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How personality relates to probability of conception[☆]

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ABSTRACT

Do personality traits relate to how likely women are to conceive? In two studies ($N = 250$), we explored the relationship between the probability of conception and the Big Five (Study 1) and the Dark Triad (Study 2) traits. Study 1 suggested that women who were freely cycling and likely to conceive were less agreeable and lower on openness, which may assist in assertiveness and higher discernibility for new partners. Study 2 suggested that coupled, as opposed to single women, who were more likely to conceive, were more narcissistic, which may be related to an increased sense of desirability and enable them to compete with their current partners over sexual access. While this was an exploratory study, it provided implications for the possibility that self-reported personality traits are sensitive to hormonal fluctuations that may be geared towards changes in women's sexual motivation..

Roberts, 2017 It is now widely recognized that personality traits are not completely fixed across situation and over time. According to the sociogenomic model of personality traits (Robert, 2017), personality is a combination of states, traits, environments, and biological factors. One source of variance in traits might be hormonal fluctuations. For instance, testosterone is associated with enhanced in-group cooperation and increased hostility towards outgroups (Reimers & Diekhof, 2015). Oxytocin is involved in bond formation between romantic partners and facilitates relationship duration (Schneiderman, Zagoory-Sharon, Leckman, & Feldman, 2012). One type of hormone that has received less attention in relation to personality variance are ovulatory hormones (e.g., estradiol). Such hormones are associated with increased sexual desire (Roney & Simmons, 2016), assertive behavior (Blake, Bastian, O'Dean, & Denson, 2017), and higher ratings of male bodies (Jünger, Kordsmeyer, Gerlach, & Penke, 2018). All these behaviors might also be captured in personality traits because one can treat personality traits as behavioral syndromes (Jonason & Zeigler-Hill, 2018; Sih, Bell, Johnson, & Ziomba, 2004). Behavioral syndromes are descriptive patterns of behavior that organisms engage in (i.e., they are downstream effects) but unlike traditional personality traits researchers do not have to assume some internal loci of control of that behavior. If behavioral syndromes are adaptive and the efficacy of adaptations depends on the context in which they are situated, we would expect natural selection to have paired hormonal shifts with sensible changes in personality traits. These hormonal variations are

hypothesized to assist with women's sexual and mating motives (Roney, 2018). In this study, we assess whether women's personality traits are sensitive to changes in their probability of conception.

Earlier attempts at understanding ovulatory cycle effects on women's behavior, preferences, and mating psychology appeared to indicate that women's mating psychology fluctuated over the reproductive cycle (Gildersleeve, Haselton, & Fales, 2014). However, what seems to be more likely is that these changes reflect a fertility-linked change in motivational priorities (Jones, Hahn, & DeBruine, 2019; Roney, 2018), driving increased sexual motivation and availability during the ovulatory phase of the cycle. Greater sexual availability in heterosexual women, at the high-fertile phase of the cycle, can be evidenced by a tendency to prefer more revealing clothes (Blake et al., 2017), increased sexual desire (Arslan, Schilling, Gerlach, & Penke, 2018; Jones et al., 2019, Roney & Simmons, 2016), increased attraction, flirting, and fantasizing towards other men (Arslan et al., 2018), assessing male bodies as more attractive in general (Jünger et al., 2018), and increased self-perceived desirability (Arslan et al., 2018; Haselton & Gangestad, 2006). Simultaneously, they may be more competitive with rivals (Eisenbruch & Roney, 2016; Lucas & Koff, 2013). That is, when women are at a higher probability of conception, they show evidence for both intersexual and intrasexual competition. Motivational priorities theory asserts that hormones signal changes in women's behavioral priorities and sexual motivation; thereby women accept higher costs of sexual activity when conception

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is most likely (Roney, 2018). What was once thought of as a change in women's mating psychology and behavior, is now conceptualized as a life history-based variation in women's motivation towards reproduction. Personality traits (taken as behavioral syndromes) may bias certain people towards investing more in reproductive effort at a given time when such a motive is fundamentally relevant (Luoto, Kramas, & Rantala, 2019).

