence as a proxy for internal traits that are valued in men, such as ambition and status. Reliance on written dating profiles removes appearance from the equation, which apparently led raters of both genders to rely equally on confidence as an indicator of mate value.

Despite the significant indirect effect of overconfidence on desirability, the results revealed no overall association between overconfidence and romantic desirability. There are two possible explanations for this lack of a direct association. First, the relationship between overconfidence and desirability might be small enough that only the indirect association emerged as significant, due to greater power to detect mediated than direct relationships (Kenny & Judd, 2013; Shrout & Bolger, 2002). Second, overconfidence might simultaneously diminish desirability in an unmeasured manner that suppressed the positive effect of confidence.

According to this second explanation, overconfidence may carry social costs as well as benefits. Although often beneficial, portrayals of confidence are not always perceived positively, as individuals who exude confidence without

**Table 2.** Means, Standard Deviations, and Zero-Order Intercorrelations for Study 2.

| | M (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. OCQ overconfidence | 0.00 (0.77) | — | | | | | | | | | | |
| 2. Confidence | 2.71 (0.38) | .11* | — | | | | | | | | | |
| 3. Arrogance | 1.72 (0.44) | .17*** | .49*** | — | | | | | | | | |
| 4. Desirability | 2.21 (0.42) | −.02 | .26*** | −.31*** | — | | | | | | | |
| 5. Social status | 1.98 (0.39) | .11* | .45*** | .22*** | .42*** | — | | | | | | |
| 6. Intelligence | 2.52 (0.47) | .07 | .34*** | −.05 | .57*** | .48*** | — | | | | | |
| 7. Creativity | 2.38 (0.50) | .03 | .27*** | −.04 | .46*** | .21*** | .50*** | — | | | | |
| 8. Humor | 2.02 (0.40) | .01 | .21*** | −.03 | .42*** | .13** | .21*** | .40*** | — | | | |
| 9. Gender (male) | 0.36 (0.48) | .12* | −.01 | .09* | −.30*** | −.18*** | −.04 | −.08 | −.17*** | — | | |
| 10. Word length | 120.67 (68.86) | .02 | .22*** | .28*** | −.01 | .11* | .17*** | .13** | .13** | −.04 | — | |
| 11. OCQ accuracy | 0.00 (0.90) | .04 | .14** | .03 | .12** | .16** | .28*** | .21*** | .14** | −.04 | .17*** | — |

*Note.* OCQ = Overclaiming Questionnaire.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

sufficient social skill can seem brazen, self-promoting, or arrogant (R. E. Johnson et al., 2010). Thus, overconfident individuals may inadvertently project negative attributes such as arrogance, especially under the watchful eyes of potential mates. Given that people react negatively to arrogance in romantic partners (Gangestad, Garver-Apgar, Simpson, & Cousins, 2007), such an increase in perceived arrogance might have suppressed the otherwise positive effects of overconfidence on romantic desirability. A second study was conducted to test this possibility.

## Study 2

Study 2 was a direct replication of Study 1, with two exceptions. First, the sample size was increased to facilitate the detection of a possible small direct effect of overconfidence on romantic desirability. Second, each profile was also rated for arrogance.

### Method

*Participants.* Authors ($n = 466$, 64.4% female, 62.6% aged 25 years or older) and raters ($n = 333$, 36% female, 64.9% aged 25 years or older; 306 heterosexual, 5 homosexual, and 22 bisexual) were recruited through Mturk as in Study 1. Each rater evaluated only 15 profiles, but as there were more raters per profile than in Study 1, each profile was still rated an average of 11 times.

*Procedure and measures.* Authors completed the same measures as in Study 1. Twenty-eight profiles were removed using the exclusion criteria from Study 1, leaving 438 total profiles. In addition to the items in Study 1, raters were asked to judge, on the same scale, the extent to which each profile was arrogant (see Supplementary Online Materials for a profile rated high in confidence but not arrogance and a profile rated high in confidence and arrogance).

### Results

Means, standard deviations, and zero-order correlations for Study 2 are reported in Table 2. Our primary hypotheses were tested with structural equation modeling using the *lavaan* package in R (see Figure 1). Because we expected the association between overconfidence and desirability to be mediated by confidence and arrogance, the direct link from overconfidence to desirability was omitted. All items were entered as observed variables, with error terms for arrogance and confidence allowed to covary. The model provided a good fit to the data, $\chi^2(1, n = 438) = 0.11$, $p = .742$, $\chi^2/df = 0.11$; comparative fit index (CFI) = 1.00; root mean square error of approximation (RMSEA) = .000; standardized root mean square residual (SRMR) = .003. As expected, profile authors' overconfidence was associated with being perceived as arrogant ($DE = .17$, $p < .001$) and confident ($DE = .11$, $p = .018$). The extent to which authors were seen as confident was positively associated with the extent to which they were seen as desirable ($DE = .55$, $p < .001$), whereas arrogance was negatively associated with desirability ($DE = −.58$, $p < .001$). As in Study 1, overconfidence had a positive indirect association with desirability, mediated through confidence ($IE = .06$, $p = .020$). Consistent with the suppressor hypothesis, overconfidence also had a negative indirect association with desirability, mediated through arrogance ($IE = −.10$, $p < .001$). Due to the countervailing influence of these two effects, overconfidence had a null total indirect association (total effect: [$TE$]) with desirability ($TE = −.04$, $p = .181$).

### Discussion

The results of Study 2 provide an explanation for the lack of a direct association between overconfidence and romantic desirability. Overconfident participants wrote profiles that were seen as more confident *and* more arrogant, resulting in no overall effect on desirability. These findings explain the results of Study 1, but they are inconsistent with the
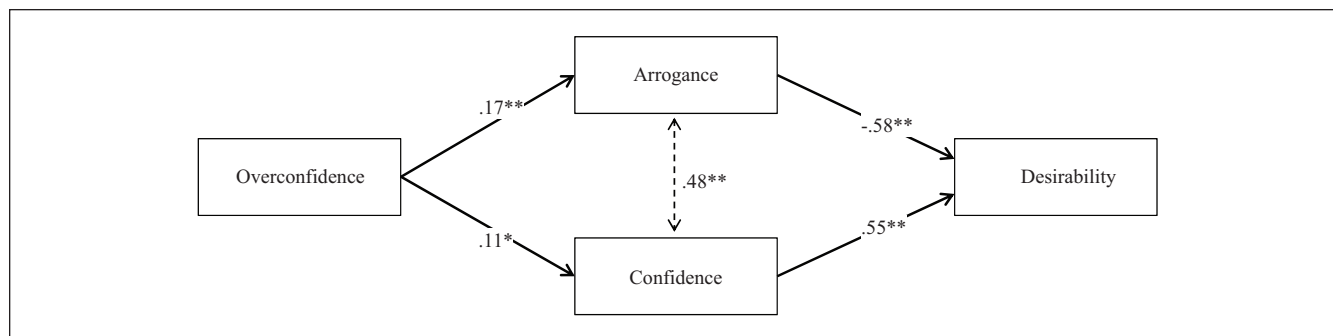
**Figure 1.** Study 2: Structural equation model of the effects of authors' overconfidence on desirability with confidence and arrogance as mediating variables (*n* = 438).
*Note.* As displayed, all SEM analyses were conducted without direct paths from overconfidence to ultimate DVs, as these paths were non-significant and did not alter results (see additional analyses in Supplementary Online Materials). Relationships between the observed variables are shown. SEM = structural equation modeling; DV = dependent variable.
*p ≤ .05. **p ≤ .01.

hypothesis that overconfidence provides an overall benefit to romantic attraction. However, these findings do suggest an additional path by which overconfidence may facilitate mating: It might help people ward off same sex competitors (via displays of confidence *and* arrogance).

Although studies of human mating typically focus on mate choice as the critical determinant of romantic success, choice is only one aspect of acquiring a mate. Competition among members of the same sex also plays a significant role in romantic success (see Puts, 2010, for a review). By driving rivals away from potential mates, people can reduce the pool of would-be suitors and thereby increase their own chance of securing a mate. In this way, traits that successfully eliminate competitors can have net mating benefits even if they are neutral or even detrimental in the mate-attraction stage. The biological literature is replete with examples of traits that facilitate intrasexual competition and have a net mating benefit despite being detrimental to desirability or success as a mating partner (Wilson et al., 2010; Wong & Candolin, 2005).

