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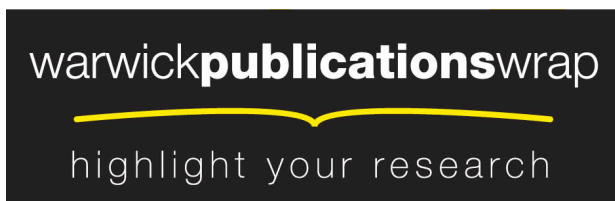
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RESEARCH REPORT

The Baby Effect and Young Male Syndrome:
Social Influences on Cooperative Risk-taking in Women and Men

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Abstract

Parental investment theory predicts differences in risk-taking for females and males as a consequence of reproductive context, with females attempting to reduce risks in relation to their own offspring (here called the baby effect), and males taking more risks in competition with one another (young male syndrome). The experiment we report tests these predictions in a cooperative context by introducing the Social Balloon Analogue Risk Task—the Balloon Analogue Risk Task modified to include a social partner (adult male, adult female, or baby)—along with a commitment device, in which participants choose among several possible social partners, with whom they will share their earnings. Results were consistent with the predictions of parental investment theory. Females did not change their levels of risk-taking when paired with adult males or females, but showed a strong reduction in risk when paired with babies. Consistent with previous research, males were strongly inclined to take more risks when paired with another male of the same age, but males showed no change in risk-taking when paired with a female of the same age or a child. The current work provides the first experimental evidence of gender differences in cooperative social risk-taking, as well as the first experimental evidence of a mediator of female risk-taking, i.e., babies.

Keywords: risk-taking, gender differences, evolutionary psychology, mating, reproduction

Suppose you were out walking with a potential long-term mate, and the opportunity arose to take a bet with a street performer. Assuming you would share the winnings with your partner, do you take the bet? Now suppose, instead, that you were walking with a child when you encounter the street performer—do you take the bet? These scenarios are representative of many domains where risk-taking has social consequences. They further demonstrate that the social consequences may vary in terms of reproductive context, that is, whether the context involves a reproductive opportunity (or threat) or an instance of parental care. Though it is well accepted that in many domains, men take more risks than women (e.g., Byrnes et al., 1999; Weber et al., 2002), the exact reasons for this risk asymmetry are not well understood. Elegant efforts to explain these differences from an evolutionary perspective have been remarkably insightful (e.g., Wilson & Daly, 1985; Daly & Wilson, 1994; Baker & Maner, 2008, 2009; Wang et al., 2009). Following this evolutionary approach, the current paper reports an experiment that extends these previous findings by testing two foundational predictions of parental investment theory (Trivers, 1972), in particular, that females will take fewer risks when in the presence of young children and that males will take more risks when paired with other males (even when these males are potential allies).

Parental investment theory (Trivers, 1972; Williams, 1975) attempts to explain how individuals should expend their resources to maximize their reproductive fitness. Noting that, across many species, one sex invests more (the ‘limiting sex’) and the other invests less, the theory explains that “Individuals of the sex investing less will compete among themselves to breed with members of the sex investing more, since an individual of the former can increase its reproductive success by investing successively in the offspring of several members of the limiting sex” (p. 141, Trivers, 1972). This statement lays out the two ideas central to understanding the evolution of risk-taking in humans. First, one sex (females) invests more in offspring, and therefore has more to lose with the loss of any individual offspring. Second, the non-limiting sex (males) should risk more (through competition and

display) to maximize their reproductive opportunities with the limiting sex (i.e., females).

Before describing our study, we discuss these evolutionary views on risk-taking individually and in more detail.

Parental Care and Female Risk-avoidance

The central observation on which parental investment theory is based is that the sexes invest different amounts in offspring (Trivers, 1972). For humans, females invest more in their offspring than males. This is in part due to their higher parental investment during gestation and more limited opportunity for children in the future. But it is also because the female does not share the male's paternal uncertainty, or the male's opportunity costs associated with seeking additional offspring with other individuals. In the presence of offspring, we predict this will lead females to risk less than males, who do not share the same investment.

Evolutionary explanations are often based on this prediction of offspring-induced female risk-avoidance. As an example, Fessler, Pillsworth and Flamson (2004) found that women are more sensitive to disgust and react more fearfully to situations that evoke anger in men. Providing an evolutionary explanation, Fessler et al. (2004) argued that the feeling of disgust in women signals the presence of potentially harmful influences (e.g. pathogens) that may threaten fetal development. In an experiment, they further demonstrated that women manipulated to feel disgusted expressed lower levels of risk-taking compared to women not manipulated. No such effect was found in men. Similar explanations for offspring-related risk-avoidance in females are quite common (e.g., Fetchenhauer & Buunk, 2005; Buss, 2004).

