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Mate value discrepancies, the Dark Triad and relationship satisfaction: A Euclidean distances approach

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Abstract

We used a Euclidean algorithmic method of calculating mate value discrepancies to test the hypothesis that mate value discrepancies would mediate a negative association between the Dark Triad and relationship satisfaction. Participants ($N = 211$) rated themselves, their partner, and their ideal partner on a set of traits known to be important in mate selection. They also completed Dark Triad and relationship satisfaction measures. We found an indirect, negative association between the Dark Triad and relationship satisfaction mediated by the Partner-Potential Partner mate value discrepancy. The higher on the Dark Triad, the more alternative partners there were that were closer to the participant's ideal mate preferences than their current partner, which was associated with decreased relationship satisfaction. This study contributes to our understanding of how the Dark Triad relates to mating psychology. These findings also highlight the utility of employing a Euclidean algorithm to understand associations between individual differences and relationship outcomes.

Keywords

Mate value; Mate value discrepancies; Dark Triad; Relationship satisfaction

Extensive research from an evolutionary perspective has addressed the function of mate preferences, explored and identified novel mate preference dimensions, and examined individual differences in, and contextual effects on, mate preferences (e.g., Atari 2017; Bech-Sørensen & Pollet, 2016; Buss, 1989; Goetz, Easton, Lewis & Buss, 2012; Haselton & Gangestad, 2006). One of the next challenges to fully understanding mating psychology is determining how the mind amalgamates input across multiple mate preference dimensions and translates it into functional output. A recent study relating mate preferences to relationship satisfaction has addressed this challenge (Conroy-Beam, Goetz, & Buss, 2016). In the present study, we build on Conroy-Beam et al.'s (2016) work by utilizing their mate preference integration algorithm to explore associations between the Dark Triad and relationship satisfaction.

New research has demonstrated that a Euclidean algorithm provides a good representation of how people integrate information about multiple mate preferences (Conroy-Beam & Buss, 2016; Conroy-Beam & Buss, 2017). This algorithm allows for ideal preferences, potential mates, and a person's actual mate to be represented as points within the same multidimensional space and calculates straight-line distances between these points to quantify how close partners and potential partners are to a person's ideal preferences. This algorithm predicts mate selection better than a host of other candidate algorithms, predicts short- and long-term mate attraction, and predicts relationship satisfaction (Conroy-Beam & Buss, 2016, Conroy-Beam & Buss, 2017; Conroy-Beam et al., 2016).

The application of this Euclidean algorithm to understanding relationship satisfaction has addressed concerns with existing hypotheses about how ideal partner preferences relate to relationship satisfaction. Although much of the literature assumes that people should be less satisfied with partners that do not match their ideal preferences, empirical evidence has demonstrated mixed support for this claim (Campbell & Stanton, 2014). Conroy-Beam et al. (2016) identified two problems with the idea that ideal preference fulfillment should predict relationship satisfaction. First, people may not be able to attract partners that meet their ideals. Dissatisfaction motivating relationship termination would not be functional if one cannot attract a better mate. Second, a person's ideal may not be present in their mating pool. Dissatisfaction with a current less-than-ideal partner would not be functional when abandoning them would not provide an opportunity to mate with a partner closer to their ideals.

Conroy-Beam et al. (2016) used a Euclidean algorithm to generate two mate value discrepancies (MVDs) that they argued would better predict relationship satisfaction than ideal preference fulfillment. The Partner-Self MVD indexes the difference between a person's value to potential mates and their partner's value to potential mates. The Partner-Potential Partner MVD computes the proportion of other potential mates that are a worse fit to a person's ideals than their current mate. Across three studies, they demonstrated that relationship satisfaction declined as there were more alternatives available that were closer to a person's ideal mate preferences than their partner, but only for participants higher in mate value than their partner. This interaction better predicted relationship satisfaction than simple ideal preference fulfillment.