Limited research undertaken on personality to date suggests an increase in assertiveness during the high-fertility period (Blake et al., 2017). In the same vein, variation in the larger behavioral syndromes found in the Big Five (i.e., extraversion, neuroticism, conscientiousness, agreeableness, and openness; McCrae & John, 1992) and the Dark Triad (i.e., narcissism, psychopathy, and Machiavellianism; Paulhus & Williams, 2002) traits might be evidenced across the cycle (i.e., in the same way that oxytocin facilitates greater agreeableness, broadly defined, in relationships; Schneiderman et al., 2012). Agreeableness, extraversion, and openness have beneficial outcomes for relationship opportunities and maintenance (Botwin, Buss, & Shackelford, 1997). Conversely, disagreeableness is associated with intrasexual competitiveness in women (Buunk & Fisher, 2009) and the Dark Triad traits are associated with competitiveness in both sexes (Carter, Montanaro, Linney, & Campbell, 2015) and sexual permissiveness (Jonason, Li, Webster, & Schmitt, 2009). Narcissism specifically is associated with sexual exploitation and a greater sense of sexual skill (McNulty & Widman, 2013). And last, women who are more narcissistic appear to have (or at least report) a shorter monthly cycle (Jonason & Lavertu, 2017).

Given that women's sexual availability and motivation is correlated with these aspects of personality, it is possible that personality, treated as a behavioral syndrome, facilitates the shift towards a reproductive motivation due to changing hormonal profiles. Personality traits may serve women in their intrasexual and intersexual competitive goals. We explored whether domain-general personality trait states such as the Big Five and Dark Triad traits, specifically in agreeableness and narcissism, vary with the probability of conception.

1. Study 1: the probability of conception and the Big Five

In Study 1, we attempt to answer a basic question. Is variance in personality sensitive to the probability of conception in women? We start by attempting to link the most general taxonomy of personality—the Big Five traits—with the probability of conception in freely cycling women and compare those correlations in (pre-menopausal) single and partnered women. The study represents the first attempt (that we know of) to link domain-general personality traits to conception risk.

2. Method

2.1. Participants and procedure

Participants were freely cycling female Americans ($N = 135$), aged 18–46 years ($M = 25.90$, $SD = 8.29$) recruited via Mechanical Turk (51%) and a public university in Alabama (49%). Forty-four percent of the sample were single and 56% were involved in a serious, romantic relationship. Ninety percent of the sample were heterosexual, 3% were homosexual, and 7% were bisexual. Fifty-six percent of the sample were of European descent, 27% were of African descent, 9% were of Hispanic descent, 6% were of Asian descent, and 2% were from some other racial/ethnic group. The study was approved by the departmental Ethics Committee. Participants were directed to the study's website and gave their consent to participate. On completion, participants were debriefed and thanked for their participation.

2.2. Assessing probability of conception

To determine probability of conception, we obtained: (1) the start dates of participants' last menstrual period and their previous two menstrual periods, (2) the expected start date of their next menstrual period, and (3) typical cycle length. From this data, we used the reverse cycle day method to predict the day of ovulation for each participant (Gangestad et al., 2016). We followed recommendations for fertile window estimation in cross-sectional data (Gangestad et al., 2016), and computed a continuous estimate of probability of conception for each participant, with higher values indicating higher conception probability ($M = 0.03$, $SD = 0.03$).

2.3. Measures

We used the 20-item short International Personality Item Pool (Donnellan, Oswald, Baird, & Lucas, 2006) to measure the Big Five personality dimensions. Participants were asked the degree to which they agreed (1 = Strongly disagree; 5 = Strongly agree) with statements such as: "Have a vivid imagination" (i.e., openness), "Get chores done right away" (i.e., conscientiousness), "Talk to a lot of different people at parties" (i.e., extraversion), "Sympathize with others' feelings" (i.e., agreeableness), and "Have frequent mood swings" (i.e., neuroticism). Items were averaged to create composites of openness (Cronbach's $\alpha = .63$), conscientiousness ($\alpha = .65$), extraversion ($\alpha = .80$), agreeableness ($\alpha = .71$), and neuroticism ($\alpha = .58$).