The results of Study 2 suggest that overconfidence may be just such a trait. Arrogant individuals are often seen as off-putting (R. E. Johnson et al., 2010), so arrogance may be beneficial in mate competition by making it seem more difficult or unpleasant to compete with overconfident individuals. Confidence should also make the prospect of out-competing an individual seem more difficult. Thus, over-confidence, and the resulting displays of confidence and arrogance, may narrow the pool of competitors for the attention of the opposite sex. Study 3 was designed to test this possibility

## Study 3

In Study 3 we set up a hypothetical dating scenario in which a new pool of participants had the opportunity to compete with the authors of dating profiles from Study 2 for the attention of

a potential mate. We hypothesized that overconfident individuals from Study 2 would be perceived as difficult and unpleasant to compete with, due to their previously rated confidence and arrogance, and that this would lead competitors in Study 3 to avoid competing with them.

### Method

*Participants.* *Competitors* were heterosexual North American participants (*n* = 556; 46.1% female, *M* = 31.47 years) who were recruited through Mturk to take part in hypothetical competition against authors of the same gender. These participants received US$0.80 for their participation.

*Competition task.* Competitors were asked to imagine that they had joined a small online dating website, and to increase their investment in the scenario, they first completed the same profile-writing task as authors in previous studies (although these profiles were not rated). The competitors were then asked to imagine that they were participating in a singles' mixer organized by the dating site and that, having read the profiles of everyone in attendance, they were only interested in one individual. Unfortunately, they arrived at the mixer to find the focus of their desire in conversation with a potential rival (of the same sex as the participant). Figure 2 shows the visual depiction of this scenario provided to participants. A friend of the object of their desire was seated at the table (to attenuate the awkwardness of interrupting an existing dyadic interaction should they attempt to sit at that table), and two less attractive opposite-sex individuals were seated unpartnered at the table to the left. Thus, the right table offered potential romantic access to the desired individual, but necessitated competing for his or her attention, whereas the left table offered less potential reward but involved no competition.

Competitors read five randomly chosen dating profiles from Study 2 and were told that they were competing against
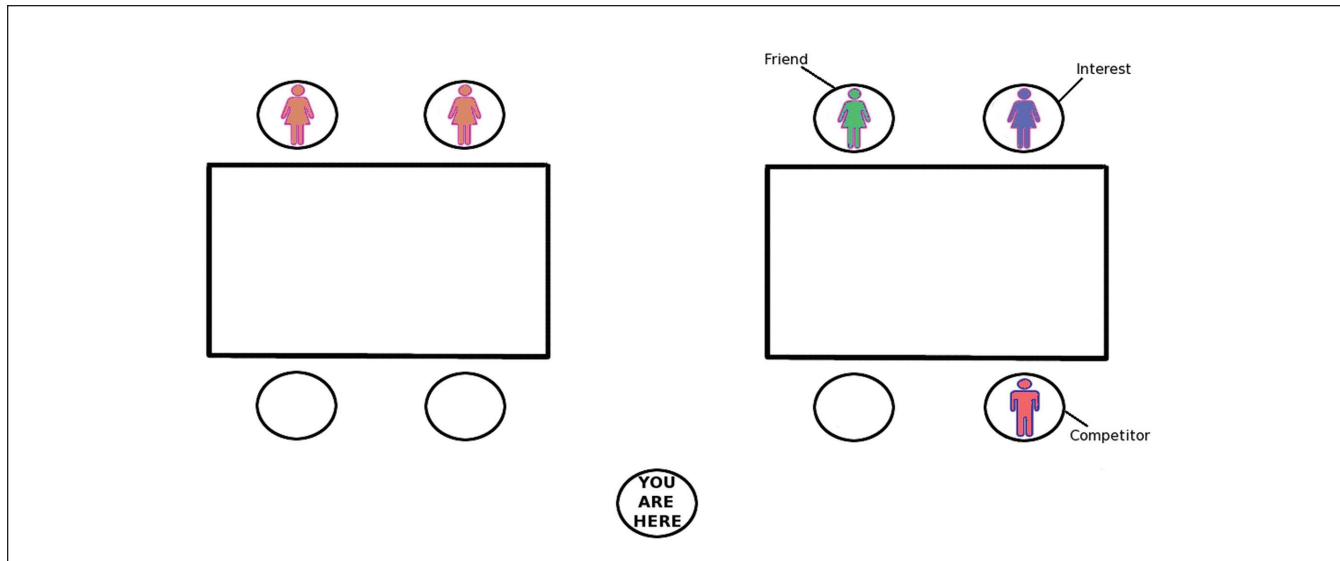
**Figure 2.** Study 3: Diagram presented to competitors to represent dating competition scenario.
*Note.* Individuals at the left table were labeled "less interesting" in text.

the author of each profile. For each profile, competitors were asked, "how pleasant do you think it would be to sit at the table (with the author)," on a 5-point scale from 1 = *very unpleasant* to 5 = *very pleasant*; "how easy do you think it would be to deal with (the author)," from 1 = *very difficult* to 5 = *very easy*; and "which table would you choose to sit at," with a binary left–right decision.

## Results

Each author from Study 2 (*n* = 438) had their profile assessed by an average of six competitors. Scores on *pleasant* and *easy to deal with* were reversed to give mean scores of how *unpleasant* and *difficult to deal with* each author was found by competitors. Table choice was coded, for each author, as the percentage of competitors who chose to compete with them by sitting at their table.[7] Means, standard deviations, and zero-order correlations are depicted in Table 3.

*Structural equation modeling.* Figure 3 depicts our primary hypotheses tested with structural equation modeling. As before, all items were entered as observed variables. Error terms for difficulty and unpleasantness were allowed to covary, as were those for arrogance and confidence. The model provided a good fit to the data, $\chi^2(3, n = 438) = 2.48$, $p = .480$, $\chi^2/df = 0.825$; CFI = 1.00; RMSEA = .000; SRMR = .017. Author arrogance predicted how difficult (*DE* = .22, $p < .001$) and unpleasant (*DE* = .40, $p < .001$) competitors felt it would be to compete with them, whereas author confidence predicted difficulty (*DE* = .20, $p < .001$) but not unpleasantness (*DE* = −.07, $p = .195$). Difficulty (*DE* = −.35, $p < .001$) but not unpleasantness (*DE* = .05, $p = .391$)

**Table 3.** Means, Standard Deviations, and Zero-Order Intercorrelations for Study 3.

|  | *M (SD)* | 1 | 2 | 3 |
|---|---|---|---|---|
| 1. Difficult to deal with | 2.60 (0.53) | — | | |
| 2. Unpleasant | 2.82 (0.57) | .56*** | — | |
| 3. Table choice (right) | 0.78 (0.19) | −.36*** | −.16** | — |
| 4. OCQ overconfidence | 0.00 (0.77) | .11* | .12** | −.06 |
| 5. Confidence | 2.71 (0.38) | .31*** | .13** | −.25*** |
| 6. Arrogance | 1.72 (0.44) | .32*** | .36*** | −.14** |
| 7. Gender (male) | 0.36 (0.48) | −.03 | .12* | .03 |
| 8. Word length | 120.67 (68.86) | .23*** | .13** | −.12** |
| 9. OCQ accuracy | 0.00 (0.90) | .07 | .01 | −.04 |

*Note.* Trait and overconfidence intercorrelations are omitted as they are redundant with Table 2. OCQ = Overclaiming Questionnaire.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

predicted table choice, and both confidence and arrogance had indirect associations with table choice through difficulty (*IE* = −.07, $p = .001$, and *IE* = −.08, $p < .001$, respectively). Confidence also had a direct association with table choice (*DE* = −.16, $p = .002$), and a significant total association (*TE* = −.24, $p < .001$), whereas arrogance had no significant direct (*DE* = .04, $p = .501$) or total (*TE* = −.02, $p = .683$) associations with table choice. Author overconfidence had positive total indirect associations with unpleasantness (*IE* = .06, $p = .002$) and difficulty (*IE* = .06, $p = .001$) and a total indirect association, through all mediators, with less competitive table choice on the part of competitors (*TE* = −.03, $p = .034$). Note that the small effect size of this (multistep) indirect association likely explains the lack of zero-order association between overconfidence and table choice (Kenny & Judd, 2013).
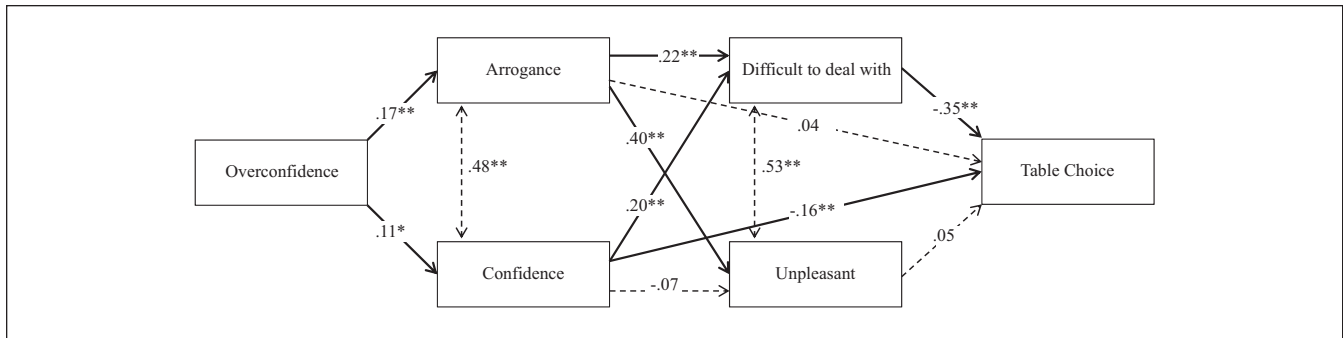
**Figure 3.** Study 3: Structural equation model of the effects of authors' overconfidence on competition outcome variables with confidence and arrogance as mediating variables (*n* = 438).
*Note.* As displayed, all SEM analyses were conducted without direct paths from overconfidence to ultimate DVs, as these paths were non-significant and did not alter results (see additional analyses in Supplementary Online Materials). Relationships between the observed variables are shown. SEM = structural equation modeling; DV = dependent variable.
*\*p* ≤ .05. *\*\*p* ≤ .01.