The application of this Euclidean algorithm may be useful for revealing associations between well-documented individual differences and relationship satisfaction. We tested a candidate individual difference dimension in the present study: the Dark Triad (Paulhus & Williams, 2002). Researchers have argued that the Dark Triad traits (Machiavellianism, psychopathy, and narcissism) collectively facilitate exploitative, short-term mating strategies because they are associated with low agreeableness and empathy, low neuroticism, a high drive for power, high extraversion, and the use of tactics for avoiding commitment (Jonason & Buss, 2012; Jonason, Li, Webster, & Schmitt, 2009). The literature on mate preferences suggests that individuals high on the Dark Triad should be particularly unattractive as long-term mates. Both men and women highly value mates who are kind and understanding, express mutual love and attraction, and are trustworthy (e.g., Buss, 1989). The Dark Triad represents the opposite of such desires. People also rate vignette narcissists, Machiavellians,

and psychopaths as unlikable and unattractive (Rauthmann & Kolar, 2012). Furthermore, the Dark Triad traits are associated with self-grandiosity through narcissism and share a self-serving core of callous-manipulation (Jones & Figueredo, 2013). Thus, although those high on the Dark Triad may not be attractive to high mate value mates, they may still perceive they deserve such mates and desire the benefits associated with having a high mate value partner. Indeed, the Dark Triad is not associated with relaxed, or different standards for long-term mates. Individuals high on the Dark Triad have similarly high standards for long-term mates as individuals low on the Dark Triad (Jonason, Valentine, Li, & Harbeson, 2011). This suggests that the Dark Triad should be negatively associated with Partner-Potential Partner MVD. Those high on the Dark Triad should be less able to attract partners that meet their ideal preferences, meaning there will be a larger proportion of alternative mates that better fit their ideal preferences. Because the MVD calculations rely on participant reports of self and partner characteristics, it is possible the Dark Triad will also be associated with Partner-Self MVD. If those high on the Dark Triad rate themselves particularly favorably, but do not extend these elevated evaluations to the ratings of their partner, we would expect the Dark Triad to be negatively associated with Partner-Self MVD.

Using the Conroy-Beam et al. (2016) method to assess and compute MVDs, we tested two moderated mediation models to determine if the Dark Triad was associated with either MVD, and to determine if these MVDs mediated a negative relationship between the Dark Triad and relationship satisfaction:

Hypothesis 1: We hypothesized that there would be a negative, indirect relationship between the Dark Triad and relationship satisfaction. We predicted the Dark Triad would be negatively related to Partner-Potential Partner MVD. We then predicted that Partner-Potential Partner MVD would positively predict relationship satisfaction, moderated by Partner-Self MVD. This would reveal a negative, indirect relationship between the Dark Triad and relationship satisfaction.

Hypothesis 2: We hypothesized that there would be a negative, indirect relationship between the Dark Triad and relationship satisfaction. We predicted that the Dark Triad would be negatively related to Partner-Self MVD. We then predicted that Partner-Self MVD would positively predict relationship satisfaction, moderated by Partner-Potential Partner MVD. This would also reveal a negative, indirect relationship between the Dark Triad and relationship satisfaction.

Both hypotheses test that the interaction of the MVDs will predict relationship satisfaction and that this interaction will mediate a negative relationship between the Dark Triad and relationship satisfaction. They differ with respect to the MVD with which the Dark Triad will be associated (See Figures 1 and 2).

Method

Participants

Participants were students at California State University, San Bernardino in long-term committed relationships and received partial course credit. Based on previous work employing these mate value discrepancy calculations we intended to collect data from 250

participants and had the resources to collect data for one academic year (Conroy-Beam et al., 2016). We excluded three participants who did not identify their sex, and four who did not complete the mate preferences instrument. Fourteen individuals did not identify as heterosexual and we excluded their data because the MVDs are calculated assuming opposite-sex partners. Our final sample was comprised of the remaining 211 participants (59 male) who ranged in age from 18 to 51 ($M = 21.70$, $SD = 4.76$). Most participants completed the study online; 52 participants completed the study in a campus research lab with their romantic partner, who also participated in the study. Excluding these participants did not change the pattern or significance of the results. We obtained informed consent from all participants and all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Measures & Procedure

Participants reported their age, partner's age, relationship length, and sexual orientation, and completed survey measures hosted on Qualtrics.com.

Participants completed the *Dirty Dozen*, a 12-item concise measure of the Dark Triad traits that contains 4-item subscales, one for each component of the Dark Triad (Jonason & Webster, 2010). Because the mate preferences instrument is long (it requires completing 69 ratings), we opted for a shorter Dark Triad measure to minimize participant fatigue. Although there are short-comings to using this brief measure, it has been demonstrated to be a valid and adequate measure of the Dark Triad (Jonason & Luévano, 2013; Webster & Jonason, 2013). Participants rated how much they agreed that each item described them on a 7-point scale ("Don't agree at all" to "Agree completely") and higher scores indicated greater levels of the Dark Triad traits. The subscales and the overall composite demonstrated high reliability ($\alpha s = .75-.85$).

