

Original Article

**SEX DIFFERENCES IN RESPONSE TO CUES OF
PARENTAL INVESTMENT: AN EVOLUTIONARY
SOCIAL PSYCHOLOGICAL PERSPECTIVE**

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Abstract

Past research on human mating behaviors has operationalized parental investment (PI) in terms of sex differences – with females reflecting high parental investment (and resultant long-term mating strategies) and males demonstrating low parental investment (and resultant short-term mating strategies). The present research draws on methods adopted from social psychology to operationalize parental investment in terms of conscious and non-conscious attitudinal indices. In a sample of young heterosexual adults, we examined sex differences in two measures of attitudes toward one's ability/willingness to invest in parenting. One measure was a self-report index while the other was based on autonomic nervous system (ANS) responses. No sex difference was obtained regarding self-report responses to PI. However, males showed significantly larger increases in heart rate than females when presented with PI-relevant (compared with PI-neutral) stimuli. The findings are consistent with past research suggesting that males are less prepared to confront issues associated with parenting than are females. Further, the findings suggest that males are somewhat unaware of their own perceived lack of parental preparedness. The incongruity between males' self-reports and their ANS responses is discussed with regard to Error Management Theory (EMT; Haselton & Buss, 2000). We also discuss more generally how this research may serve as a model for using the subjectivist tradition in social psychology to expand our study of objective variables derived from the evolutionary perspective.

Key Words: Parental Investment, physiological measures, sex differences, Error Management Theory, Mating Intelligence

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Introduction

Trivers' (1972) depiction of parental investment (PI) as a foundational variable affecting multiple classes of social behavior provides an important exemplar of how evolutionary theory can provide coherent and generative constructs that shed new insights into the behavioral patterns of animals (human and non-human alike). In particular, parental investment theory has served as an axiomatic set of ideas that has driven recent research in human mating (e.g., DeBacker, Braeckman, & Farinpour, 2007). In human mating research, parental investment is typically defined in terms of sex differences (with females representing high PI individuals and males representing low PI individuals).

The current work seeks to expand our understanding of parental investment by adopting perceptual-based ways of conceptualizing PI. Social psychology has a long tradition of focusing on individuals' perceptions of reality as an important determinant of behavior apart from reality itself (Ross & Nisbett, 1991). In keeping with this tradition, our research conceptualizes PI in both objectivist terms (by examining sex differences) and subjectivist terms (by examining perceptions of parental investment). Accordingly, this research provides a model for how the subjectivist tradition in social psychology can be applied to expand our understanding of variables that are derived from evolutionary theory (such as parental investment) to move toward a richer and broader understanding of human nature than can be obtained via either standard social or standard evolutionary psychology alone.

Parental Investment and human mating

According to current work in evolutionary psychology (e.g., Buss, 2003), Parental Investment (PI) strategies differ among the sexes due to evolved psychological mechanisms, which arose to optimize reproductive success on the part of the individual (Trivers, 1972; Buss & Schmitt, 1993). In line with Trivers' (1972) classic formulation of parental investment theory, PI involves effort exerted by an individual to invest time and/or resources in one offspring in such a manner as to increase the offspring's chances of survival. When an individual invests in one offspring, this investment comes at the costs of lost mating opportunities as well as lost opportunities to invest in other offspring. Much research suggests that there is a distinct relationship between the sexual strategy that an individual employs and the level of his or her parental investment (c.f., Buss, 2004).

When members of one sex invest more than the other in offspring, two resulting effects upon mating strategies can be predicted (Trivers 1972; Buss & Schmitt, 1993). First, members of the sex that invests more in offspring will tend to display higher discrimination in the choice of a mate. Second, members of the sex that invest (relatively) minimally in offspring will benefit reproductively from pursuing many short-term mates. The biological sex differences in reproduction – where women bear the responsibility of gestation and lactation – may be thought to dictate the employment of different mating strategies (Geary, 2000).