Several studies demonstrate additional indirect evidence of offspring-related risk-avoidance. Tangential evidence that females may have more reason to reduce risks associated with offspring is found in a study of parental grief following child mortality, where mothers were found to have significantly more negative feelings (e.g., despair,

depression, and loss of appetite) than fathers (Schwab, 1996). This is consistent with the idea that females may perceive that they have more to lose with the loss of any individual offspring, and that post-gestational parental care invested by females is thus a mechanism for reducing the risks to their offspring. More generally, Wang and colleagues (2009) have found that parents self-report lower likelihoods of engaging in risky behaviors associated with within and between group competition (but they do not report whether this effect was also mediated by gender). In this light, parental care can be interpreted as an offspring-related risk-avoidance policy, which—in the presence of young children—should lead to a greater reduction in risk-taking for females than males.

With respect to the present experiments, it is important to note that females may also benefit from caring for offspring that are not their own. In both birds and mammals, caregivers often benefit from experience, and this may be gained through the care of young that are not genetically related (Emlen, 1984). Accordingly, many animal societies demonstrate cooperative breeding, even among non-related individuals. Besides experience acquired through care-giving, many of these societies show clear evidence of reciprocity (Clutton-Brock, 2002), which can further aid females in raising their own offspring.

However, the benefit to males of caring for non-related offspring is not so apparent. Tests of the paternal resemblance hypothesis indicate that males, relative to females, are more discriminating in how they allocate parental investment—in particular, they prefer offspring that resemble themselves (Platak et al., 2002). This is consistent with the evolutionary hypothesis that males gain less from indiscriminate caregiving than females, and should therefore be generally less interested in reducing risks associated with children. In sum, evolutionary theory leads to the prediction that females should be more risk-averse than males around young children—what we call *the baby effect*—but to our knowledge, this fundamental claim of parental investment theory has not yet been tested experimentally.

Reproductive Competition and Male Risk-taking

In comparison with females, males often take more risks in both social and non-social contexts. Much of the evolutionary research on risk-taking has focused on explaining this observation. In particular, male risk-taking is at its height during the earliest reproductive years, before marriage (Wilson & Daly, 1985, 2001). One of the principle explanations for this rise in risk-taking is termed the *young-male syndrome* (Wilson & Daly, 1985). The young-male syndrome stems from the predictions of parental investment theory, which suggests that risky and violent behavior should be found most frequently among the sex with the most intense reproductive competition. Consistent with this idea, in a study of 690 homicidal conflicts in Detroit in 1972, Wilson and Daly (1985) were led to conclude that a “taste for risk...is primarily a masculine attribute, and is socially facilitated by the presence of peers in pursuit of the same goals.” Notably, this taste for risk is significantly reduced among married men, but rises again among the divorced and widowed (Wilson & Daly, 2001).

The hypothesis that risk-taking is a competitive display for males is consistent with *costly signaling theory* (Bleige et al., 2001), stemming from the *handicap principle* of Zahavi (1975). Costly signaling theory suggests that risk-taking may be an honest display mechanism that helps males improve their reproductive potential by demonstrating their ability to take risks without suffering negative consequences. Importantly, studies find that risk-taking by males is attractive to other males, and somewhat less so to females. Farthing (2005) found that both males and, slightly more so, females found males more attractive who took more ‘heroic’ (both brave and altruistic) risks, but only males (not females) preferred same sex friends who took more physical or financial risks. This is consistent with the hypothesis that much of risk-taking is related to male-male displays, where the benefits of risk-taking may accrue in cooperative as well as competitive relationships. The strongest benefit may be associated with status, which can have consequences for both inclusive fitness and additional access to females (Daly & Wilson, 2001). Additionally, male risk-taking may

intimidate other males into being less competitive and more cooperative, and thus reduce potential competition with them in the future (Buss, 2004). Consistent with this hypothesis, Ermer and colleagues (2008) found that men took risks in status relevant domains, but not in status irrelevant domains. The above evidence suggests that males, as opposed to females, should be more prone to taking risks around members of the same sex—even when those relationships are ostensibly cooperative.