To generate MVD variables, participants completed the 23-item mate preference instrument employed by Conroy-Beam & Buss (2017). Participants first rated their ideal partner, then their actual mate, and then themselves on 23 characteristics important in mate selection such as "intelligent" and "kind." We computed the MVDs according to the methods described by Conroy-Beam & Buss (2017) and Conroy-Beam et al. (2016) using R. The Partner-Potential Partner MVD quantifies the proportion of mates rated by other participants in the sample that are a worse match to a participant's ideal preferences than their partner is. For each preference dimension we calculated the difference between each participant's stated ideal and their partner's actual trait positioning. We squared and summed these differences and calculated the square root of this sum for each participant. The result is a straight-line distance between a person's ideal mate and actual mate through multidimensional preference space. We then repeated this calculation between the participant and each other mate reported by same-sex participants. This allowed us to compute the proportion of other participants' mates who would have a longer Euclidean distance from the person's ideal preferences than the distance between their current mate and their ideal preferences. The larger this proportion, the more alternative partners there are who are a worse fit for a

person's preferences than their current mate. In other words, a higher Partner-Potential Partner MVD means there are fewer alternatives that are closer to a person's ideal preferences than their current mate.

The Partner-Self MVD calculation involved multiple steps. First, we computed the average male and female preferences for each dimension. Then we calculated the Euclidean distance through multidimensional preference space between each participant's traits and the average ideal preferences of the participant's opposite sex, which served as an estimate of participant mate value. The Euclidean distance between each participant's partner's traits and the average preferences of the participant's same-sex served as an estimate of the mate value of each participant's partner. These distances were then scaled so that the shorter the Euclidean distance, the higher the mate value. The Partner-Self MVD was computed by subtracting participant mate value from their partner's mate value. Positive Partner-Self MVD values indicate the participant's mate is higher in mate value than they are.

We measured relationship satisfaction using the Quality Marriage Index, modified to ask about the participant's relationship rather than their marriage (QMI; Norton, 1983). Participants rated their agreement with five statements about their relationship, such as, "We have a good relationship." on a 7-point Likert scale ranging from "*Strongly Disagree*" to "*Strongly Agree*." A sixth question asked participants to rate their happiness in their relationship, everything considered, on a 7-point scale from "*Extremely unhappy*" to "*Extremely happy*." The average of these six items served as a measure of relationship satisfaction for each participant ($\alpha = .95$).

Results

Statistical analyses were conducted using IBM SPSS Statistics version 23 using the PROCESS macro (PROCESS Model 14; Hayes 2013). For all tests of moderated mediation, we used biased-corrected 95% confidence intervals as the index of moderated mediation, and examined direct and indirect effects based on 10,000 bootstrapped samples. A significant effect is indicated by a confidence interval that does not include zero. The correlations between the variables of interest and descriptive statistics are presented in Table 1.

Hypothesis 1 was that the Dark Triad would be indirectly related to relationship satisfaction through Partner-Potential Partner MVD moderated by Partner-Self MVD. The index of moderated mediation was not significant, $b = .03$, 95% CI: $[-.01, .10]$; Model: $F(4, 206) = 15.76$, $p < .001$; $R^2 = .23$. However, Partner-Potential Partner MVD did mediate an indirect, negative relationship between the Dark Triad and relationship satisfaction. As predicted, the Dark Triad was directly negatively related to Partner-Potential Partner MVD ($b = -.06$, $p = .01$) and Partner-Potential Partner MVD was positively related to relationship satisfaction ($b = 2.00$, $p < .001$). This resulted in a significant, indirect relationship between the Dark Triad and relationship satisfaction through Partner-Potential Partner MVD at all values of the hypothesized moderator (Figure 1). Results from analyses exploring the same statistical model using each of the trait subscales are available in the online supplemental material (Online Resources 1).

Hypothesis 2 was that the Dark Triad would be indirectly related to relationship satisfaction through Partner-Self MVD, moderated by Partner-Potential Partner MVD. The index of moderated mediation was not significant, $b = -.04$, 95% CI: $[-.21, .02]$; Model: $F(4, 206) = 15.76$, $p < .001$; $R^2 = .23$. The Dark Triad was not directly related to Partner-Self MVD ($b = .09$, $p = .12$). Partner-Self MVD did not mediate a relationship between the Dark Triad and relationship satisfaction at any level of the moderator (Figure 2).