While there is great individual variability as well as complexity in human sexual strategies, there appear nonetheless to be marked sex differences in general strategies employed (Buss, 2003). Men show a greater interest than women in pursuing several short-term mates, and also less commitment to the offspring produced by these mate

pairings (Buss & Schmitt, 1993). Further, women demonstrate a proclivity toward high selectivity in mates, followed by high PI in the offspring produced. Of course, men often commit and invest and women pursue short-term mates under certain conditions. In other words, males and females both include short and long-term strategies in their mating repertoires (i.e., *strategic pluralism* exists for both sexes; see Simpson & Gangestad, 2000).

However, men and women generally tend to employ different strategies from one another, likely because of their differentiated anatomical designs. Simply, an individual employs a given sexual strategy because it is optimized to provide the greatest reproductive benefit within the context of the individual's relation to the environment. As the conditions around the individual change, it may be beneficial to shift his or her sexual strategy. Likewise, as the sexes differ anatomically, mating strategies should be sex-differentiated.

A broader perspective on Parental Investment

Thus far, our summary of the role of parental investment in human mating likely sounds familiar to readers of the evolutionary psychology literature. In fact, Trivers' (1972) theory of parental investment has led to a landslide of research on sex differences in human mating – providing countless insights into our understanding of sex differences in mating strategies. Such research has focused, variously, on sex differences in qualities desired in potential mates (Buss et al., 1990), mechanisms for attracting mates (Bressler & Balshine, 2006), contexts that elicit jealousy (Buss, Larsen, Westen, & Semmelroth, 1992), qualities advertised in efforts to obtain mates (DeBacker et al., 2007), etc.

Consistent with the spirit and mission of this journal (the *Journal of Social, Evolutionary, and Cultural Psychology*), the current work – designed as a broader perspective on parental investment – integrates multiple approaches (in this case, evolutionary and social psychology) to yield novel questions and findings. Past work on the role of parental investment in human mating has conceptualized parental investment as an objective variable – best operationalized in terms of sex differences (female as high PI, males as low PI). While this approach makes a great deal of sense in light of anatomical differences between the sexes, we are interested in expanding this approach by conceiving of parental investment in both objectivist and subjectivist terms.

Social psychology has a long history of demonstrating that reality often matters less than perceived reality. In making this point, Ross and Nisbett (1991) demonstrated that perceptions of stimuli often affect behavior considerably more than objective qualities of stimuli themselves. This subjectivist notion opens the door for an intellectual marriage between the relatively objectivist evolutionary psychological approach and the more subjectivist traditional social psychological approach. Evolutionary psychology is filled with major variables that underlie human behavior – delineated in light of careful and logical theoretical analyses. Given the somewhat essentialist approach that typifies evolutionary psychology, evolutionary psychologists often conceive of these variables in objective ways, such as operationally defining parental investment in terms of sex differences.

In working toward a broader evolutionary psychology, the current work expands our understanding of parental investment by adding a social psychological touch. Clearly, the sexes differ in terms of anatomical features that are relevant to parental investment - females are required to invest more than males in the domain of reproduction. However,

above and beyond these anatomical requirements, individual males and females likely differ in their attitudes toward stimuli that are pertinent to parental investment. For instance, some males may perceive the idea of having a newborn to look after as aversive while others may see it in more positive terms.

In addition to our point that the social psychological approach opens the doors for a more subjectivist approach to understanding a major evolutionarily oriented variable such as parental investment, additional benefits of using a social psychological framework for addressing evolutionarily relevant variables exist. Consider the fact that subjectivist approaches to the study of attitudes in social psychology come in different flavors. The serious scientific study of attitudes, in fact, suggests that there are varied ways of studying any particular attitude. Attitudes can be examined in terms of self-report indices (e.g., Bauman & Geher, 2003), measures of autonomic responses to stimuli (Geher, Bloodworth, Mason, Downey, Renstrom, & Romero, 2005), response-time indices using cognitive measures such as the Implicit Association Test (Nosek et al., 2005), etc. Perhaps, then, variability in parental investment can not only be studied from *a single* social psychological perspective – perhaps traditional social psychology has *multiple methodological and conceptual ways* to expand our understanding of the nature of parental investment in human psychology.