## Discussion

Consistent with the hypothesis that overconfident individuals would benefit in mate competition because of their displayed confidence and arrogance, people were less willing to compete with profile authors who appeared confident and arrogant. Furthermore, overconfidence was associated with increased perceptions that authors were difficult to compete with, and thus with a lower likelihood that competitors would choose to compete with them in the hypothetical scenario. Instead, competitors were more likely to sit at a different table when an overconfident individual already occupied the table with their preferred partner. Although both arrogance and unpleasantness were associated with competitors being less willing to sit with the authors, these relationships were weaker than those of confidence and difficulty, respectively, and were not significant in the full model. These results indicate that although arrogant individuals do ward off competitors, this is largely because they also tend to be perceived as confident.

## Study 4

Study 3 illustrates that overconfident individuals may reduce others' willingness to compete with them, giving them an advantage in mate competition. But we have yet to consider the case when overconfident individuals are themselves deciding whether to compete for a mate. Evolutionary models suggest that in competitive situations where the rewards are high and the costs relatively low, people who overestimate their chances of success can achieve better outcomes because they are more willing to compete with others (D. D. P. Johnson & Fowler, 2011). Mating contexts in which it is unlikely that competition will escalate into violence (such as the table-choice task in the current research) represent just such a situation. Thus, in addition to deterring *others* from competing with *them*, overconfident individuals may gain an

advantage if their overconfidence makes *them* more likely to compete with *others* for a romantic partner.

To test this possibility, Study 4 extended the table-choice scenario. All participants completed a set of overconfidence measures and wrote a dating profile before being assigned to one of two groups: the authors, who finished the study after writing their profile, and the competitors, who were then given the opportunity to compete with the authors in a version of the table-choice task from Study 3. This design allowed us to assess the role of overconfidence on both sides of the competition. To encourage individuals to make realistic decisions about whether they would compete, we also increased the stakes of the table-choice task by giving competitors the opportunity to win money.

A final goal of Study 4 was to replicate the previous findings and test our new predictions with multiple measures of overconfidence. The previous studies relied solely on the OCQ to tap overconfidence. Although this measure has clear advantages (a lack of obvious demand characteristics and minimal common method variance with the dating profile), there is always a risk that a single measure may have idiosyncratic properties that cause the observed effects. Accordingly, in Study 4 we added two new measures of overconfidence to form a latent overconfidence factor.

## Method

*Participants. Authors* and *Competitors* were heterosexual North Americans (*n* = 1,134; 40.1% female, *M* = 28.83 years) recruited through Mturk as in the prior studies (26 profiles were removed for the reasons outlined in the previous studies, leaving 1,108 usable participants). After 467 authors completed the measures and wrote their profiles, the remaining 641 participants were assigned to be competitors, who also competed against the authors in the table-choice task.

Raters were heterosexual North Americans (*n* = 482; 59.3% female, *M* = 29.58 years) recruited through Mturk to

**Table 4.** Means, Standard Deviations, and Zero-Order Intercorrelations for Study 4 Trait Ratings.

| | M (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. OCQ overconfidence | 0.00 (0.66) | — | | | | | | | | | | | | |
| 2. Knowledge overconfidence | 0.00 (1.00) | .08** | — | | | | | | | | | | | |
| 3. Vocabulary overconfidence | 0.00 (1.00) | .16*** | .52*** | — | | | | | | | | | | |
| 4. Confidence | 4.96 (0.68) | .09** | .09** | .09** | — | | | | | | | | | |
| 5. Arrogance | 3.11 (0.84) | .05 | .07* | .05 | .44*** | — | | | | | | | | |
| 6. Desirability | 4.10 (0.75) | .07* | −.01 | −.01 | .43*** | −.23*** | — | | | | | | | |
| 7. Social status | 3.85 (0.72) | .11*** | .01 | −.01 | .58*** | .20*** | .56*** | — | | | | | | |
| 8. Intelligence | 4.68 (0.81) | .12*** | .03 | .01 | .42*** | −.08* | .68*** | .62*** | — | | | | | |
| 9. Creativity | 4.28 (0.83) | .14*** | −.01 | −.01 | .36*** | −.10** | .55*** | .30*** | .55*** | — | | | | |
| 10. Humor | 3.74 (0.70) | .06* | −.04 | −.01 | .28*** | −.03 | .43*** | .12*** | .27*** | .45*** | — | | | |
| 11. Gender (male) | 0.60 (0.49) | .00 | .22*** | .14*** | .07* | .01 | −.06* | .03 | .05 | −.01 | −.04 | — | | |
| 12. Word length | 104.26 (50.25) | −.02 | .01 | .01 | .20*** | .20*** | .06* | .13*** | .15*** | .18*** | .16*** | −.04 | — | |
| 13. OCQ accuracy | 0.00 (1.03) | .07* | −.01 | .01 | .06* | −.01 | .13*** | .10*** | .25*** | .23*** | .15*** | −.10*** | .08** | — |

*Note.* OCQ = Overclaiming Questionnaire.
*p ≤ .05. **p ≤ .01. ***p ≤ .001.

rate the profiles written by both authors and competitors. Each rater rated 25 profiles, leading to an average of 11 ratings per profile.

### Procedure and measures

*Overconfidence.* Authors and competitors completed three measures of overconfidence. First they completed two measures that operationalized overconfidence as the discrepancy between performance and self-evaluation (Ames & Kammrath, 2004; Anderson et al., 2012; Kruger & Dunning, 1999). We created vocabulary and general knowledge tests for this purpose. Each test consisted of 25 multiple-choice questions gathered from online sources and pre-tested for an average accuracy of 75%. To prevent participants from searching for answers online, questions had 10 s time limits. After each test, participants rated their performance compared with fellow Mturk workers on a 100-point percentile scale. In accordance with previous research (Anderson et al., 2012; Bonanno, Field, Kovacevic, & Kaltman, 2002; Paulhus, 1998), we regressed the percentile self-ratings on the participants' actual scores, saving the standardized residuals as our measures of knowledge overconfidence and vocabulary overconfidence. Participants then completed a 25-item form of the OCQ, which had been validated against the larger scale (Bing & Davidson, 2012).

*Dating profile measure.* Both authors and competitors wrote a dating profile using the instructions from Study 2.

*Table-choice measure.* After completing the above measures, the competitors proceeded to perform the table-choice task as in Study 3, competing against the profiles of the authors. To provide real consequences for their decisions, competitors were told that choosing the non-competitive table

would guarantee them a US$0.10 bonus for each table choice. If they chose the competitive table, however, they would earn US$0.20 if they were rated as more desirable than the author but US$0 if not. Several questions probed their understanding of these instructions before they continued.

*Dating profile rating.* Raters read the profiles of both authors and competitors, rating them on confidence, arrogance, and desirability. To increase the range of responses, the ratings were given on a 7-point scale ranging from 1 (*not at all like this person*) to 7 (*very much like this person*). A new dichotomous desirability measure also asked the rater whether they would be willing to go on a date with each profile writer.

## Results

*Overconfidence and desirability.* Because author and competitor profiles were both evaluated by raters, we used all of their profiles ($n = 1,108$) to examine the effects of the latent overconfidence variable on arrogance, confidence, and desirability. Means, standard deviations, and zero-order correlations are reported in Table 4.