In response to reviewer feedback, we examined whether the Dark Triad, relationship satisfaction, and the mate value discrepancies were correlated with the participant's age, the age difference between the participant and their partner (calculated as participant age subtracted from their partner's age), and/or relationship length. Age and age difference were not related to any of the variables of interest. Relationship length was negatively related to satisfaction and the mate value discrepancies (Table 1).

In sum, we found partial support for Hypothesis 1. We demonstrated an indirect, negative relationship between the Dark Triad and relationship satisfaction mediated by Partner-Potential Partner MVD. However, this relationship was not moderated by Partner-Self MVD. Hypothesis 2 was not supported. There was no indirect relationship between the Dark Triad and relationship satisfaction via Partner-Self MVD.

Discussion

We demonstrated an indirect, negative relationship between the Dark Triad and long-term relationship satisfaction. The Dark Triad was negatively associated with Partner-Potential Partner MVD, which meant that the higher an individual was on the Dark Triad, the greater the proportion of alternative mates closer to their ideal preferences than their current partner. This MVD mediated a negative relationship between the Dark Triad and relationship satisfaction.

Our findings demonstrate the potential of using a Euclidean algorithm to operationalize MVDs. Our methods may better reflect the computations human mating mechanisms employ when assessing the multitude of traits important in partner selection compared to previous methods (Conroy-Beam & Buss, 2016; Conroy-Beam et al., 2016). Although there are limitations to using self-report to assess self and partner traits, our approach had the benefit of not relying on participants' explicit perceptions of discrepancies between self and partner. Furthermore, the Partner-Potential Partner MVD calculation assesses an individual's specific ideal preferences. This is particularly important when studying the Dark Triad. Recent research has demonstrated that psychopathy and narcissism are uniquely related to mate preferences (Atari & Chegeni, 2017). Capturing respondent-specific ideal preferences may be useful for relating a variety of individual differences to relationship outcomes.

Extant research linking the Dark Triad to long-term mating outcomes has been sparse compared to research on the Dark Triad and short-term mating, and somewhat less conclusive. Jonason and colleagues (2009) found no relationship between the Dark Triad and long-term mating interest while Jones and deRoos (2017) found an unpredicted positive association between narcissism and long-term mating interest. In one study of couples, the

Dark Triad was negatively associated with relationship satisfaction and commitment; however, these relationships were only marginally significant (Smith et al., 2014). We, too, did not find a direct relationship between the Dark Triad and relationship satisfaction. The Dark Triad may be related to relationship satisfaction through multiple positive and negative pathways which mask underlying relationships when only the direct relationship is studied. For example, narcissism is associated with overconfidence (Campbell, Goodie, & Foster, 2004). Confidence may be attractive to potential mates, increasing the likelihood that a person would attract a mate closer to their ideals. This would result in an indirect pathway positively linking the Dark Triad to relationship satisfaction. Full understanding of how many individual differences relate to relationship outcomes may depend on parsing out such individual indirect relationships. We demonstrated one such indirect pathway.

The finding that Dark Triad is indirectly related to relationship satisfaction has important implications for understanding relationship functioning. The decreased satisfaction in relationships through MVDs may lead to greater relationship dysfunction, instability, and termination. It is possible that the dissatisfaction stemming from Partner-Potential Partner MVD fuels the higher infidelity rates associated with the Dark Triad (Jones & Weiser, 2014). Future research should test this mechanism of relationship dissatisfaction to determine if it predicts other relationship emotions and outcomes, such as jealousy, infidelity, and commitment.

There was no association between the Dark Triad and relationship satisfaction mediated by Partner-Self MVD. The Dark Triad was negatively correlated with both the participant's mate value ($r = -.30, p < .001$) and their partner's mate value ($r = -.14, p < .05$), and self and partner mate value were significantly correlated ($r = .40, p < .001$) which suggests participants who were high on the Dark Triad were mated to similarly lower in mate value partners, and would explain why the Dark Triad and Partner-Self MVD were not related to one another. Kardum, Hudek-Knezevic, Schmitt, & Covic (2017) demonstrated assortative mating for the Dark Triad and showed that this may be due to initial assortment (similarity at the beginning of the relationship rather than convergence). They also did not find support for the active assortment hypothesis, that partners were actively selecting based on Dark Triad traits. This fits with the overall thrust of our findings. Those high on the Dark Triad may be settling for partners that are not close to their ideals, but are similar to them. This also indicates that the Dark Triad is not associated with inflated self-ratings on characteristics important in mate selection. In fact, the only self-ratings that were significantly correlated with the Dark Triad were emotional stability ($r = -.20$), kindness ($r = -.22$), healthy ($r = -.20$), and loving ($r = -.26$; all $ps < .01$). With the exception of healthy, these negative associations would be predicted by individuals high on the Dark Triad accurately rating traits rather than inflating.