Responses to Parental-Relevant stimuli

A great deal of research has been conducted on adults' responses to stimuli that are highly parental relevant. Such research has focused on adults' responses to such stimuli as infants crying (e.g., Furedy, Fleming, Ruble, Scher, Daly, Day, & Loewen, 1989), photographs of infants' faces (Hess, 1975), emotional expressions of infants (Babchuck, Hames, & Thompson, 1985), and those oft-annoying whines of otherwise loveable children (Sokol, Webster, Thompson, & Stevens, 2005). In light of the social psychological approach to parental investment being developed in the current work, we can think potentially of these kinds of adult responses as psychological indices of perceptions of the costs associated with parenting. For instance, perceiving a child's whine as extremely annoying (Sokol et al., 2005) may be interpreted as perceiving parenting as relatively taxing (high parental investment perceived).

As a step toward understanding parental investment in the expanded social psychological manner suggested here, it is important to consider the inter-relationships among different indices of parental investment. Sex differences are particularly important to consider here as variability in biological sex provides the primary operationalization of parental investment heretofore used by psychological researchers.

If women do in fact have an evolved proclivity to invest more in offspring than men, women would be expected to behave in more parenting-relevant ways than men – and physiological differences between the sexes should be consistent with such behavioral differences. Some past research on this topic has provided evidence for this predicted pattern of sex differences in caretaking (for a relatively early review on this topic, see Berman 1980). For instance, previous research has demonstrated that women judge the emotions expressed by infants' facial expressions more quickly and more accurately than men regardless of caretaking experience (Babchuck et al., 1985). These findings possibly indicate a competency possessed to a greater degree by women than men, which may have arisen out of the different selective pressures placed upon men and women in the evolutionary past.

Parental Investment

In a similar line of research, Hess (1975) observed greater pupil dilation in females, compared to males, when participants viewed photographs of infants. These findings were interpreted to indicate that females show a greater unconscious responsiveness to young children compared with men. Additionally, some research suggests that mothers can identify their newborns by scent alone hours after birth, whereas fathers cannot (Russell, Mendelson, & Peeke, 1983). Women, it appears, are psycho-physiologically prepared to attend to their offspring to a greater extent than men.

Research on sex differences in physiological responses to stimuli that are highly charged in terms of parental themes has been somewhat mixed. While Furedy et al. (1989) found that females showed a more marked increase in heart rate to infant-crying stimuli (than males), other researchers, such as Frodi and Lamb (1978) found that the sexes did *not* differ in their responses to babies in terms of physiological measures. Thus, it seems that there may be some important and reliable sex differences in physiological responses to parenting-relevant stimuli, but researchers in this area must realize that past research paints a somewhat mixed picture of this issue.

While most research on sex differences in responses to babies and children has shown that females seem to respond to parenting in a more prepared manner than males, the approach taken in the current work, focusing on *perceptions of costs of parenting*, suggests that perceptions of parental costs are likely sex-differentiated. When thinking about sex differences in perceptions of parental investment from a subjectivist perspective, it becomes clear that some elements of parental investment may be perceived as more costly to females than males while others may be seen as more costly to males. For instance, given the fact that pregnancy takes a toll on a woman's body – dovetailed with the fact that female mating psychology focuses on appearing physically attractive – perceiving an infant as having adverse effects on a parent's physical attractiveness may be considered a relatively salient cost for females. Likewise, the fact that a new baby likely has an adverse effect on one's ability to effectively do his or her job should be perceived as more costly to males (who may be more motivated to succeed in work-related contexts than females due to sex-differentiated selection pressures (see Miller, 1999)).

The stimuli in the current research present scenarios that would have adverse effects on one's ability to succeed at work (such as a scenario about having to reschedule your entire work day because you unexpectedly find that your 3-year old has an ear infection). As such, the current research uses different stimuli compared with past research in that we use stimuli predicted to affect males more than females (unlike videotapes of babies crying which should affect females more than males). Items in both our self-report and ANS-based indices of attitudes toward parental investment focus on spending time, money, and energy on a newborn. Thus, when we think of parental investment in this manner, we are focusing more on parental costs that would be perceived as taxing to males compared with females.

Conscious versus non-conscious indices of Parental Investment

The present research examines the interface of three indices of parental investment – biological sex, a conscious (self-report) measure of attitudes about investing in parenting, and a non-conscious (ANS-based) measure of attitudes about investing in parenting. This kind of attempt at addressing potential convergence and divergence among self-report versus non-self-report measures of attitudes toward an important class

of social stimuli fits well with much traditional social psychology (c.f., Nosek, Greenwald, & Banaji, 2005).