*Structural equation modeling.* Figure 4 depicts tests of the effects of overconfidence on rated desirability via structural equation modeling. The three overconfidence measures were entered as observed variables loading onto a latent overconfidence variable with its variance scaled to 1. The model provided a relatively good fit to the data, $\chi^2(7, n = 1,108) = 17.92$, $p = .012$, $\chi^2/df = 2.57$; CFI = 0.99; RMSEA = .038; SRMR = .025. The latent overconfidence factor predicted raters' perceptions of the confidence ($DE = .12$, $p = .002$) and arrogance ($DE = .07$, $p = .046$) of the profiles. Examina-
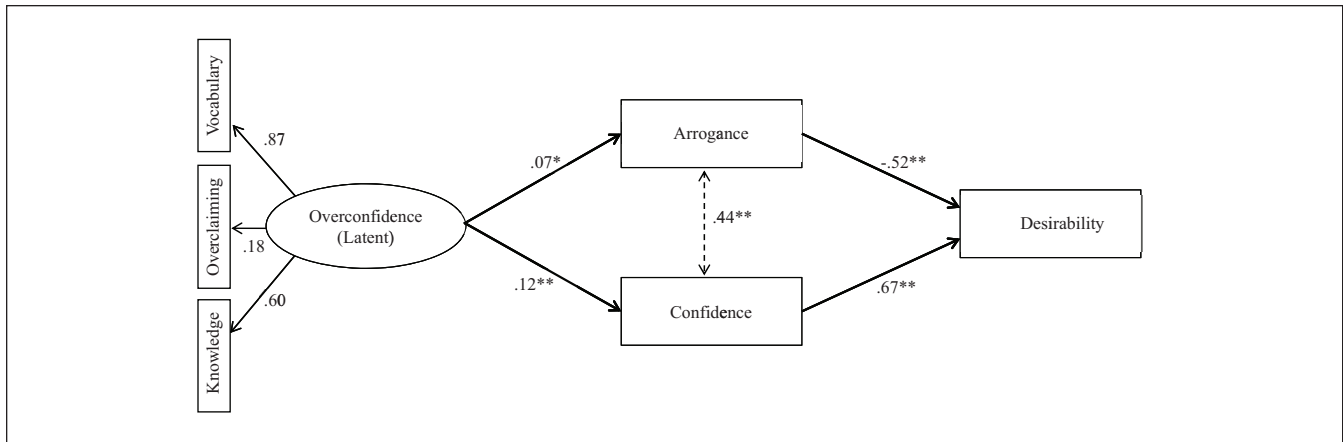
**Figure 4.** Study 4: Structural equation model of the effects of authors' and competitors' latent overconfidence on desirability with confidence and arrogance as mediating variables (*n* = 1,108).
*Note.* As displayed, all SEM analyses were conducted without direct paths from overconfidence to ultimate DVs, as these paths were non-significant and did not alter results (see additional analyses in Supplementary Online Materials). Relationships between variables of interest are shown. SEM = structural equation modeling; DV = dependent variable.
*\*p ≤ .05. \*\*p ≤ .01.*

**Table 5.** Means, Standard Deviations, and Zero-Order Intercorrelations for Study 4 Deterrence Effects.

|  | M (SD) | 1 | 2 | 3 |
|---|---|---|---|---|
| 1. Difficult | 2.56 (0.46) | — |  |  |
| 2. Unpleasant | 2.74 (0.47) | .40*** | — |  |
| 3. Table choice (right) | 0.65 (0.23) | −.39*** | .11* | — |
| 4. OCQ overconfidence | 0.00 (0.66) | .02 | −.04 | −.06 |
| 5. Knowledge overconfidence | 0.00 (1.00) | .01 | .07 | .04 |
| 6. Vocabulary overconfidence | 0.00 (1.00) | .07 | .14** | −.01 |
| 7. Confidence | 4.96 (0.68) | .23*** | −.08 | −.42*** |
| 8. Arrogance | 3.11 (0.84) | .27*** | .24*** | −.10* |
| 9. Desirability | 4.10 (0.75) | .06 | −.31*** | −.39*** |
| 10. Gender (male) | 0.60 (0.49) | −.05 | .10* | .09* |
| 11. Word length | 104.26 (50.25) | .11* | .01 | −.23*** |
| 12. OCQ accuracy | 0.00 (1.03) | −.09 | −.06 | −.02 |

*Note.* Trait and overconfidence intercorrelations are omitted as they are redundant with Table 4. OCQ = Overclaiming Questionnaire.
*\*p ≤ .05. \*\*p ≤ .01. \*\*\*p ≤ .001.*

tion of the indirect effects of overconfidence on desirability revealed a positive indirect association through confidence (*IE* = .08, *p* = .002) and a negative indirect association through arrogance (*IE* = −.04, *p* = .047), resulting in a null indirect association overall (*TE* = .04, *p* = .068). A substantively equivalent pattern of effects was observed on raters' willingness to consider a date with the profile writer (see Supplementary Online Materials).

*Overconfidence from the author's perspective: Deterring competition.* As in Study 3, for each author we averaged the scores they were given by competitors to create mean scores for how difficult and unpleasant to deal with they were perceived to be, and how frequently competitors chose to compete with them on table choice. Each author was assessed by an aver-

age of 7 competitors. Means, standard deviations, and zero-order correlations are depicted in Table 5.

*Structural equation modeling.* Figure 5 depicts the effect of author overconfidence on competitors' table choice, as estimated by structural equation modeling. The model was set up using full information maximum likelihood (FIML) estimation (Allison, 2003). This technique enabled us to use ratings of the entire sample (*n* = 1,108) to estimate paths from overconfidence to confidence and arrogance, while using the sub-sample of 467 authors to estimate links to difficulty, unpleasantness, and table choice.

The model provided a relatively good fit to the data, $\chi^2(13, n = 1,108) = 24.25$, $p = .029$, $\chi^2/df = 1.87$; CFI = 0.99; RMSEA = .028; SRMR = .030. As in Study 3, arrogant
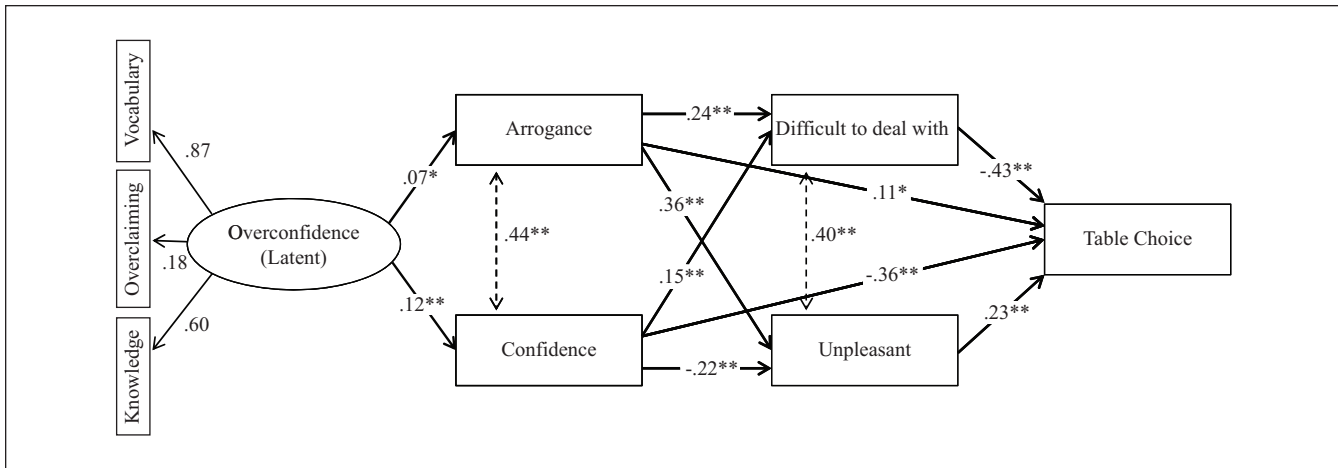
**Figure 5.** Study 4: Structural equation model of the effects of authors' overconfidence on deterrence outcome variables with confidence and arrogance as mediating variables.
*Note.* As displayed, all SEM analyses were conducted without direct paths from overconfidence to ultimate DVs, as these paths were non-significant and did not alter results (see additional analyses in Supplementary Online Materials). Relationships between variables of interest are shown. *n* = 1,108 for direct links from overconfidence, *n* = 467 for other links. SEM = structural equation modeling; DV = dependent variable.
*\*p* ≤ .05. *\*\*p* ≤ .01.

authors were perceived as more difficult to deal with (*DE* = .24, *p* < .001) and unpleasant, (*DE* = .36, *p* < .001), while confident authors were perceived as more difficult (*DE* = .15, *p* = .002). In contrast to Study 3, in which there was no effect of confidence on unpleasantness, confident authors were now perceived as less unpleasant (*DE* = −.22, *p* < .001). As in Study 3, authors perceived as difficult were the targets of less competitive table choice (*DE* = −.43, *p* < .001), but whereas unpleasantness had no effect on table choice in Study 3, unpleasant authors in Study 4 were the targets of more competitive table choice (*DE* = .23, *p* < .001). Replicating Study 3, author confidence was indirectly associated with less competitive table choice through perceptions of difficulty (*IE* = −.07, *p* = .004) and was also directly associated with less competitive table choice (*DE* = −.36, *p* < .001). In contrast to Study 3, confidence was also indirectly associated with less competitive table choice through decreased perceptions of unpleasantness (*IE* = −.05, *p* = .001). These effects led to a significant total association of confidence with less competitive table choice, as in Study 3 (*TE* = −.47, *p* < .001). As in Study 3, arrogance had an indirect association with less competitive table choice through difficulty (*IE* = −.10, *p* < .001), but unlike Study 3, arrogance was associated with more competitive table choice both directly (*DE* = .11, *p* = .023) and through unpleasantness (*IE* = .08, *p* < .001). As in Study 3, this combination led to no total effect of arrogance on table choice (*TE* = .09, *p* = .072). In contrast to Study 3, overconfidence no longer had any indirect association with unpleasantness (*IE* = .00, *p* = .978), but did retain its positive indirect association with difficulty (*IE* = .04, *p* = .011) and a negative total indirect association with table choice (*TE* = −.05, *p* = .004), such that overconfident authors were competed against less.