Though Wilson & Daly (1985) emphasize the risk-facilitating effect of other young males, for some males in some risk-taking domains this may be a display to women. Several studies have demonstrated the sensitivity of male risk-taking to context and individual differences. For example, Baker and Maner (2009) demonstrated that males with higher levels of sexual arousal took more risks in the Balloon Analogue Risk Task (BART; Lejuez et al., 2002) when they believed they were playing in front of attractive and available females. Other studies have demonstrated similar effects of females on male risk-taking (e.g., in the physical domain, Ronay & von Hippel, 2010; in the financial domain, Baker & Maner, 2008) with these effects mediated by individual differences in males', respectively, testosterone levels and mating motivation. Similarly, Kelly and Dunbar (2001) found that females rated males as more attractive when males acted more bravely. Importantly, these studies do not address male risk-taking in explicitly cooperative relationships with attractive females. In the Wilson & Daly (1985) study, 73% of homicide offenders over 14 years of age were unmarried males, indicating that males who have social commitments with females may be less inclined to engage in risky behavior (see also Daly & Wilson, 1990, 2001). This is further supported by evidence that married males take far fewer risks than unmarried males, and have significantly lower rates of mortality than unmarried males (Waite, 1995).

In sum, the evolutionary predictions based on parental investment theory suggest that male risk-taking in cooperative social settings should primarily be induced by the presence of other males, and perhaps less so by females, whereas female risk-taking in cooperative

settings should be unaffected by either adult males or females.

The Current Study

Here, we examine the role of social influences on risk-taking in males and females, by employing a modified BART task (here called the Social BART), similar to that used by Baker & Maner (2009). In the BART, participants make gains by pumping up a fixed number of balloons, but they also risk losing any gains they have already made for each balloon if that balloon pops before they stop pumping. Thus, the BART combines both gains and losses in one task. In the Social BART, we manipulated the risk-taking context that individuals experienced by varying the task across four conditions: non-social, opposite sex partner, same sex partner, and young children. Further, to ensure that participants were equally invested in the social context across the social conditions, we employed a ‘commitment device’, such that each participant chose an individual (from three possible choices), for each condition, with whom they would play the game and share the winnings. Sharing winnings was implemented to ensure consistency across the social conditions and because the evolutionary theory is indifferent to whether the winnings are shared between same sex partners (e.g., any male can potentially become a reproductive competitor to another male), whereas sharing with opposite sex partners and children is consistent with behavior associated with reproductive partners and parental care. Each social context was therefore a context in which the participant viewed their social partner in a cooperative fashion.

Our predictions follow from the two claims outlined above for parental investment theory: males will show the highest levels of risk-taking in relation to potential reproductive competitors (i.e., other males) whereas females will show the lowest levels of risk-taking in relation to parental care (i.e., with young children).

Method

Participants

Eighty undergraduate students (forty males and forty females) participated in this study at the University of Basel for partial fulfilment of course requirements as well as a small monetary compensation that was based on their performance in the Social BART (2.60 - 7 CHF). Sessions lasted approximately 45 minutes.

Material

Measure of risk-taking. Risk-taking was assessed with the Social BART, which is an adaptation of the Balloon Analogue Risk Task (BART; see Lejuez et al., 2002). In the BART people are presented with an on-screen balloon and a balloon pump. By pumping up the balloon people earn points, with each pump earning 10 points. This is stored in a “temporary bank” until one of two events occurs: a) the balloon explodes, or b) the participant decides to stop pumping and transfer the “temporary bank” to a “permanent bank”. However, if the balloon pops before collecting the earnings, no earnings from the temporary bank for that balloon are transferred to the permanent bank. The sum of the earnings in the permanent bank after the final balloon constituted the participant’s final payoff. The explosion threshold for each balloon varied randomly and was unknown to participants.

The BART has been shown to correlate positively with traits that approximate relative levels of risk-taking, including sensation seeking, impulsivity, drug, alcohol, and cigarette use, gambling, sexual risk-taking, and stealing (Lejuez et al., 2002). The BART also has adequate test-retest reliability ($r = .77$; Lorian & Grisham, 2010).

Social stimuli. Pictures of men, women, and babies used in the Social BART-task were drawn from semi-professional model pictures (no celebrities). Adults were approximately between 20 and 30 years of age, children were aged 0-2 years. Eighteen pictures (six pictures in each category) were submitted to an independent sample of eight judges (five male) for the purpose of rating pictures according to attractiveness. People had to indicate their three favorite pictures per category. The three top rated pictures for each category were used in the Social BART. Pictures were grey scaled.

Design and Procedure for the Social BART

After signing a consent form, participants were individually seated in front of a computer in the laboratory. After completing a series of five “test-balloons” to train the participants on the general BART protocol, the remainder of the experiment was as depicted in Figure 1.