Under many conditions, our self-reported attitudes diverge markedly from other, more objective indices of our attitudes such as unobtrusive behavioral measures (e.g., Mooney, Cohn, & Swift, 1992), physiological measures (e.g., Geher et al., 2005), or response-time-based cognitive measures (e.g., Nosek et al., 2005). In early work on this feature of human psychology, Nisbett and Wilson (1977) implemented several clever studies to demonstrate (a) that many of our attitudes are shaped by non-conscious processes and (b) that we are quite often unaware of this fact. In other words, we tend to believe that we know why we hold a certain attitude, even if we are incorrect.

Wilson and Dunn (2004) reported on research speaking to these points across more than a quarter century of research in social psychology. These authors suggest that our relatively poor efforts at being accurate when it comes to self-knowledge stem from our motives to block out unwanted thoughts, our inability to access information gleaned from relatively low-level, automatic processes (such as visual perception), and a general inability to engage in successful introspection.

This work within traditional social psychology has implications for how people might respond to parental-relevant stimuli. Generally, it may be the case that normal adults have a disconnect between their self-reported (and conscious) attitudes about parenting and their more visceral, less conscious, physiological responses when it comes to parenting. Given the central nature of parenting in our psychology from an evolutionary perspective, a disconnect between self-reported and physiologically oriented responses to parental-relevant stimuli would be of particular importance.

Parenting behaviors tend to be highly sex-differentiated in our species (Buss, 2004). Thus, we can predict that sex differences in self-report and non-self-report-based measures of attitudes toward parenting exist. Further, if we think about a disconnect between varied indices of perceptions of parental stimuli, such a disconnect should be more pronounced for males than for females. As females are the relatively prepared sex when it comes to parenting (e.g., Babchuck et al., 1985), we predict that females should show less of a disconnect between conscious and non-conscious PI indices than males. Males, on the other hand, are less likely to take on parental roles across all cultures – and are less likely to spend time thinking about parental issues, compared with females, from a very early age (see Barash & Lipton, 1997). This fact suggests that males' perceptions of costs associated with parenting across different modes of consciousness may be less internally consistent than females' perceptions.

The current study

The body of literature described in the prior section suggests that females are more prepared than males (both physically and psychologically) for dealing with infants. The research described herein addresses the flip side of this assertion. If females demonstrate indices of physiology that suggest preparedness for parenting (an adaptation that would be highly consistent with parental investment theory), males, on the other hand, should demonstrate indices of physiological responding which suggest that they are relatively under-prepared for parenting – particularly with stimuli that emphasize costs of parenting that are particularly relevant to male mating psychology. Specifically, this research tested whether males' heart rates (as an index of autonomic arousal) increase

more when presented with parenting-relevant stimuli that bear on male mating psychology (such as costs that tax one's ability to work) compared with females.

A further variable examined pertains to self-reported readiness for parenting. The index of this variable created for this research taps how prepared (non-parent) participants *believe* they are for investing time, money, and emotional resources in offspring at the time of completing the survey. Regarding this self-report variable, we predicted sex differences to be smaller than for the physiologically based variable. Thus, while males are predicted to show larger increases in pulse rate in response to parental-laden stimuli (compared with females), sex differences in self-reported preparedness to parenting were predicted to be smaller (such that males would be only slightly more likely to report seeing costs of parenting as high compared with females).

This prediction that males and females would be more similar for the self-report than the ANS index is based on the following reasons. First, given the social desirability associated with self-reports of attitudes toward parenting, and the importance of coming across as having parental potential in courting females (LaCerra, 1995), heterosexual males are predicted to be motivated to see themselves as being capable of parenting. Further, from the perspective of a disconnect between conscious and non-conscious processes (Nisbett & Wilson, 1977), while males may *really* be made uncomfortable by thoughts of parenting (relative to females), they may be unaware of these underlying psychological processes – a pattern that would likely lead to underestimating how scared they are of parenting. This trend would lead to relatively small sex differences in the self-report variable relative to the ANS variable.

