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Environmental Contingency in Life History Strategies: The Influence of Mortality and Socioeconomic Status on Reproductive Timing

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Abstract

Why do some people have children early, whereas others delay reproduction? By considering the trade-offs between using one's resources for reproduction versus other tasks, the evolutionary framework of life history theory predicts that reproductive timing should be influenced by mortality and resource scarcity. A series of experiments examined how mortality cues influenced the desire to have children sooner rather than later. The effects of mortality depended critically on whether people grew up in a relatively resource-scarce or resource-plentiful environment. For individuals growing up relatively poor, mortality cues produced a desire to reproduce sooner—to want children now, even at the cost of furthering one's education or career. Conversely, for individuals growing up relatively wealthy, mortality cues produced a desire to delay reproduction—to further one's education or career before starting a family. Overall, mortality cues appear to shift individuals into different life history strategies as a function of childhood socioeconomic status, suggesting important implications for how environmental factors can influence fertility and family size.

Keywords

life history theory; reproductive timing; childhood development; socioeconomic status; mortality

The average age at which women have their first child in the United States is 25 years (Mathews & Hamilton, 2009). This average age varies across cultures. It varies, for example, from 29.2 years in Japan to 25.9 in Poland and from 22.2 for the Turkana of Kenya to 20.5 for the Hiwi of Venezuela (Walker et al., 2006). Variation in reproductive timing, however, is much larger within countries than between. In the United States, for example, nearly 10% of first births occurred to women over the age of 35 years old, whereas 21% of first births occurred to women under age 20 (Mathews & Hamilton, 2009).

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Reasons for the variability in reproductive timing are complex. There are many contributing factors, including those emphasized by researchers studying personality, development, social psychology, clinical psychology, economics, sociology, and other areas. In the current research, we consider variation in reproductive timing from an evolutionary perspective. Our approach is based on the framework of life history theory (Charnov, 1993; Roff, 1992; Stearns, 1992), which encompasses a large body of research developed by evolutionary biologists and behavioral ecologists to help understand how and why different organisms allocate their resources across the lifespan. From this perspective, reproductive timing is directly related to two different types of life courses. These life courses fall on a continuum from a "slower" course, related to a slower pace of reproduction and allocation of resources toward production of higher quality offspring, to a "faster" course, related to a faster pace of reproduction and allocation of resources toward to higher quantity of offspring (Bielby et al., 2007; Ellis, Figueredo, Brumbach, & Schlomer, 2009). Because life history theory describes the factors that lead an individual to adopt a slower or faster life course, we examine whether these broad life courses—and the reproductive timing decisions directly associated with each type of course—may be influenced by events in one's current adult environment and events that are salient in one's childhood environment.

By integrating research on life history theory with psychological models of social cognition, we derive a series of novel hypotheses about how environmental experiences from childhood might interact with current environmental cues to influence decisions and desires concerning reproductive timing. This research aims not only to shed light on how and why individuals within groups have children earlier or later; it also seeks to integrate theory and research from developmental, social, and personality psychology, as well as anthropology, behavioral ecology, and evolutionary biology.

Life History Theory

A fundamental problem faced by all organisms is the successful allocation of time, resources, and energy among the various tasks necessary for survival and reproduction. For all organisms, natural selection favors allocation strategies that optimize resource use over the life course (Schaffer, 1983; Williams, 1957). To explain how and why organisms, including humans, allocate energy, time, and resources across their lifetime, evolutionary biologists and behavioral ecologists developed life history theory (Charnov, 1993; Daan & Tinbergen, 1997; Horn, 1978; Low, 2000; Roff, 1992; Stearns, 1992). This framework has accrued copious empirical support in research on animal behavior, and it has become increasingly important in research within human behavioral ecology, anthropology, and developmental psychology (see, e.g., Belsky, Steinberg, & Draper, 1991; Chisholm, 1993; Davis & Werre, 2008; Del Giudice, 2009; Eibl-Eibesfeldt, 1989; Ellis, 2004; Ellis et al., 2009; Figueredo et al., 2006; Hill & Kaplan, 1999; Horn & Rubenstein, 1984; Kaplan & Gangestad, 2005; Low, Simon, & Anderson, 2002; Promislow & Harvey, 1990; Quinlan, 2007; Walker, Gurven, Burger, & Hamilton, 2008).