Although we hypothesized a causal mechanism, our study design was correlational and the results must be interpreted with caution. Relationship satisfaction is influenced by factors other than MVDs, and it may in turn influence self-perceptions, and perceptions of one's mate and one's ideal mate. Future studies would benefit from experimentally manipulating perceptions of MVDs to test the directionality of the associations with the Dark Triad and relationship satisfaction. Longitudinal work tracking the Dark Triad, MVDs, and

relationship satisfaction could help support these findings. Additionally, our sample was largely female. Conroy-Beam et al. (2016) did not find sex differences in how the MVDs related to relationship satisfaction, and we also did not expect sex differences in the pattern of relationships between the Dark Triad, the MVDs, and relationship satisfaction. Also, we did not find the expected interaction between the MVDs predicting relationship satisfaction. Both MVDs were independently positively related to relationship satisfaction. One possibility is that our sample size was too small to replicate the effect. Future work would benefit from using a less sex-biased and larger sample to better explore sex differences. Finally, we relied on participant reports of their own and their partner's traits, which may be biased. Verifying these findings using third-party ratings of participant and partner characteristics will be a necessary next step. However, this study provides an initial first step by documenting these previously unknown associations.

This study uncovered a previously unknown pathway connecting the Dark Triad to relationship satisfaction. It contributes to the complex picture of how the Dark Triad is associated with mating strategies and behavior. Of equal importance may be the application of this Euclidean algorithm for operationalizing MVDs. This method may be fruitfully applied to the study of individual differences beyond the Dark Triad to explore their associations with the gamut of mating strategies, and the variety of emotions and behaviors involved in close relationships.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Condition Indirect Effects (Bold text indicates a significant path)

Dark Triad → Partner- Potential Partner MVD → Relationship Satisfaction	
-1 SD from moderator mean	-.13 (-.30 to -.02)
Moderator mean	-.12 (-.25 to -.01)
+1 SD from moderator mean	-.10 (-.23 to -.01)

Figure 1.

Test of Hypothesis 1. Path analyses examining direct and indirect effects of the Dark Triad on relationship satisfaction via Partner-Potential Partner MVD, moderated by Partner-Self MVD. Solid lines indicate significant pathways; dotted lines show non-significant pathways. Condition indirect effects are inset and presented with 95% confidence intervals.

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

Condition Indirect Effects (Bold text indicates a significant path)

Dark Triad → Partner- Potential Partner MVD → Relationship Satisfaction	
-1 SD from moderator mean	.02 (-.00 to .10)
Moderator mean	.01 (-.02 to .09)
+1 SD from moderator mean	.00 (-.06 to .06)

Figure 2.

Test of Hypothesis 2. Path analyses examining direct and indirect effects of the Dark Triad and each subscale on relationship satisfaction via Partner-Self MVD, moderated by Partner-Potential Partner MVD. Solid lines indicate significant pathways; dotted lines show non-significant pathways. Condition indirect effects are inset and presented with 95% confidence intervals.

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

Table 1
Correlations among the Dark Triad, MVDs, and Relationship Satisfaction, and Descriptive Statistics

Variables	1	2	3	4	5	6	7	8	9	M	SD
1. Dark Triad	---									2.25	.88
2. Machiavellianism	.81***	---								2.26	1.08
3. Psychopathy	.68***	.45***	---							1.65	.92
4. Narcissism	.81***	.45***	.28***	---						2.83	1.41
5. Relationship Satisfaction	-.08	-.06	-.10	-.03	---					5.56	1.44
6. Partner-Potential Partner MVD	-.18*	-.14*	-.20**	-.09	.47***	---				.81	.28
7. Partner-Self MVD	.11	.15*	.07	.04	.27***	.42***	---			-.03	.74
8. Age	.03	.01	.08	-.00	.01	.05	-.03	---		21.70	4.76
9. Age Difference	-.04	-.09	-.07	.05	.00	.08	-.11	-.09	---	.52	3.23
10. Relationship Length (months)	-.11	-.11	-.07	-.07	-.28***	-.28***	-.16*	-.05	.12	39.20	40.50

* $p < .05$,

** $p < .01$,

*** $p < .001$