Method

Participants

The participants in this study were 91 heterosexual non-parent undergraduate students at the State University of New York at New Paltz, of which 35 were males and 56 were females ranging from age 18 to 30 ($M = 21.94$; $SD = 2.29$).

Materials and Procedure

Participants responded to the Parental Investment Perception Scale (PIPS; Geher & Renstrom, 2002). The PIPS measured subjective perceptions of parental investment in a 5-point Likert-scale format along three a priori dimensions: The participant's general attitude of his or her capacity to raise a child (e.g., "I believe that I am very prepared to raise a child at this point in my life."); cognitions regarding parenting at the current point in the participant's life (e.g., "Given my current schedule, I believe I would have enough time to raise a child."); and, last, the participant's affective response to the notion of parenting at the current point in his or her life (e.g., "I would be very afraid to raise a child by myself."). Each subscale included six items. Internal-reliability analyses were computed for each subscale. Unfortunately, some Cronbach's alpha coefficients were relatively low when the scale was examined in this manner ($\alpha = .53, .35, \text{ and } .72$ for the attitude, cognition, and affective subscales accordingly). The alpha for the total scale score was, on the other hand, sufficient (.77). As such, analyses that included the PIPS are based exclusively on the total score (with high scores interpretable as perceiving parenting as relatively costly).

To assess ANS activity, we used a Psylab System, Model 5, manufactured by Contact Precision Instruments to tap pulse rate (heart beats per minute) measured by the PPA2 Pulse Plethysmograph. The software program used was Psylab 7.0. Eleven 20-second pulse rate samples were collected from each participant to address individual differences in perceptions of PI as a function of ANS responses. In addition to a baseline sample collected upon entry into the lab, five samples were taken from participants in response to neutral stimuli and five were taken in response to PI-laden stimuli. The stimuli consisted of hypothetical scenarios that participants were asked to imagine while their heart rates were monitored.

An example of a neutral scenario asked each participant to imagine the following: "... you have just gotten your mail. You have received three pieces of junk mail and one bill that you expected." An example PI-laden scenario asked each participant to imagine the following: "... you are the parent of a three-year old girl who has an ear infection. Your plans for the day have been completely changed as you now need to tend to her and take her to the doctor."

All participants were connected to the pulse measure and acclimated to the lab upon entry. Participants were then given a packet, which included the PIPS and the stimuli for the ANS response component. Upon completing the self-report measurement, each participant read the five neutral and five PI-laden stimuli (randomly ordered), and had a 20-second heart rate sample taken for each such stimulus. Pulse-rate scores were highly internally consistent by stimulus type (for the five PI-laden stimuli, Cronbach's alpha = .98, for the five neutral stimuli, Cronbach's alpha = .96).

For the ANS variable, a heart-rate score was calculated for each participant by subtracting his or her mean heart rate during the neutral-stimuli exercise from his or her mean heart rate during the PI-laden stimuli exercise. Higher scores on this heart-rate variable correspond to stronger responses to PI thought samples relative to neutral thought samples. In subsequent sections of this paper, scores on this variable are referred to as *ANS scores*.

Results

Intercorrelations among PI indices

This research essentially employed three indices of PI: Biological sex, PIPS scores, and ANS scores. To examine the correlation between self-reported PI responses and ANS responses, we computed a correlation between the PIPS and the ANS. A significant negative correlation was observed ($r(88) = -.21, p < .05$). Thus, participants who reported seeing parenting as very costly with the self-report measure were likely to have lower scores on the ANS variable.

Next, we computed a standard regression to examine the relationship between these variables (with ANS as the dependent variable). Each of the two predictor variables, PIPS scores and sex, was independently predictive of ANS scores (see Table 1). Further, in combination, these variables accounted for a significant amount of variability in ANS scores ($R^2 = .08, p < .05$). These results are consistent with the prior findings suggesting that biological sex and self-reported responses to parenting-relevant stimuli are unrelated.