Research applying the insights of life history theory to humans has largely involved correlational studies (e.g., Ellis, McFayden-Ketchum, Dodge, Pettit, & Bates, 1999; Figueredo, Vásquez, Brumbach, & Schneider, 2004; Kruger & Nesse, 2006; Nettle, 2010; Wilson & Daly, 1997). Thus, one of the goals of the current work is to use experimental psychological methods to provide insight into the design of mental mechanisms that regulate life history strategies and tradeoffs. In particular, we examine how specific environmental cues predicted by life history theory affect decisions and desires concerning reproductive timing.

The Trade-Off Between Current Versus Future Reproduction

At the core of a life history framework is a simple biological fact: Because energy and resources are inherently limited, all organisms face important trade-offs in how they divide and use their resource "budget" at any given point in the life course. The laws of thermodynamics dictate that energy allocated for one task cannot simultaneously be allocated for another task. For example, energy spent to maintain the body (e.g., immune system) cannot concurrently be spent to attract a mate (e.g., intrasexually competitive behaviors; Kaplan & Gangestad, 2005; Roff, 2002). At a given point in time, all individuals must therefore choose between allocating resources toward furthering one versus another fitness-relevant life component, which means either forgoing or delaying investment in a different life component.

This resource-allocation dilemma poses a fundamental trade-off investigated under the rubric of life history theory: whether and when to invest in somatic versus reproductive effort (Alexander, 1987; Hill, 1993). Energy devoted to *somatic effort* (the growth and maintenance of one's body and mind, including the accumulation of knowledge, skills, and other types of embodied capital) cannot simultaneously be devoted to *reproductive effort* (intra-sexual competition, courtship, gestation, birth, and childcare). Whereas investing in somatic effort is analogous to building a bank account, investing in reproductive effort is analogous to spending this account in ways that help replicate the bank account owner's genes. The particular nature of how and when this tradeoff is resolved by a given organism (e.g., when and how an organism begins to spend its bank account) constitutes that organism's *life history strategy*.

Just as people do not put money in a bank account for the sake of having a bank account, somatic effort—growth, maintenance, and learning—is not an end in itself. Instead, investment in somatic effort is investment in future reproduction: By growing a larger bank account now, an organism can create more or higher quality offspring in the future. Thus, the trade-off between reproductive and somatic effort can be conceptualized as a decision between spending resources on *current reproduction* versus *future reproduction*. Consider the following example from the animal behavior literature, which demonstrates two types of life history strategies that organisms follow (see Ellis et al., 2009; Kenrick & Luce, 2000; Nettle, 2006). The tenrec, a small mammal from Madagascar, adopts a fast life history strategy: Tenrecs tend to begin reproducing only a few weeks after birth, investing most of their energy in current reproduction and thereby investing little in growth and maintenance for future reproduction. Other species, such as elephants, follow a slower life history strategy; elephants tend to mature more slowly and wait many years before beginning to reproduce. Instead, they invest resources in somatic effort, developing larger and higher quality phenotypes, because doing so historically meant leaving more descendents than did elephants that did not invest as much into somatic effort.

Environmental Contingency in Life History Strategies

Why do some organisms adopt a fast strategy whereas others adopt a slow strategy? Considerations of life history theory identify several environmental factors that influence life history strategies. These environmental factors include harshness (e.g., the age-specific rates of mortality and morbidity), unpredictability (e.g., the consistency of harshness from one period to another), and resource scarcity (e.g., the availability of energetic resources and level of competition for these resources; Ellis et al., 2009).

Species that evolved in environments varying in the environmental factors described above tend to adopt different life history strategies. For example, species that evolved in harsh and unpredictable environments tend to invest less in somatic effort and start reproducing as

soon as they reach sexual maturity. This fast strategy is generally adaptive for members of such species, because individuals living in such environments risk dying from predation or starvation without leaving any offspring if they fail to reproduce relatively quickly. In contrast, a harsh but predictable environment dramatically changes the payoffs associated with increased somatic investment. In these kinds of predictable environments, in which organisms can exert some control over their own mortality, investment in somatic effort increases an organism's likelihood of survival. Furthermore, investment in somatic effort tends to enhance an individual's ability to compete for mates and provide more offspring care. Thus, species that evolved in predictable harsh environments tend to follow slower strategies, investing more in somatic effort and delaying reproduction.