3. Results and discussion

To calculate the relationship between the Big Five traits and probability of conception, we conducted a series of correlation and regression analyses. We correlated the Big Five traits with the probability of conception. The only trait linked to the probability of conception was agreeableness ($r(133) = -.24$, $p < .01$), an effect that was robust to the partialing of the shared variance in the Big Five traits ($\beta = -.23$, $t = 2.45$, $p < .05$). We compared these correlations in single women to women in a relationship and found no differences in the correlations for extraversion, neuroticism, and conscientiousness. In contrast, the correlation between probability of conception and agreeableness remained in single women ($r(57) = -.32$, $p < .01$) and was non-significant for women in a relationship ($r = -.17$), however, these did not differ from one another ($p = .35$), likely as a function of an underpowered test. There was a significant difference (Fisher's $z = -2.14$, $p < .05$) in the correlation between openness and the probability of conception for single women ($r(57) = -.27$, $p < .05$) and those in a relationship ($r = .10$). In this study, we have documented the first evidence linking the Big Five traits of agreeableness and openness to variance in the probability of conception in women. We contend that these personality traits reflect a modification of their behavioral syndrome that may enable women, when they are most likely to conceive, to modulate their social interactions to be more discerning with mates and assist in their self-perceived bargaining power (Blake et al., 2017).

4. Study 2: the probability of conception and the Dark Triad

While Study 1 provided new data on the possibility that personality variance is sensitive to individual differences in probability of conception, it was limited by using the only one broad-band measure of personality. In particular, the Big Five may paint an overly "rosy" view of human nature. In Study 2, we again examine the role of probability of conception as it relates to personality traits, but now consider three socially adverse traits: psychopathy, narcissism, and Machiavellianism. Again, we examine the role of relationship status as a moderator in accounting for personality states as a function of the probability of conception. And last, consistent with Study 1, we targeted only freely cycling women.

5. Method

5.1. Participants and procedure

Participants were 111 female psychology students aged 18–46 years ($M = 21.35$, $SD = 4.85$) from the Southern U.S. who received partial course credit for their participation and were freely cycling with regular monthly menstrual cycles (i.e., 25–35 days). Data was collected in parallel with Study 1. Fifty-three percent of the sample were single and 47% were involved in a serious, romantic relationship. Eighty-eight percent of the sample were heterosexual, 4% were homosexual, and 8% were bisexual. Sixty percent of the sample were of European descent, 26% were of African descent, 6% were of Asian descent, 4% were of Hispanic descent, and 4% were from some other racial/ethnic group.

The study was approved by the departmental Ethics Committee. Once again, participants completed the study online and gave their consent to participate. On completion, participants were debriefed and thanked for their participation. To determine probability of conception, we obtained: (1) the start date of participants' last menstrual period and their previous two menstrual periods, (2) the expected start date of their next menstrual period, and (3) typical cycle length. We then used the method described above to predict the day of ovulation for each participant and assigned a continuous measure of fertility ($M = 0.04$, $SD = 0.04$).

5.2. Measures

We used the Dark Triad Dirty Dozen, a 12-item measure of the Dark Triad with four items per subscale (Jonason & Webster, 2010). Participants were asked how much they agreed (1 = *not at all*; 5 = *very much*) with statements such as: "I want others to admire me" (narcissism), "I am not concerned with the morality of my actions" (psychopathy), and "I have used deceit or lied to get my way" (Machiavellianism). Items were averaged together to create an index of narcissism (Cronbach's $\alpha = .83$), Machiavellianism ($\alpha = .78$), and psychopathy ($\alpha = .58$).¹

6. Results and discussion

To calculate the relationship between the Dark Triad traits and probability of conception, we conducted a series of correlation and regression analyses. We correlated the Dark Triad traits with the probability of conception. Psychopathy and Machiavellianism were not linked to conception probability, but narcissism was ($r(109) = .25$, $p < .05$) overall, an effect that was robust to the partialing of the shared variance in the Dark Triad traits ($\beta = .29$, $t = 2.41$, $p < .05$). When we compared the correlations between the Dark Triad traits and conception probability across those who were single and those who were in a serious romantic relationship, the correlations for psychopathy and Machiavellianism were close to zero. However, when we looked at narcissism, we found that in single women, the correlation was near zero ($r = .09$) and was moderate in women in relationships ($r(50) = .42$, $p < .01$), a significant difference (Fisher's $z = -1.84$, $p < .05$). We contend these results reflect a modification of the narcissistic behavioral syndrome that may enable women at a higher probability of conception to compete with their partners over sexual access (McNulty & Widman, 2013).