Table 1: Regression to Predict HR Increases from Sex and PIPS Total Scores

Predictor Variable:	B	b	sr ²
PIPS total	-.21*	.00	.04
Sex Number ⁺	.19*	1.71	.04
R ² = .08*			

+Sex Number - females coded as '1,' males coded as '2'; * p < .05

Sex differences in physiological and self-report indices of Parental Investment

To test the hypotheses suggesting that males should score higher than females on both indices of PI (particularly on the physiological index), between-group t-tests were computed for each PI index (with sex as the grouping variable). A significant sex difference was observed for the pulse-rate variable; as predicted, males scored significantly higher than females ($t(86) = 1.86, p < .05$; Cohen's $d = 1.80$; see Table 2). For males ($N = 35$), the pulse rate was, on average, 1.99 ($SD = 5.25$) beats per minute higher than it was for neutral stimuli where females' ($N = 56$) mean pulse rate for PI-laden stimuli was only .25 ($SD = 3.55$) beats per minute higher than it was for neutral stimuli. Thus, males showed a larger increase in physiological responding to parental stimuli (relative to neutral stimuli) compared with females. Further, this effect size (Cohen's $d = 1.80$) is very large in terms of standard effect size conventions. However, no significant difference was found for the self-report index (Males: $M = 62.75 (SD = 11.44)$, Females: $M = 63.36 (SD = 9.34)$; $t(86) = .28, ns$; Cohen's $d = .14$; See Table 2).

Table 2: Means and Standard Deviations (in Parentheses) to Examine Sex Differences in Physiological and Subjective Indices of Parental Investment

	ANS ^{*1}	PIPS ²
Males	1.99 (5.27)	62.75 (11.44)
Females	.25 (3.55)	63.36 (9.34)

*significant sex difference for this variable ($p < .05$); ¹ANS is an index of heart-rate responding to parental-laden stimuli (higher scores correspond to a larger increase in pulse rate to parental-investment laden compared with neutral stimuli); ²PIPS refers to the Parental Investment Perception Scale (higher scores correspond to reporting that one perceives the costs of parenting as relatively high on an 18-item (1-5) Likert scale); N(males) = 36; N(females) = 52

Discussion

This research was designed to elaborate on work in evolutionary psychology examining issues derived from parental investment theory. Past research on this topic has generally operationally defined high versus low levels of PI in terms of sex differences (males as the low-investing sex; females as the high-investing sex). In using a methodological paradigm adopted from the tradition of attitude research in social psychology, the current work expands on this empirical conception of PI by examining two novel PI indices: a self-report index and a relatively unconscious physiologically based index.

The relationship between conscious and non-conscious indices of Parental-Investment attitudes

Regarding the relationship between our different indices of attitudes toward parenting, there was a significant negative relationship between self-reported perceptions of costs of parenting and ANS responses to PI-laden stimuli. People who report parenting as very costly tended to show relatively small ANS responses; people who report parenting as being not particularly costly showed relatively strong ANS responses when considering PI-laden stimuli. This finding held up controlling for sex of participant. It seems that being especially scared of parenting in a visceral sense may be associated with a strong defensive response, leading to reports of overly positive attitudes toward parenting. This defensive reaction seems to characterize males and females similarly based on the current findings. This defensiveness-based explanation provides just one possibility – we had no a priori predictions regarding the correlation between these variables. Thus, it seems that this finding is interesting, but that it needs to be explored in future research.

Sex differences in indices of Parental-Investment attitudes

Given that both the self-report and ANS indices of PI were coded such that higher scores corresponded to seeing investing in children as costly in terms of money, time, and energy, we expected that males would score higher than females (as males should be less likely to want to invest their resources in this manner). Thus, we predicted that males would score higher than females on both the physiological and the self-report indices of responses to PI. As it turned out, males and females did not differ at all in their scores on the PIPS, suggesting that the sexes may not differ systematically regarding their perception of the costs of raising offspring. However, males did, in fact, demonstrate a significantly higher increase in pulse rate than females when considering the PI-laden, rather than the neutral, stimuli. In fact, with a Cohen's d of 1.80, the effect size for this sex difference is extremely large.