According to life history theory, the environmental factors linked to different life history strategies are manifested in modern human environments by cues such as the local mortality rate and the availability of resources in the local environment (Kaplan & Gangestad, 2005; Quinlan, 2007; Worthman & Kuzara, 2005). Thus, in the current research, we examined how mortality cues and resource scarcity might relate to different life history strategies.

Within-Species Variation in Life History Strategies

Much research has documented that different species enact a variety of life history strategies. Humans, for example, are defined by the considerable investments they typically make in somatic development at the expense of early reproduction. Compared with chimpanzees, for instance, humans reach physical maturity later and begin reproducing at a later age (Kaplan, Hill, Lancaster, & Hurtado, 2000). Originally, comparative biologists focused on characterizing species-typical life history strategies, comparing the strategy of one species with that of another (e.g., Lack, 1950). Accruing evidence, however, indicates adaptive within-species variation in life history strategies in many diverse taxa (e.g., Daan & Tinbergen, 1997; Tinbergen & Both, 1999). In other words, some elephants and tenrecs reproduce earlier, but other elephants and tenrecs delay their reproduction relative to other members of their species. Indeed, organisms appear to monitor the current and expected state of their environments, adjusting the life history strategies they enact based on environmental demands and pressures (Ellis et al., 2009). This research suggests that, instead of being fixed for life, life history strategies show environmental contingency in response to particular types of cues during childhood and adulthood.

Environmental Contingency in Human Life History Strategies

Human life history strategies may also be sensitive to particular environmental cues (see Simpson & Belsky, 2008). Chisholm (1993, 1996), for example, has proposed that local mortality rates should have been an important ecological cue in evolutionary history. This, in turn, sets up selection pressures for a psychology that uses these cues adaptively to shunt people down slower versus faster developmental and reproductive paths. Consistent with this notion, multiple studies indicate that mortality cues are strongly related to reproductive timing. When examining the association between life expectancy (an indicator of mortality) and age at first birth in 170 nations, Low, Hazel, Parker, and Welch (2008) found that variation in life expectancy accounted for 74% of the variation in age at first birth, with shorter life expectancy predicting earlier age at first birth. Similar patterns emerged in a study comparing different neighborhoods within the same city (Chicago, Illinois). For the 10 neighborhoods with the highest life expectancy, median age of mothers giving birth was 27.3 years, whereas it was 22.6 years in the 10 neighborhoods with lowest life expectancy (Wilson & Daly, 1997). Taken together, these findings suggest that, instead of having a set life history strategy at birth, people might nonconsciously monitor specific features of the environment (e.g., mortality cues) in childhood and/or in adulthood to calibrate how and when to invest in somatic and reproductive effort.

One of the main goals of the current research is to use multiple methods to examine whether and to what extent human life history strategies—and the reproductive timing decisions directly associated with such strategies—may be sensitive to two specific environmental cues: (a) cues indicating high mortality and (b) cues indicating resource scarcity. The most direct prediction from life history theory is that cues of greater mortality (e.g., high levels of violent crime) and resource scarcity (e.g., low relative income) should lead to faster life history strategies associated with earlier ages of reproduction.

Study 1: Correlations Between Crime, Socioeconomic Status, and Reproductive Timing

We examined whether income and crime, specifically violent crime directly related to mortality, would influence the age at which people had children. To examine this, we obtained U.S. data regarding crime, income, and birth records. We then examined which factor(s) uniquely predicted the age at which parents had children.

Method

We obtained county-level data on per capita crime (both violent and property crime), per capita income, and birth records that included the age of the parents at the child's birth (the analyses use the average of the mother's and father's age) from publicly available datasets: the United States Federal Bureau of Investigation (2004) Uniform Crime Report, the United States Census (2000), and the United States Centers for Disease Control National Vital Statistics System (2004), respectively. We analyzed all counties for which data on all variables were available. In total, we examined 373 counties that represented approximately 146,115,163 individuals.

The United States categorizes crime into two distinct categories: violent crime (e.g., homicide, assault, rape) and property crime (e.g., theft, car theft, burglary). Whereas violent crime consists of face-to-face physical injury and influences mortality rates directly, property crime consists primarily of faceless vandalism that generally does not physically injure others. Given the predicted relationship between mortality levels and faster life history strategies, we predicted a negative relationship between violent crime and the age at which people had children. However, we predicted that property crime would not have a similar effect.