*Overconfidence from the competitor's perspective: Facilitating competition.* The analyses above tested whether overconfident *authors* were competed against *less*. We next examined whether overconfident *competitors* might choose to compete *more*. In contrast to the previous analysis, competitors are now the unit of analysis, and so, for each competitor, we took the average of their five table-choice decisions to calculate how willing they were to compete. We also included a new outcome variable: the amount of money that competitors won from their decisions. Competitors won a contest if they chose to compete and their rated desirability was higher than the desirability of the author whose profile they had viewed. Means, standard deviations, and zero-order correlations are depicted in Table 6.
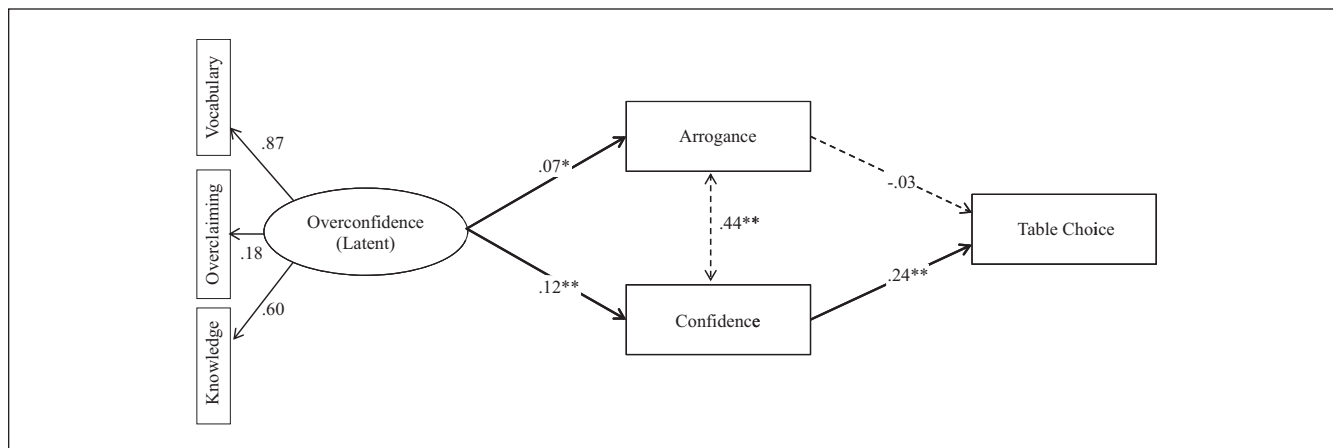
*Structural equation modeling.* Figure 6 depicts tests of the effect of competitors' overconfidence on their table choice via structural equation modeling. The model was set up as in the previous analysis, and provided a relatively good fit to the data, $\chi^2(7, n = 1,108) = 12.57$, $p = .083$, $\chi^2/df = 1.80$; CFI = 0.99; RMSEA = .027; SRMR = .024. Competitors who wrote profiles that were perceived as more confident (*DE* = .24, *p* < .001) but not more arrogant (*DE* = −.03, *p* = .487) were more likely to choose to compete. Competitors' overconfidence was indirectly associated with increased competition through perceived confidence (*IE* = .03, *p* = .006) but not through perceived arrogance (*IE* = .00, *p* = .512), and had an overall indirect association with increased competition (*TE* = .03, *p* = .006).

Figure 7 depicts the same model as Figure 6, but with the amount of money won from competition as the outcome variable. The model again provided a relatively good fit to the data, $\chi^2(7, n = 1,108) = 15.16$, $p = .034$, $\chi^2/df = 2.17$;

**Table 6.** Means, Standard Deviations, and Zero-Order Intercorrelations for Study 4 Competitor Effects.

|  | M (SD) | 1 | 2 |
|---|---|---|---|
| 1. Table choice (right) | 0.66 (0.31) | — | |
| 2. Money won | 0.54 (0.27) | .08 | — |
| 4. OCQ overconfidence | 0.00 (0.66) | .08* | .07 |
| 5. Knowledge overconfidence | 0.00 (1.00) | .04 | .02 |
| 6. Vocabulary overconfidence | 0.00 (1.00) | .05 | −.01 |
| 7. Confidence | 4.96 (0.68) | .23*** | .23*** |
| 8. Arrogance | 3.11 (0.84) | .08* | −.22*** |
| 9. Desirability | 4.10 (0.75) | .16*** | .71*** |
| 10. Gender (male) | 0.60 (0.49) | .06 | .01 |
| 11. Word length | 104.26 (50.25) | .22*** | −.03 |
| 12. OCQ accuracy | 0.00 (1.03) | −.01 | .10* |

*Note.* Trait and overconfidence intercorrelations are omitted as they are redundant with Table 4. OCQ = Overclaiming Questionnaire.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.



**Figure 6.** Study 4: Structural equation model of the effects of competitors' latent overconfidence on competitors' table choice with confidence and arrogance as mediating variables.
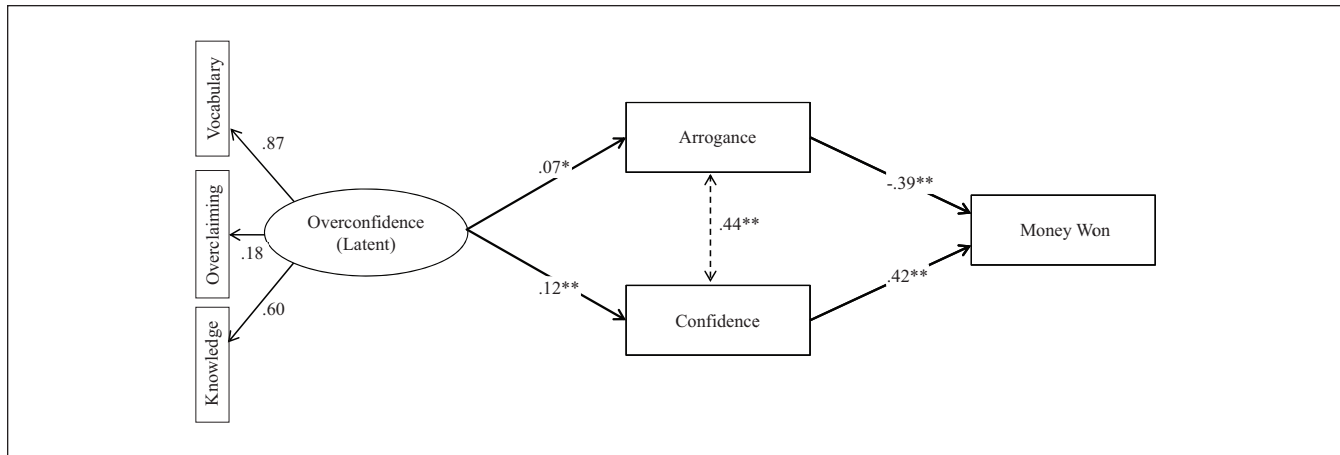*Note.* As displayed, all SEM analyses were conducted without direct paths from overconfidence to ultimate DVs, as these paths were non-significant and did not alter results (see additional analyses in Supplementary Online Materials). Relationships between variables of interest are shown. $n = 1,108$ for direct links from overconfidence, $n = 641$ for other links. SEM = structural equation modeling; DV = dependent variable.
*$p \leq .05$. **$p \leq .01$.

CFI = 0.99; RMSEA = .032; SRMR = .024. Confidence was associated with an increase in the amount of money won ($DE = .42$, $p < .001$), whereas arrogance was associated with less money won ($DE = -.39$, $p < .001$). Overconfidence was indirectly associated with more money won through confidence ($IE = .05$, $p = .002$) and with less money won through arrogance ($IE = -.03$, $p = .050$), leading to a null overall indirect effect ($TE = .02$, $p = .173$).