This sex difference in physiological responding to parental-laden thought samples provides evidence for the flip side of the “mothers are relatively prepared for babies” phenomenon. Here, we have evidence suggesting that would-be fathers may be particularly under-prepared psychologically. This evidence comes in the form of males demonstrating significantly higher increases in heart rate when presented with parental-laden stimuli compared with females. Another facet of this effect seems to be that females' autonomic nervous systems are not particularly reactive when faced with such

stimuli. Males' pulse rates increased two full beats per minute (on average) when faced with parental stimuli. Females pulse rates increased a mere .25 beats per minute by comparison.

The findings regarding the relationship between the self-report and the physiological indices tell an interesting story regarding the psychological and physiological mechanisms that underlie basic responses to babies across the sexes. Males seem to be considerably more affected than females by the particular kinds of parental-relevant thoughts used in this study. However, males are unable (or unwilling) to report that they are affected by such thoughts. Thus, when it comes to parenting, males may be particularly out of touch with their true feelings compared with females. Further, the fact that the correlation between the self-report and ANS indices is negative suggests that males who report being the most prepared to parent (scoring lowest on the self-report index) are actually the males who show the strongest ANS responses!

In the Introduction, we suggest that males may be unaware of their relatively non-prepared nature in the domain of parenting as they may be less likely than females to be aware of their inner workings when it comes to a psychological domain that is typically more salient for females. Dovetailed with this explanation, we think it may be useful to consider a current evolutionarily oriented theory of bias and errors in judgment. Specifically, these findings may be explained in terms of Haselton and Buss' (2000) Error Management Theory, which suggests that errors in social judgments tend to be biased in ways that err on the side of facilitating reproductive success. The (likely erroneous) conscious belief on the part of single college males that they are relatively prepared to parent may encourage them to engage in behaviors that are relatively attractive to females, such as expressing a desire to have children and/or fondness for children. This behavioral manifestation of the erroneous belief held by males may ultimately serve them well in terms of reproductive success. Further, the costs of this error may be small relative to the potential costs of coming across as fully unprepared to parent in the domain of courting females (who focus on indices of parental quality in judging suitability of mates (LaCerra, 1995)).

This error management explanation is consistent with O'Sullivan's (2007) conceptualization of mating intelligence as adaptive self-deception in the sphere of mating. O'Sullivan argues that human mating intelligence (Geher & Miller, 2007) includes a proclivity toward adaptive self-deception, such that those who are successful in the mating market lie to themselves in a way that helps convince them that they have high mate value. In other words, people convince themselves of realities that reflect mating-relevant self-enhancement (such as a male convincing himself that he is more likely to make large sums of money than is actually the case). Given the high priority that females put on indices of effective parenting in males (LaCerra, 1995), it would be in males' interest to convince themselves that they are more interested in investing in parenting than they really are.

Limitations and future research

While the evolutionary social psychological analysis presented here – designed to account for the fact that the sexes did not differ in self-reported differences in attitudes toward parenting, but differed markedly in their physiological responses – seems plausible to us, it should be noted that alternative explanations might account for this same pattern of results. A key to this point pertains to the fact that indices of ANS

arousal, such as the heart-rate measure included here, are not typically telling of *reasons* for physiological activity – reasons that may be positive or negative in direction (see Cacioppo & Petty, 1983). Thus, the fact that males showed higher ANS responses to the parental stimuli in our study compared with females may actually suggest that males were made more anxious by such stimuli (consistent with our perspective suggesting that they are less emotionally prepared for such thoughts). However the same outcome (increased heart rate) could be associated with the fact that males are actually more excited, in a positive manner, by thoughts of parenting young children (compared with females).

Further, males being more attentive to parental-laden scenarios than females would lead to increases in ANS activity for males compared with females. Again, this interpretation would match the data – and it would have different implications than the implications based on error management theory presented here. Thus, future research on the sex differences described in this paper could benefit from measuring attentiveness to parental-investment-laden stimuli as well as measuring indices of ANS that provide information about both attitude strength *and* direction (such as facial EMG).

A related avenue of future research may take a phenomenological approach to elaborate on sex-differentiated costs associated with parenting. The idea of parental investment conceptualized in subjectivist terms opens the door for thinking about classes of parental stimuli that should be perceived as particularly costly to females versus stimuli that should be particularly costly to males. As a variable rooted in perceptions and attitudes, there may be particular aspects of parental investment in humans that are perceived as relatively costly to females and other aspects of parental investment that are perceived as costly to males. A future study that specifically explored sex-differentiated perceptions of costs of parenting with a focus on this issue would help us better understand the social psychology of perceptions of parental investment.