Although much previous research has noted the relationship between socioeconomic status (SES) and earlier age at reproduction (e.g., teenage pregnancy), we were particularly interested in whether reproductive timing may be uniquely related to crime. Indeed, although crime and income are sometimes correlated, we were particularly interested in examining whether different types of crime might predict reproductive timing, even after SES is taken into account. Thus, we examined violent crime, property crime, and income simultaneously to determine which factor(s) uniquely predicted reproductive timing. Analyses were done at the county level.

Results and Discussion

Before turning to the primary analysis, we first examined the zero-order correlations between the variables. As one would expect, the zero-order correlation between violent crime and property crime was very high ($r = .83$, $p < .001$). It is perhaps surprising that there were no correlations between income and either violent crime ($r = -.04$, $p = .22$) or property crime ($r = .02$, $p = .34$) in this sample. Age at reproduction was correlated with income ($r = .75$, $p < .001$), violent crime ($r = -.18$, $p < .001$), and property crime ($r = -.11$, $p = .02$).

In our primary analysis, the three predictors were regressed simultaneously on age at reproduction: per capita income, property crime, and violent crime. As would be expected, income was a significant unique predictor of age at reproduction ($\beta = .75$, $p < .001$). Property crime did not predict age at reproduction ($\beta = 0$). However, violent crime did have a unique relationship with reproductive timing ($\beta = -.15$, $p = .014$), showing that higher levels of violent crime led people to have children earlier, even when controlling for income.

The key finding of this study is that violent crime rates in a specific county were negatively related to the age at which people had children in that county. This effect persisted even when SES was controlled for, and the effect was specific to violent crime but not property crime. These findings suggest that reproductive timing does not simply vary as a function of SES or of crime in general but, rather, is related specifically to violent crime—the precise type of crime associated with local mortality dangers. More broadly, the findings from this preliminary study are in line with general predictions from life history theory, whereby both persistent mortality cues and persistent resource scarcity appear to lead people to adopt faster life history strategies consistent with earlier ages of reproduction (Wilson & Daly, 1997).

Study 2: Mortality, SES, and Reproductive Timing Attitudes

Because we are particularly interested in examining the causal mechanism underlying the relationship between mortality cues, resource scarcity, and reproductive timing, we next investigated the effects of priming individuals with mortality cues (e.g., having people read a news article about increasing murder rates) on the psychology related to reproductive timing.

Although life history strategies develop early in life (Boyce & Ellis, 2005; Ellis, Essex, & Boyce, 2005), they are unlikely to be fixed throughout life. Instead, life history strategies may be responsive to several types of environmental cues that signify important changes in one's local ecology. Thus, the first research question in the current experiment is whether people's reproductive timing desires shift following exposure to stimuli indicating danger.

Past research on life history theory indicates that is critical to take into account both resource availability and the influences of mortality to fully understand human life history trajectories (e.g., Walker et al., 2006; Walker & Hamilton, 2008). Thus, the second question in the current study concerns potential moderating effects of resource scarcity on the relationship between mortality cues in one's current environment and reproductive timing. For example, there might be a synergistic effect between resource scarcity and mortality, such that the presence of one exacerbates the effects of the other. In particular, mortality cues might be especially likely to promote a faster strategy for individuals with relatively few resources. Because such individuals would have less ability to succeed in a world with increasing harshness and unpredictability, such individuals might have benefited the most historically from shifting to a faster strategy and thereby reproducing earlier.

Finally, in addition to measuring current and future expected levels of SES, we measured the extent to which people experienced resource-scarcity in childhood. There are several reasons to believe that childhood exposure to life-history-relevant cues might have a particularly strong effect on the strategies one adopts as an adult (e.g., see Belsky, 2007; Belsky & Pluess, 2009; Boyce & Ellis, 2005; Ellis et al., 2005; Lummaa, 2003). For example, recent medical research consistently shows that effects of stress on health vary as a function of an individual's childhood SES but not as a function of current SES (e.g., Cohen, Doyle, Turner, Alper, & Skoner, 2004; Galobardes, Lynch, & Davey Smith, 2004; Miller et al., 2009). Similarly, multiple psychological phenomena show critical or sensitive periods during which an organism calibrates life history strategies based on environmental inputs, meaning that

childhood might be a critical window for setting life history parameters. Thus, we examined how mortality cues influenced reproductive timing attitudes as a function of both current SES and childhood SES.