*Mixed-effects models of author–competitor interactions.* To examine the interaction between author and competitor characteristics on competition outcomes, we next analyzed the data at the level of individual table-choice decisions. We performed linear mixed-effects modeling using the *lme4* package in R to control for the non-independence caused by having multiple observations for each author and each competitor (Baayen, Davidson, & Bates, 2008). Analyses revealed no significant interactions between the overconfidence of the author and competitor in predicting table choice or money won. Models with all author–competitor confidence and arrogance interactions specified revealed no interactions predicting table choice. There were, however, interactions between competitor confidence and author arrogance ($B = .004$, $SE = .001$, 95% confidence interval [CI] [.001, .006]) and confidence ($B = -.003$, $SE = .001$, 95% CI [−.006, −.001]) in predicting money won, such that competitor confidence conferred a smaller monetary benefit when competing against more confident authors, and a larger benefit when competing against more arrogant authors. There were no such interactions for competitor arrogance, and no significant three-way interactions.

**Figure 7.** Study 4: Structural equation model of the effects of competitors' latent overconfidence on competitors' money won with their confidence and arrogance as mediating variables.
*Note.* As displayed, all SEM analyses were conducted without direct paths from overconfidence to ultimate DVs as these paths were non-significant and did not alter results (see additional analyses in Supplementary Online Materials). Relationships between variables of interest are shown. *n* = 1,108 for direct links from overconfidence, *n* = 641 for other links. SEM = structural equation modeling; DV = dependent variable.
\**p* ≤ .05. \*\**p* ≤ .01.

## *Discussion*

The results of Study 4 replicated the previous findings that overconfident authors are perceived as more confident and arrogant, and that although these qualities have a neutral overall effect on desirability, they effectively deter competitors who read their profiles. The replication of this pattern of results with a latent factor constructed from multiple measures of overconfidence is evidence that these findings are not artifacts of the OCQ.

The results also revealed that overconfident people are more likely to engage in mate competition, which in this study meant betting money that they would be found more desirable than the other individual. These effects of overconfidence remained indirect, however, and were such that overconfident individuals were more willing to compete to the extent that they projected more confidence, but not more arrogance. Although they were more willing to compete, overconfident individuals did not win more money because overconfidence did not increase desirability (as in previous studies).

As might be expected, the addition of the monetary incentives seems to have shifted the basis of decision making in the table-choice task. In the hypothetical scenario of Study 3, people visualized themselves competing with confident and arrogant individuals for a target's romantic attentions, and were deterred in part by the anticipated unpleasantness of competing with an arrogant individual. In contrast, in Study 4 the incentives required only that participants be seen as more desirable for them to win the competition, and thus they were not deterred by the hypothetical unpleasantness of their competitors (whom they may have accurately presumed to be less attractive). As a consequence, the association

between arrogance and table choice diminished. Despite this shift, the total indirect association of overconfidence with table choice remained, indicating that overconfidence can effectively deter competitors solely through perceptions of the increased difficulty of competing with overconfident individuals.

## Study 5

The results of the first four studies suggest that overconfidence is associated with increased perceptions of confidence and arrogance that appear to have a net zero effect on mate attraction due to their countervailing effects on desirability. Nonetheless, the results of these studies also highlight the possibility that overconfidence, even though it often comes across as arrogance, might enhance mating success by driving away the competition. One way to test this possibility is through agent-based modeling, which can offer insight into how these effects affect outcomes and interact with one another under different environmental conditions.

Agent-based modeling involves programming behavioral rules into a large number of hypothetical actors, and examining the resulting effects on the system as a whole, as well as the actors in the system. This type of model has a long history in the social sciences; one of the first applications was Schelling's (1971) famous model of segregation, which showed that a mild preference to be around similar individuals could lead to complete segregation (for a more recent example, see Gray et al., 2014). Agent-based modeling allows us to examine the expected value of overconfidence—as manifested in confidence and arrogance—on mating success in a variety of situations. Specifically, we can use agent-based models to assess how

the costs and benefits of confidence and arrogance fluctuate under more or less competitive pressure. By modeling different levels of competition, we can test whether competitive pressures cause the combination of confidence and arrogance typically associated with overconfidence to become beneficial.

We hypothesized that under low levels of mate competition, the benefits of confidence and the costs of arrogance would negate each other as we have seen in the prior experiments. Under increased competition, however, the combined effects of confidence and arrogance on mate acquisition should become more positive. Thus, overconfidence should have a net positive effect at higher levels of romantic competition.

## Method

*Creating the model.* We based our simulations on a scenario extended from our table-choice tasks. We imagined individuals searching for potential partners in an environment rich with targets and competition. In each simulation, varying numbers of individuals approach a potential partner. The confidence and arrogance displayed by each individual affects the chance of his or her advances being accepted by the target, the likelihood that they would be willing to compete for the target, and their likelihood of deterring competitors from doing the same.

We ran the following simulation for every number of competitors ($k$) from 0 to 20, with 0 representing a lone individual with no competition. To begin each simulation, we used the "mvrnorm" function in R to generate a population of $1,000 * (k + 1)$ individuals whose perceived confidence and arrogance fit the empirical distribution of our data (i.e., means, *SD*s, and the correlation between confidence and arrogance; using standardized scores for arrogance and confidence). We then used the binary choice data from Study 4 to estimate the likelihood that a target would find each individual desirable enough to accept his or her advances. We calculated the probability that each individual would be found desirable based on his or her confidence (C) and arrogance (A), including residual error variance (E), in accordance with the regression equation derived from the data.

$$P_{desire} = .488 + .103C - .104A + E.$$

We then broke the individuals into 1,000 groups of $k + 1$ competitors each. Where $k$ was greater than 0, we calculated each individual's likelihood of competing with each other individual in their group based on both of their confidence and arrogance scores, according to the equation below. Here, characteristics of decision makers are marked with a 1; those of competitors currently being assessed are marked with a 2. Coefficients for decision maker characteristics that influence competition are drawn from Study 4, while coefficients for competitor characteristics are drawn from Study 3 to esti-

mate the effects of arrogance and confidence when competitors imagined an interaction with the author.

$$P_{compete} = .658 + .077C_1 - .011A_1 - .044C_2 - .004A_2 + E.$$

After calculating $P_{compete}$, we assessed the likelihood that each individual would remain to compete for the target by taking the cumulative product of his or her likelihood to compete with each individual competitor. This is conceptually equivalent to an individual facing (for example) three competitors, making independent decisions about whether it is worth competing against each of the three, then staying to compete if the result of all of their decisions was *yes*.

$$P_{stay} = P_{compete1} * P_{compete2} * \ldots P_{compete\,k-1}.$$

We then updated $P_{desire}$, for each individual, multiplying it by his or her $P_{stay}$. In this way, we account for the fact that one needs to stay to compete to have a chance of being desired. In the 0 competitor scenario, $P_{stay}$ was set to 1.

$$P_{desire} = P_{desire} * P_{stay}.$$

We next calculated $P_{none}$, which is the probability of the target choosing no one, and allows for the chance of a target refusing all advances if all competitors are found unacceptable.

$$P_{none} = (1 - Pi_{desire}) * (1 - P2_{desire}) \ldots * (1 - Pn_{desire}).$$

Finally, we calculated our outcome variable, the probability of each individual being chosen by the target ($P_{chosen}$). First, each individual's $P_{desire}$ was divided by the sum of the $P_{desire}$ of every individual in the group, giving the chance that they, of all competitors, would be chosen. This was then multiplied by the probability that the target would choose any of the competitors to account for the target's chance of leaving alone.

$$P_{chosen} = \left(Pi_{desire} / \left(\Sigma\left(Pi_{desire}, P2_{desire} \ldots Pn_{desire}\right)\right)\right) * (1 - P_{none}).$$

For each number $k$ of competitors, we then saved the standardized betas of confidence and arrogance simultaneously predicting $P_{chosen}$ among the $1,000 * k$ individuals. To account for variability in simulations, we repeated the above process 40 times for each level of $k$ and averaged the results.