7. General discussion

The possibility that women experience changes in their mating

psychology as a function of hormones has received much attention in recent years (e.g., Gildersleeve et al., 2014). What is less clear is if trait-consistent behavior exhibits similar fluctuations in response to mating priorities. We examined whether women experienced trait-consistent behavioral regularities that respond to a change in fertility-linked mating priorities as measured by conception risk. Women in relationships experienced increases in narcissism and reductions in agreeableness in-line with conception risk. In contrast, single women experienced reductions in the traits of openness and agreeableness.

Whilst we cannot say these are directly related to mating functions as we did not measure these directly, the results are consistent with motivational priorities theory (Roney, 2018). These variations may be caused by the shift towards sexual motivation during this period. Lower state agreeableness for partnered women is consistent with increased assertiveness and bargaining power during this period (Blake et al., 2017). Alternatively, lower state agreeableness may assist with countervailing a partner's mate-guarding attempts (Haselton & Gangestad, 2006). Contrary to previous reported findings, narcissistic states increased for women in relationships. Arslan et al. (2018) used a modified scale to refer to comparisons with other women, as they hypothesized that narcissism was related to intrasexual competition. Our findings indicate the opposite – that women may experience narcissistic behavior as a result of intersexual competition. Increased narcissistic states for partnered women is consistent with a sense of sexual skill and sexual exploitation of partners which may lead to greater sexual satisfaction (McNulty & Widman, 2013). If this narcissism is related to partnered sexual behavior, future research should test this hypothesis with the Sexual Narcissism Scale (Widman & McNulty, 2010). Increased narcissism may also be a product of increased self-desirability (Arslan et al., 2018; Haselton & Gangestad, 2006). Disagreeableness in single women may facilitate competition with rival women (Buunk & Fisher, 2009; Eisenbruch & Roney, 2016; Lucas & Koff, 2013). Lower openness may inhibit single women's tendency to seek new long-term relationships (Botwin et al., 1997) but it may enable high discernibility for short-term relationships, as women favor high-quality partners for short-term relationships (Blake et al., 2017; Kruger, 2006). In sum we contend that personality traits facilitate women who are facing intrasexual and intersexual competition when fertility-linked changes in sexual priorities occur (Roney, 2018).

7.1. Limitations and conclusion

Despite the novelty of our study, it has some limitations. One limitation of this study was the low rate of internal consistency we reported for some of our measures. This number falls below traditional cutoffs but is still higher than more liberal standards of .50 (Schmitt, 1996). Another limitation is that we relied on estimates of conception risk which are less accurate than direct measurement of hormonal data (Gangestad et al., 2016); future studies should incorporate hormonal measurement to ensure accuracy of ovulation effects. Third, the Dark Triad Dirty Dozen has been criticized for its brevity (Muris, Merckelbach, Otgaar, & Meijer, 2017), but is still valid (for a discussion see: Koehn, Okan, & Jonason, 2018). Last, we captured cross-sectional individual differences in freely cycling women; a longitudinal design would reveal further short-term fluctuations across the reproductive cycle. Despite these limitations, we have provided new information about personality in (freely cycling) women.

In conclusion, we have provided novel findings about how personality traits might be sensitive to fluctuations in mating priorities as a result of hormonal profiles of women. Our results provide initial support for personality traits, reflected as behavioral syndromes, fluctuating across the ovulatory cycle to meet changing motivational priorities. More research is needed to test the robustness of the personality effects, under what conditions these personality behavioral syndromes operate, and to what degree do these personality syndromes function as mediators between physiology and behavior. Both domain general-

¹ Psychopathy was correlated with Machiavellianism ($r(109) = .45$, $p < .01$) and narcissism ($r(109) = .35$, $p < .01$) and narcissism was correlated with Machiavellianism ($r(109) = .61$, $p < .01$).

and-domain-specific personality traits may facilitate mating-relevant goals such as mate attraction, sexual conflict, and intrasexual competition. Indeed, the variability in the ovulatory cycle research (e.g., Gildersleeve et al., 2014; Jones et al., 2019) might be reconciled in the future by examining individual differences, and how these may moderate/mediate the ovulatory cycle effects. Certain ovulatory cycle effects may be localized to certain people characterized by certain traits.

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