Method

Participants—One hundred seventy students (44 men, 126 women) at a large public university participated in the study for course credit. Mean age of participants was 18.9 years (*SD* = 1.63), and none of the participants were married or had children. All participants (Ps) came to the lab in small groups and were seated at computers between partitions.

Design and procedure—The study had two between-subjects prime conditions: mortality and control. Mortality cues were primed by having Ps read a short newspaper article. Ps then responded to items about reproductive timing. At the end of the study, Ps indicated their current and childhood SES.

To minimize potential suspicions and demand characteristics, a cover story was used. Ps were told that they were going to participate in several different studies, the first of which concerned memory. Consistent with this cover story, Ps read a short news article and were told that they would be asked to recall information about the article later in the session. However, because it was important to let some time pass before the memory recall task (ostensibly to allow for memory decay), Ps would work on another survey regarding family decisions. In poststudy interviews during pilot testing, no participants indicated suspicion about the study or thought that there was a link between the article and the dependent measures.

Mortality prime: Consistent with the cover story, Ps first read a purported short news article. The article was titled “Dangerous Times Ahead: Life and Death in the 21st Century,” and it described recent trends in the increases in violence in the United States, noting that there have been increases in shootings in both residential and commercial areas. The article ends by emphasizing that seemingly random deaths are becoming a more common part of life. Ps were told that the article recently appeared in a Sunday section of the *New York Times*. The article was also formatted to look like an actual *New York Times* Web article, including featuring the newspaper’s logo, font, and style. Consistent with the cover story, Ps were told that “this article was chosen because it is exactly 600 words in length, which makes it ideal for psychological memory tasks.”

The control condition involved reading a purported news article that was similar in length and style, came from the same source, and was designed to elicit similar levels of general arousal. The article described a person’s afternoon at home, whereby the person had lost his keys and spent several hours searching for them around the house.

To ensure that the mortality article elicited the intended state, as well as eliciting similar levels of general arousal as the control article, both articles were pretested with a separate group of 44 participants (24 women, 20 men). Half of these participants read the mortality article, and the other half read the control article, with instructions identical to those used in the experiment. Participants then responded to five items. The first two items assessed the extent to which the news stories led them to be concerned with safety: (a) “To what extent did the story make you think the world will become a more dangerous place?” and (b) “To what extent did the story make you think the world will become unsafe?” The next two items assessed the extent to which the news stories led them to view the world as unpredictable and uncertain: (c) “To what extent did the story make you think the world will become more unpredictable?” and (d) “To what extent did the story make you think the

world will become more uncertain?" The final item asked whether the story led them to be generally aroused: (e) "To what extent did the story make you feel emotionally aroused?" All five items were rated on a 7-point scale anchored at *not at all* and *very much*, and the five items were presented in random order.

Findings were consistent with expectations. The mortality story led people to see the world as more *dangerous* ($M_{Mortality}$ = 4.44, SD = 1.95; $M_{Control}$ = 1.71, SD = 1.27; $p < .001$, d = 1.7) and more *unsafe* ($M_{Mortality}$ = 4.61, SD = 1.75; $M_{Control}$ = 2.24, SD = 1.73; $p < .001$, d = 1.4). The mortality story also led people to see the world as more *unpredictable* ($M_{Mortality}$ = 4.74, SD = 1.71; $M_{Control}$ = 2.48, SD = 1.91; $p < .001$, d = 1.3) and more *uncertain* ($M_{Mortality}$ = 5.04, SD = 1.22, $M_{Control}$ = 2.62, SD =1.94; $p < .001$, d = 1.6). Despite these differences, the mortality story led people to feel the same level of *emotional arousal* as did the control story ($M_{Mortality}$ = 3.52, SD = 1.53, $M_{Control}$ = 3.43, SD = 1.91; p = .86). Thus, the manipulation elicited the intended states.

Dependent measures: To assess attitudes toward early reproduction, participants responded to three 9-point scale items: (1) "Would you like to have children in the next few years?" (*definitely no–definitely yes*), (2) "If you were to have a child in the next few years, how would you feel?" (*feel negative–feel positive*), and (3) "How disappointed would you be if you did *not* have a child in the next few years?" (*not at all–very*). The order of the items was randomized. Responses were combined into a reproductive timing attitudes index (α = .70), where higher numbers indicate more positive attitudes toward starting a family sooner.