## Results

Below, we plot the results of this simulation on the expected values of arrogance, confidence, and the combination of the two that is typically seen in overconfidence. As the ratio of the two traits that is associated with overconfidence is not identical between Studies 2 and 4, we mixed the two evenly,
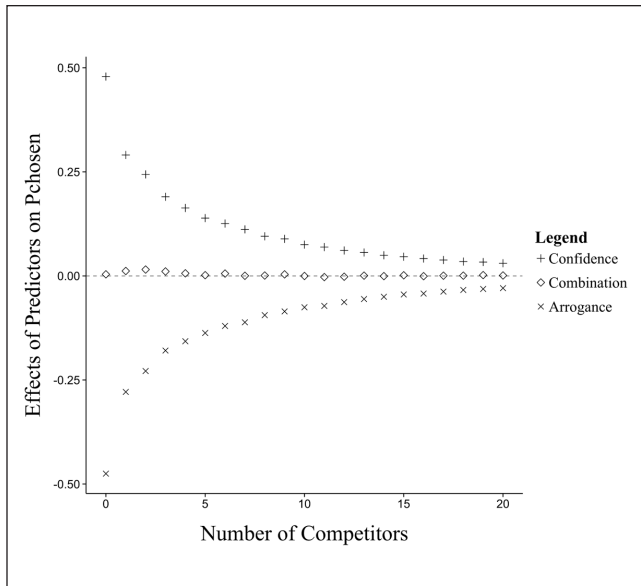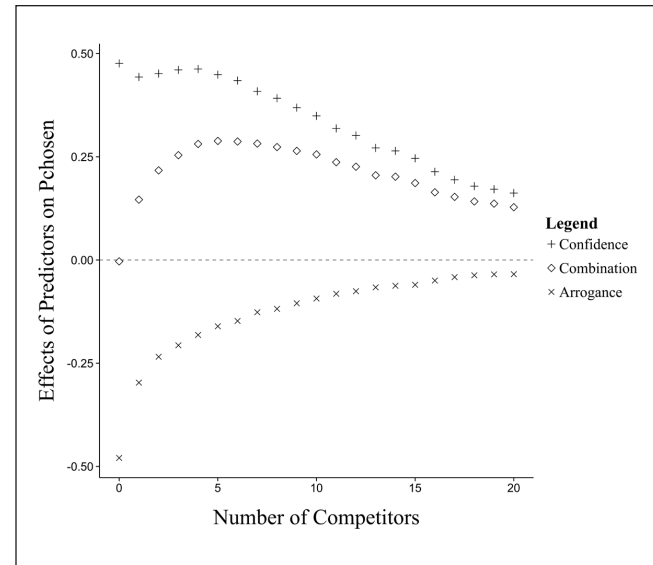
**Figure 8.** Study 5: Estimated effects of confidence, arrogance, and the sum of the two on the probability of mating success under Stage 1 of the agent-based model, in which only deterrence effects are active.



**Figure 9.** Study 5: Estimated effects of confidence, arrogance, and the sum of the two on the probability of mating success under Stage 2 of the agent-based model, in which all effects are active.

although the shape of the relationship is largely unaffected by varying ratios. Note that these estimates are of the direct effects of the sum of arrogance and confidence, not the smaller indirect effects of overconfidence. Figure 8 shows the results of this simulation when the effects of confidence and arrogance are restricted to deterring competitors. Figure 9 shows the effects when arrogance and confidence are also allowed to increase one's own propensity to compete.

The first thing that becomes clear is that under the more minimal conditions of the model in Figure 8, the deterrent effects of confidence and arrogance shift the estimated effects of their combination from neutral to slightly positive under low levels of competition, but this benefit is quite small and disappears under increasing levels of competition. Under the fuller model in Figure 9, however, the effect of the combination of confidence and arrogance rapidly becomes highly beneficial, and remains beneficial under high levels of competition, although the estimated effects peak at around 5 competitors.

This finding suggests that the increase in willingness to compete associated with confidence and arrogance seems to be responsible for the majority of their positive effects under competition. This finding also indicates that the deterrence effects of confidence and arrogance diminish in strength when more than a few competitors are present. Though there are more competitors to deter, each competitor is assessing more and more individuals, diminishing each individual's contribution to their decision. In contrast, people's willingness to compete is applied to every decision they make, and so the effect of confidence and arrogance on willingness to

compete contributes more to their decision to stay when more competitors are present. As the number of competitors grows very high, the effect of any individual traits diminish as the desirability of other competitors in the group increasingly affects an individual's chances of success. Thus, the effectiveness of arrogance and confidence is highest with an intermediate number of competitors.

## Discussion

Using agent-based modeling, we were able to estimate how confidence and arrogance could affect mate acquisition under varying levels of competition. Through this modeling, we can see that the combination of confidence and arrogance that is associated with overconfidence becomes beneficial under moderate to high levels of mate competition. Of course, this model assumes that the effects of confidence and arrogance on decision making remain constant as competition levels increase. We cannot know for sure how these effects might change in high-competition scenarios without further research. Nevertheless, these simulations derived from the empirical relationships found in Studies 2, 3, and 4 indicate that overconfidence can substantially improve an individual's potential for romantic success in competitive settings.

## General Discussion

The results of four empirical studies and agent-based modeling provide evidence for the role of overconfidence in mate acquisition and competition. In Study 1, overconfident people

were perceived as more confident in their dating profiles, and confident profiles were perceived as more desirable, but there was no zero-order association between overconfidence and romantic desirability. The results of Study 2 provided evidence for countervailing forces underlying overconfidence, whereby the positive effect of confidence on desirability was suppressed by the negative effect of arrogance. Thus, overconfident people increase their romantic desirability by appearing confident but they concurrently decrease their romantic desirability by displaying arrogance.

Study 3 showed a benefit of overconfidence in the domain of mate competition; perceived confidence and arrogance led to increased deterrence of competitors for romantic attention. Although this deterrence effect was partially mediated by the perceived difficulty and unpleasantness of competing with overconfident individuals, these need not be the only reasons that individuals chose not to compete. For instance, potential competitors might have thought that they could match the confidence and arrogance of the author, but were nonetheless unwilling to do so because of the potential negative impression that this would leave on the romantic target. Future studies could disentangle these possibilities by varying whether the competition takes place before approaching the target or in the presence of the target. Either way, overconfident individuals were able to reduce their pool of competitors for romantic targets, suggesting that overconfidence might be beneficial despite typically not being more romantically desirable.

Study 4 found that, to the extent that overconfident individuals appeared more confident, they were more willing to gamble that they would be chosen as a romantic partner (although they did not win additional money from their increased competition). Thus, the data from Study 4 suggest that overconfident individuals are more likely to deter mate competition and less likely to be deterred. Study 4 also replicated the previous results with a latent variable created from three different measures of overconfidence (despite the fact that none of these measures of overconfidence tapped people's self-perceived desirability as a dating partner).

It is worth addressing why in Study 4 the increased willingness of overconfident individuals to compete was mediated by the confidence others saw in their dating profiles, rather than being a direct effect of overconfidence itself. It seems likely that this mediation is due to the fact that our measure of confidence throughout this article is more closely associated with romantic decision making than are our measures of overconfidence. Individuals' decisions to compete should be directly affected by confidence in their romantic abilities, of which our best measure is the perceived confidence with which they wrote dating profiles. In contrast, we measured overconfidence in abstract intellectual domains, which are rather far removed from romantic activities (indeed, many people probably have great confidence in their intellectual abilities and little confidence in their romantic ones). Thus, our measure of romantic confidence, which

is more proximal to the decision to compete, mediates the effects of overconfidence as we have measured it.

It seems likely that a study that measured overconfidence in romantically relevant traits such as appearance, earning potential, or sexual prowess, might find more direct effects of overconfidence on romantic competition. While most romantic traits are difficult to objectively measure, overconfidence in physical attractiveness may be a promising avenue for future work. This can be measured by comparing self-ratings of attractiveness with the average attractiveness ratings of standardized photographs, but more direct measures are also available. For instance, Epley and Whitchurch (2008) morphed facial photographs of their participants to varying degrees with attractive and unattractive models, and then asked their participants to find their actual face in an array of such morphs. They found that participants were more likely to choose a photo morphed 10% with the more attractive image than either their actual photo or their photo morphed with the unattractive image, suggesting that most participants were overconfident about their own attractiveness. Such measures may prove useful in future investigations of romantic overconfidence.

In Study 5 agent-based simulations indicated that the effects of overconfidence in mate competition and acquisition vary according to the number of competitors. At moderate to high levels of competition, the negative effects of arrogance were diminished, and the positive effects of confidence strengthened, leading to positive estimates of the combination of the two on expected mating success. These data are consistent with the notion that overconfidence benefits mating success primarily through its role in intrasexual competition.

The current research revealed a nuanced pattern of costs and benefits of overconfidence to romantic desirability, but previous studies have found that overconfident people reap only benefits, being perceived as competent with little apparent cost (Anderson et al., 2012; Lamba & Nityananda, 2014). It is an open question why the costs of arrogance that we found were not apparent in these other settings. Do people scrutinize others less in settings that do not involve romantic attraction? Does arrogance matter less in such settings, so long as we think our teammates are competent? Or is it easier for overconfident people to avoid the appearance of arrogance in these settings? Future work could extend our analysis of confidence and arrogance into competence-based settings to distinguish these possibilities. Given that overconfident people gained an advantage in the current research when in a competitive mating environment, it would be interesting to test whether the benefits of being overconfident in other settings are also greater when the environment is competitive.