Finally, it is noteworthy that the error management explanation of males' tendency to overestimate their attitudes toward investing in offspring suggests that this perceptual error is *adaptive* in nature. Thus, this argument suggests that males who are particularly prone toward this error should reap mating-relevant benefits. For instance, they may be rated as having higher mate values compared with other males by actual females. Future research clearly needs to address this implication of our work.

Conclusion

Evolutionary psychologists who use parental investment theory as a framework for studying human mating have been wildly successful in providing insights into human mating psychology (see Geher, Miller, & Murphy, 2007). However, such research has typically operationalized differences in parental investment exclusively in terms of sex differences. The tradition of research on conscious and non-conscious indices of attitudes from social psychology provides additional ways to integrate parental investment into the psychology of human mating. Thus, we can think about parental investment like a traditional social psychologist (conceptualizing it as an attitudinal variable).

At a proximate level, this research expands our understanding of mating-relevant biases that may have some adaptive value – such as a tendency for males to deceive themselves about how willing they would be to invest time and energy into caring for infants. In a more ultimate sense, this research provides a model for using rich traditions that reside in social psychology to help inform and expand research that takes an

evolutionary approach. Within psychology, the evolutionary approach is peerless in terms of its ability to delineate the major conceptual variables that underlie human behavior writ large. In addition to degree of parental investment (Trivers, 1972), other such variables include degree of relatedness between individuals (Hamilton, 1964), prevailing sex ratios in a localized population (Schmitt, 2005), physical attractiveness (Buss, 2003), fluctuating asymmetry (Gangestad & Thornhill, 1997), behavioral courtship abilities (Miller, 2000), etc. See Table 3 for a framework designed to stimulate research on other variables that integrates the objectivist tradition of the evolutionary approach and the subjectivist tradition of social psychology.

The social psychological approach taken in the current work provides a potential model for reframing some of these major evolutionarily founded variables to expand our understanding of human psychology. Thus, while each of these variables clearly exists in some objective sense, *perceptions* of these variables may well vary from one person to the next. Social psychologists talk about such individual differences in perceptions of objective entities as the *principle of construal* (Ross & Nisbett, 1991). The current research shows that a major evolutionarily charged variable, such as parental investment, can be studied from this social psychological perspective to yield new insights into human nature.

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Table 3: A Framework for Using the Subjectivist Approach from Social Psychology to Study Objectivist Variables Derived from Evolutionary Psychology

<i>Variable Derived from Evolutionary Approach</i>	<i>Typical Objectivist Approach to Operationally Defining Variable</i>	<i>Potential Subjectivist Approach to Operationally Defining Variable</i>
Parental Investment (Trivers, 1972)	Sex differences (with females as the high investing sex and males as the low investing sex)	Individual differences in the perceptions of the costs associated with parenting (as per the research described in this article)
Genetic Relatedness (Hamilton, 1964)	Shared genotypes between individuals as a function of kin relationships (e.g., siblings have a relatedness coefficient of .5)	Examining the degree to which people perceive themselves to be related to others – and assessing how such perceptions affect relevant social behavior
Sex Ratios in Localized Mating Markets (Schmitt, 2005)	The actual ratio of male to female adults in a particular region at a particular time	Perceptions of localized sex ratios (separate from <i>actual</i> sex ratios) – which may have independent effects on mating and parenting behavior
Fluctuating Asymmetry (Gangestad & Thornhill, 1997)	Degree to which specific parts of individuals' bodies (such as width of fingers) objectively vary in symmetry	Perceptions of symmetry of self and others – such perceptions could be compared with actual symmetry, ratings of attractiveness, and several other mating-relevant variables
Mutation Load (Keller & Miller, 2006)	Total number of new and ancestral mutations in an individual's genotype.	Perceptions of mutation load in self and in potential mates. Research could address whether such perceptions are accurate and whether such perceptions impact mating behaviors in predictable ways

[Note that these five variables are included as examples of the approach taken in the current work – they are by no means designed to be exhaustive.]

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