[Figure 1]

For every participant a session consisted of four “non-social” trial blocks, with no faces presented and three “social” trial blocks, where either a baby, male or female face was presented in the upper right corner of the BART display. The order of the social blocks was counterbalanced over participants. A commitment device was used before every social block, in which participants had to choose the person that would be presented to them in the corresponding trial block. For example, for the female faces Social BART, participants were presented with the three best-ranked female faces and asked to choose which female they would prefer to perform the task with. The instructions were as follows:

“In the following display, three pictures of women will be presented to you. Pick the one in whose company you will play the following trials. IMPORTANT: Imagine that the earnings made in her presence will be shared with her at the end of this session.”

The instructions and model pictures were designed to indicate that these were hypothetical ‘imaginary’ partners; no live partners were present nor were they implied by the experimental setting.

Results

We used a hierarchical linear-mixed effects model, grouping data by subject, with participant gender and condition (non-social, child, female, or male faces) as within-subject factors and log average number of pumps per unexploded balloon as the dependent variable (a test of normality in averaged pumps found the data was substantially long-tailed: Shapiro Wilk test, $W = 0.94$, $P < 0.001$). Results indicated a significant main effect of gender (ANOVA: $F_{1,78} = 5.86$, $P = 0.02$) and condition (ANOVA: $F_{3,234} = 3.12$, $P = 0.03$), as well as a significant interaction between sex and condition (ANOVA: $F_{3,234} = 4.65$, $P < 0.01$). We describe these results individually and in more detail below.

Males took more risks than females, demonstrated by higher levels of balloon pumping per unexploded balloon. Planned post-hoc analysis found that male risk-taking was significantly higher than female risk-taking over all conditions (t-test: $t_{79} = -2.16$, $P = 0.03$, $d = 0.49$), consistent with prior research showing that males take more risks than females. This effect was dominantly mediated by the social conditions, as shown in Figure 2A which presents the levels of balloon pumping for males and females separated by non-social and social conditions. In the non-social conditions, male balloon pumping was not significantly higher than female balloon pumping, though there was a trend towards increased pumping for males (t-test: $t_{78} = -1.69$, $P = 0.10$, $d = .38$). However, in the social conditions, males pumped balloons significantly more than females (t-test: $t_{78} = -2.50$, $P = 0.01$, $d = 0.57$).

To isolate the gender differences in risk-taking as a consequence of their social partner, we investigated the relative change in risk-taking when comparing each participant's social risk-taking for the different social conditions with their baseline level of non-social risk-taking averaged over the four non-social blocks (Figure 2B). The results are consistent with our predictions, with males taking more risks when paired with another male, and females taking fewer risks when paired with a child. Male risk-taking was significantly higher ($M = 9\%$) when males were paired with a male social partner (one sample t-test: $t_{39} = 2.73$, $P < 0.01$, $d = 0.87$). However, males did not substantially alter their behaviour when

paired with a female social partner ($P = 0.62$) or with a child ($P = 0.25$). Females, on the other hand, were indifferent to conditions involving other adult males or females ($P = 0.73$ and 0.55 , respectively). However, female risk-taking in the baby condition was significantly lower ($M = -10\%$) than their non-social baseline (one sample t-test: $t_{39} = -2.23$, $P = 0.03$, $d = 0.71$). In sum, our results show that, in a cooperative setting, males take more risks when paired with other males, while females take fewer risks when paired with children. No other effects were significant.

[Figure 2]

Discussion

What are the conditions that drive males and females to take different levels of risk? Our findings are consistent with the hypotheses that the main causes of differential risk-taking between males and females are a consequence of reproductive context. In our experiment, males were primarily driven to take risks in situations that were associated with competition among other males (young-male syndrome). Women, on the other hand, were indifferent to contexts involving reproductive opportunities or competitors (in conditions with adult men or women), but were strongly motivated to avoid risk-taking in conditions involving parental investment, with young children (the baby effect). Following previous research (e.g., Baker & Maner, 2008, 2009; Wang et al., 2009), our findings provide additional evidence that risk-taking is mediated by reproductive context, consistent with the dominant claims of parental investment theory (Trivers, 1972).

Though our results indicate that males were not sensitive to the presence of attractive females, we feel these results are not inconsistent with previous investigations of male risk-taking. Some studies that have demonstrated increased risk-taking in males in the presence of attractive females have done so in the presence of other males (e.g., in the physical domain, Ronay & von Hippel, 2010). In other cases, male risk-taking was strongly correlated

with the information about female availability and male sexual motivation, arousal levels, or individual differences in testosterone (Baker & Maner, 2008, 2009; Ronay & von Hippel, 2010). It is clear from this previous research that these mediators play an important role in male risk-taking, and it is thus an overstatement of the evidence to conclude that attractive females lead males to take more risks; they lead *some* males to take more risks under *some* conditions. Exactly what those conditions are remains an open question, to which this prior research has made no small contribution. Nonetheless, given the potential cost of male-risk taking (e.g., Waite, 1995), this area clearly deserves more study.