Finally, we should note that although we repeatedly found that the countervailing effects of confidence and arrogance led to null effects of overconfidence on romantic desirability at the sample level, this null effect did not uniformly emerge at

the individual level. The moderate size of the correlation between arrogance and confidence indicates that many individuals benefit from overconfidence by projecting confidence in the absence of arrogance, whereas others pay a cost for their overconfidence by projecting arrogance but little confidence. The role of overconfidence in causing people to project one or the other is likely to be moderated by various factors such as social skills, reputation, and attractiveness. Because individuals who can project confidence but not arrogance will benefit strongly in both mate attraction and mate competition, the factors underlying this ratio of perceived confidence to arrogance would seem to be a worthwhile area for further research.

## Conclusion

To the extent that others use our confidence as a way to judge our internal qualities, confidence itself becomes a valuable trait to display. The current studies showed that overconfident self-beliefs can create a net advantage that increases mating success in competitive environments, despite the costs associated with overconfidence. In line with evolutionary theorizing about the interpersonal role of overconfidence (Trivers, 2011; von Hippel & Trivers, 2011), the current work suggests that overconfidence might not only induce people to place risky bets, but might actually help them win—at least if they are gambling in the game of love.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

### Notes

1. Age was measured categorically in Studies 1 and 2.
2. Results were unchanged by excluding non-heterosexual raters in Studies 1 and 2, and so they were included in all analyses.
3. Overclaiming Questionnaire (OCQ) bias and accuracy are calculated using a score of 1, *slightly familiar*, as the cutoff for a hit, then 2, 3, and 4. These scores are then averaged to get the overall bias and accuracy indices.
4. Although less central to hypotheses, raters also judged how creative, intelligent, humorous, and high in social status each author seemed. Confirmatory factor analyses indicated that when these variables were combined with confidence they did not form a single *positivity* factor. Rather, confidence was conceptually distinct from these other positive traits, and further analyses indicated that confidence was the only consistent mediator of the positive effects of overconfidence on desirability. For more information on analyses with these variables, please see the Supplementary Online Materials.
5. All mediation and structural equation modeling (SEM) analyses in Studies 1 through 4 are based on linear regression using

averaged ratings. Averaged ratings are also the basis of all correlation tables. Mixed-effects (multilevel) models that accounted for the nested data structure (each rater judging multiple authors, each author rated by multiple raters) did not show any differences from the reported results.
6. All analyses reported in this article were essentially unchanged when controlling for gender, number of words in the profile, and OCQ accuracy scores. In addition, none of the path coefficients reported in the article were moderated by gender (see additional analyses in Supplementary Online Materials for more detail on gender).
7. Analyses in this article treat table-choice percentages as continuous outcomes. Comparable analyses treating them as binomial show no substantive differences (see Supplementary Online Materials).

### Supplemental Material

The online supplemental material is available at http://pspb.sagepub.com/supplemental.

### References

Allison, P. D. (2003). Missing data techniques for structural equation modeling. *Journal of Abnormal Psychology*, *112*, 545-557.

Ames, D. R., & Kammrath, L. K. (2004). Mind-reading and metacognition: Narcissism, not actual competence, predicts self-estimated ability. *Journal of Nonverbal Behavior*, *28*, 187-209.

Anderson, C., Brion, S., Moore, D. A., & Kennedy, J. A. (2012). A status-enhancement account of overconfidence. *Journal of Personality and Social Psychology*, *103*, 718-735.

Arnott, G., & Elwood, R. W. (2009). Assessment of fighting ability in animal contests. *Animal Behaviour*, *77*, 991-1004.

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*, 390-412.

Bing, M. N., & Davidson, H. K. (2012, October). *Measuring faking using the overclaiming instrument*. Paper presented at the River Cities Industrial and Organizational Psychology Conference, Chattanooga, TN.

Bonanno, G. A., Field, N. P., Kovacevic, A., & Kaltman, S. (2002). Self-enhancement as a buffer against extreme adversity: Civil war in Bosnia and traumatic loss in the United States. *Personality and Social Psychology Bulletin*, *28*, 184-196.

Buss, D. M., & Barnes, M. (1986). Preferences in human mate selection. *Journal of Personality and Social Psychology*, *50*, 559-570.

Buunk, B. P., Dijkstra, P., Fetchenhauer, D., & Kenrick, D. T. (2002). Age and gender differences in mate selection criteria for various involvement levels. *Personal Relationships*, *9*, 271-278.

de Jong, A., de Ruyter, K., & Wetzels, M. (2006). Linking employee confidence to performance: A study of self-managing service teams. *Journal of the Academy of Marketing Science*, *34*, 576-587.

Epley, N., & Whitchurch, E. (2008). Mirror, mirror on the wall: Enhancement in self-recognition. *Personality and Social Psychology Bulletin*, *34*, 1159-1170.

Gangestad, S. W., Garver-Apgar, C. E., Simpson, J. A., & Cousins, A. J. (2007). Changes in women's mate preferences across the ovulatory cycle. *Journal of Personality and Social Psychology*, *92*, 151-163.

Gray, K., Rand, D. G., Ert, E., Lewis, K., Hershman, S., & Norton, M. I. (2014). The emergence of "us and them" in 80 lines of code: Modeling group genesis in homogeneous populations. *Psychological Science*, *25*, 982-990.

Johnson, D. D. P., & Fowler, J. H. (2011). The evolution of over-confidence. *Nature*, *477*, 317-320.

Johnson, R. E., Silverman, S. B., Shyamsunder, A., Swee, H., Rodopman, O. B., Cho, E., & Bauer, J. (2010). Acting superior but actually inferior?: Correlates and consequences of workplace arrogance. *Human Performance*, *23*, 403-427.

Kenny, D. A., & Judd, C. M. (2013). Power anomalies in testing mediation. *Psychological Science*, *25*, 334-339.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*, 1121-1134.

Lamba, S., & Nityananda, V. (2014). Self-deceived individuals are better at deceiving others. *PloS ONE*, *9*(8), e104562.

Maynard-Smith, J., & Harper, D. (2003). *Animal signals*. Oxford, UK: Oxford University Press.

Paulhus, D. L. (1998). Interpersonal and intrapsychic adaptiveness of trait self-enhancement: A mixed blessing? *Journal of Personality and Social Psychology*, *74*, 1197-208.

Paulhus, D. L., Harms, P. D., Bruce, M. N., & Lysy, D. C. (2003). The over-claiming technique: Measuring self-enhancement independent of ability. *Journal of Personality and Social Psychology*, *84*, 890-904.

Penrod, S., & Cutler, B. (1995). Witness confidence and witness accuracy: Assessing their forensic relation. *Psychology, Public Policy, and Law*, *1*, 817-845.

Puts, D. A. (2010). Beauty and the beast: Mechanisms of sexual selection in humans. *Evolution & Human Behavior*, *31*, 157-175.

Schelling, T. C. (1971). Dynamic models of segregation. *The Journal of Mathematical Sociology*, *1*, 143-186.

Shamir, B., House, R. J., & Arthur, M. B. (1993). The motivational effects of charismatic leadership: A self-concept based theory. *Organization Science*, *4*, 577-594.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*, 422-445.

Simpson, J. A., Gangestad, S. W., Christensen, P. N., & Leck, K. (1999). Fluctuating asymmetry, sociosexuality, and intra-sexual competitive tactics. *Journal of Personality and Social Psychology*, *76*, 159-172.

Stanislaw, H., & Todorov, N. (1999). Calculation of signal detection theory measures. *Behavior Research Methods, Instruments, & Computers*, *31*, 137-149.

Trivers, R. (2011). *The folly of fools: The logic of deceit and self-deception in human life*. New York, NY: Basic Books.

von Hippel, W., & Trivers, R. (2011). The evolution and psychology of self-deception. *Behavioral & Brain Sciences*, *34*, 1-16.

Wilson, R. S., Condon, C. H., David, G., Fitzgibbon, S., Niehaus, A. C., & Pratt, K. (2010). Females prefer athletes, males fear the disadvantaged: Different signals used in female choice and male competition have varied consequences. *Proceedings of the Royal Society B*, *277*, 1923-1928.

Wong, B. B. M., & Candolin, U. (2005). How is female mate choice affected by male competition? *Biological Reviews of the Cambridge Philosophical Society*, *80*, 559-571.

Zimmermann, A. C., & Easterlin, R. A. (2006). Happily ever after? Cohabitation, marriage, divorce, and happiness in Germany. *Population and Development Review*, *32*, 511-528.