Individual differences in perceived resource availability: We assessed two types of socioeconomic standing: To what extent did people feel resource-deprived *in their childhood*, and to what extent do people feel resource-deprived *in the present and foreseeable future*? To measure these constructs, Ps responded to the following six statements on a 7-point scale anchored at *strongly disagree* and *strongly agree*. The items for childhood resource availability were (a) "My family usually had enough money for things when I was growing up"; (b) "I grew up in a relatively wealthy neighborhood"; (c) "I felt relatively wealthy compared to the other kids in my school." The items for current and expected resource availability were (a) "I have enough money to buy things I want"; (b) "I don't worry too much about paying my bills"; (c) "I don't think I'll have to worry about money too much in the future."

A principal axis factor analysis of the six SES items yielded two factors with eigenvalues above 1.0 (3.26 and 1.27). A visual inspection of the scree plot also suggested that two factors be extracted. Hence, we extracted and rotated two factors using direct oblimin criteria to allow for correlated factors. The first rotated factor consisted of the three childhood SES items with pattern matrix loadings ranging from .71 to .90, and it accounted for 42% of item variance. The second rotated factor consisted of the three current SES items with pattern matrix loadings ranging from .72 to .75, and it accounted for 38% of item variance. Hence, the factors were moderately correlated (r = .39) but were nevertheless empirically distinct. Thus, we created a composite for childhood SES (α = .84) and a composite for current SES (α = .83), analyzing each one separately.

Results

We first examined the results for potential sex differences. Using a general linear model approach, we examined a model in which desire to have children soon was the dependent measure, Participant Sex and Prime were categorical factors, and both types of SES were centered and entered as continuous factors. The analysis revealed a marginal main effect of participant sex, whereby women had more positive attitudes toward having children sooner

than men ($p = .058$). In the current study, however, we were interested in whether Prime and/or SES were having a similar or different influence on men's and women's attitudes. An analysis of potential interactions did not reveal a three-way interaction with Participant Sex, Prime, and either type of SES ($p > .65$), a two-way interaction with Participant Sex and Prime ($p > .80$), or with Participant Sex and either type of SES ($ps > .90$). Thus, the effects were indistinguishable for male and female participants.

Using the same analytic approach, we first examined whether there was an effect of Prime on desire to have children when we controlled for both types of SES. We did not find a main effect of the Prime ($p > .9$). We next examined possible interactions between Prime and SES. Current/Expected SES did not interact with Prime ($p = .61$), meaning that mortality cues had the same effect regardless of whether people currently felt or expected to be wealthier or poorer. However, Prime interacted significantly with Childhood SES, $F(1, 166) = 5.59$, $p = .019$. This means that the influence of mortality cues on reproductive timing attitudes depended on a person's childhood SES.

Following Aiken and West (1991), we next probed the interaction between Prime and Childhood SES by calculating the predicted mean difference in reproductive timing attitudes between participants in the mortality prime versus control prime conditions for individuals at ± 1 standard deviations from the mean of Childhood SES (i.e., we tested for effects of prime for individuals who grew up "wealthy" versus those who grew up "poor"). Using two-tailed tests, this analysis showed that people who grew up in subjectively disadvantaged economic environments had somewhat more positive attitudes toward earlier reproduction when exposed to cues of mortality: At one standard deviation below the mean of Childhood SES, people had marginally more positive attitudes toward having children earlier in the mortality condition relative to the control condition, $\beta = .18$, $t(166) = 1.66$, $p = .099$, $r^2_{sp}=.02$ (see Figure 1). Conversely, for people who grew up in relatively advantaged economic environments, mortality cues had the opposite effect: At one standard deviation above the mean of Childhood SES, people had marginally less positive attitudes toward having children earlier in the mortality condition relative to the control condition, $\beta = -.19$, $t(166) = 1.69$, $p = .094$, $r^2_{sp}=.02$ (see Figure 1).

Discussion

In this study, the influence of mortality cues on reproductive timing attitudes depended critically on a specific type of resource availability: whether an individual grew up in a relatively resource-scarce or resource-plentiful environment. For individuals who reported feeling poor during childhood, mortality cues led to somewhat more positive attitudes toward earlier reproduction. Such attitudes are consistent with a faster life history strategy. Conversely, for individuals who reported feeling wealthy during childhood, mortality cues led to somewhat more negative attitudes toward earlier reproduction. Such attitudes are consistent with a slower life history strategy.