Another important contribution of the present work is that it differs from previous research in terms of inducing cooperative changes in risk. Prior work has dominantly been non-cooperative and did not involve participants choosing their partners; the males did not contribute their winnings to the females nor choose their female partner. Our experiment differs in such a way that extreme risk-taking in males in response to attractive females may have less appeal. In the Social BART, increased risk-taking carries with it the threat that there may be nothing to share after the final play; males who already have a commitment with a female should not take this risk. They stand to lose more than they gain. Thus, there may well be a “pacifying effect” on males who established relationships with female partners because, as Daly and Wilson (2001) note with regards to the reduced homicide rate among married men, “they already possess that which the competition is largely about and have something to lose” (p. 19).

The tables are turned, however, for males in cooperative relationships with another male. Young-male syndrome would suggest that increased risk, even though it may lead to a lower final payoff, does carry an additional display characteristic. Such a display may lead to a competitive advantage in the acquisition of social compatriots and/or facilitate the repelling of potential reproductive competitors (e.g., Buss, 1989; Wilson & Daly, 1985). According to

parental investment theory, females should benefit less from such a display, as their access to males is unlikely to be hampered by competition with other females.

Finally, our data indicate the largest effect on risk-taking (a 10% reduction in risk) stems from the fundamental assumption of parental investment theory. Females, who must invest more in offspring, should be least willing to take unnecessary risks associated with those offspring. Females who take unnecessary risks with offspring threaten to lose a large investment in fitness. Males, especially when they may perceive no genetic relation with those offspring (e.g. Platek et al., 2002), should not be so influenced. To our knowledge, the current study is the first experimental test of this differential effect on risk-taking in males and females when in the presence of children.

The current research provides a number of important directions for future research. First, the presentation of the stimuli in the present experiment was preceded by a commitment device (the choosing of the social partner). This avoided the problem that males or females may have no social commitment to their partners, and thus be less influenced by their presence. However, previous research has examined risk-taking in the absence of such a commitment (e.g., Baker & Maner, 2008, 2009). Additional research is needed to understand the nature of partner choice on subsequent risk-taking. Second, future research is needed to understand the potential mediators of the baby-effect and young male syndrome. In our study, participants were undergraduate students. This population may be biased towards females who are at their peak reproductive age, and thus may be highly sensitive to the presence of young children. Our male participants, on the other hand, may be at the peak age associated with young-male syndrome (as noted by Baker & Maner, 2009), and thus may be differentially inclined to attend to potential male competitors. Males and females who become parents may show different levels of sensitivity to young children, and future research is needed to understand this potential mediator (for one approach, see Wang et al., 2009). Two additional routes to studying these proximate mediators are through the

development and direct measurement of psychological states related to parental investment (similar to the measures of arousal used by Baker & Maner, 2008, 2009) and through the induction of these states (similar to the imagined scenarios of Nairne, Pandeirada, & Thompson, 2008). Finally, we note that the present study focuses on a specific risk domain (social risk-taking with simultaneous financial gains and losses). Domains of risk have proven to be important for understanding male-risk taking, as noted above. Further research will be needed to understand domain specificity in relation to the baby-effect.

Decision-making under uncertainty is an important research domain, with consequences for human longevity, economic prosperity, and general well-being. The current research adds an additional theoretical basis for understanding risk-taking in females, and further contributes to our understanding of the finer details of risk-taking in males. In particular, we demonstrate that males are most sensitive to conditions that include the presence of other males, whereas females are most sensitive to conditions involving young children. This further develops our understanding of risk-taking as predominantly a factor induced by reproductive costs and benefits, as suggested by parental investment theory and our developing understanding of evolutionary theory in the domain of human behavior.

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Figure Legends

Figure 1. The sequence of trial blocks, alternating between non-social and social trials. Social trial blocks included pictures of adult males, adult females, or young children (babies) chosen by the participant. The order of social blocks was counterbalanced across participants. Numbers represent the number of balloons per block.

Figure 2. Risk-taking for males and females. A. Risk-taking as a measure of balloon pumps per unexploded balloon, separated by non-social and social conditions. Log axes are presented, consistent with the statistical analysis in the text B. Percentage change in risk-taking relative to the combined non-social conditions. Error bars are SEM.

Figure 1

| | | | | | | |
|-------------------|---------------|-------------------|---------------|-------------------|---------------|-------------------|
| Non-social | Social | Non-social | Social | Non-social | Social | Non-social |
| 5 | 10 | 5 | 10 | 5 | 10 | 5 |

Figure 2