Recall that in our first study examining the association between violent crime and reproductive timing across the United States, we found that the prevalence of mortality cues was related to earlier reproduction. However, such aggregate data did not allow us to examine potential moderating effects of childhood environment on reproduction. Indeed, results from the current experiment suggest that the effect of mortality cues on reproductive timing may depend on economic security experienced during development. These findings are consistent with the notion that salient mortality cues might shift individuals' life history strategies. However, this study suggests that such shifts may depend critically on childhood resource availability—an effect we attempted to replicate in the next experiment.

Study 3: Mortality, Childhood SES, and Desired Age of Reproduction

The goal of this experiment was straightforward: We aimed to replicate the unique interactive pattern of findings from the first experiment. The current study was similar in most ways to the previous experiment. However, to focus on the specific pattern of effects and demonstrate their robustness, the current study differed in two key ways: (a) Rather than assessing attitudes about earlier reproduction, the dependent measures directly assessed the age at which people wanted to have their first child; and (b) to ensure that the effects in the last experiment were not caused by something peculiar in the news article used in the control prime condition, participants did not read anything in the control condition in the current study.

On the basis of considerations of life history theory and the findings from the last experiment, we made a series of specific predictions: (a) The influence of the mortality prime on desired age of first reproduction should interact with childhood SES, but not necessarily with current and future expected SES; (b) for individuals who felt poor as children, mortality cues should lead to a desire to have children sooner; (c) for individuals who felt wealthy as children, mortality cues should lead to a desire to delay reproduction.

Method

Participants—One hundred eighty-two undergraduate students (85 men, 97 women) at a large public university participated in the study for course credit. Mean age of participants was 19.4 years (SD = 1.75), and none of the participants were married or had children. All participants (Ps) came to the lab in small groups and were seated at computers between partitions.

Design and procedure—The study had two between-subjects prime conditions: mortality and control. Mortality cues were again primed using the *New York Times* article. To minimize potential suspicions and demand characteristics, the same cover story was used. In the control condition, there was no prime, meaning that Ps simply responded to the dependent measures. At the end of the study, Ps indicated their childhood and current/expected SES using the same items as in Study 2.

Dependent measures: To assess the age at which people wanted to start a family, participants first responded to two items regarding when they *want to have their first child*. The first item was open-ended, asking, “How old do you think you’ll be when you have your first child?” Responses ranged from 20 to 36 years of age. The second item asked, “If you were to have children, in how many years do you want to have your first child?” Participants responded to this item on an 11-point scale, where the first 10 points on the scale corresponded to 1–10 years in 1-year increments (e.g., “in 1 year,” “in 2 years”); the 11th and final point on the scale was labeled “in 11+ years.” Responses to the first open-ended item were transformed by subtracting the participants age from their response, thereby indicating the number of years from now when the person plans to have their first child. The two items were highly correlated (r = .73) and were thus combined into an index of desired age to have their child.

In addition to reporting when they wanted to have their first child, Ps also responded to two items regarding when they *want to get married*. Given the importance of forming long-term pair bonds to human reproduction, these items serve as a conceptual replication of the desired age at childbirth items. The first item was open-ended, asking, “How old do you think you’ll be when you get married?” Responses ranged from 19 to 36 years. The second item asked, “If you were to get married, in how many years from now do you want to get married?” Participants responded to this item on an 11-point scale, whereby the first 10

points on the scale corresponded to 1–10 years in 1-year increments (e.g., “in 1 year,” “in 2 years”); the 11th and final point on the scale was labeled “in 11+ years.” Responses to the first open-ended item were transformed by subtracting the participants age from their response, thereby indicating the number of years from now when the person plans to get married. The two items were highly correlated ($r = .71$), and were thus combined into an index of desired age at marriage.

Results

We first examined the results for potential sex differences. Using a general linear model approach, we examined a model in which desired age at reproduction or marriage were the dependent measures, Participant Sex and Prime were categorical factors, and both types of SES were centered and entered as continuous factors. As might be expected, women generally indicated a desire to have children and get married sooner than did their male counterparts, although these main effects did not reach conventional levels of significance. In the current study, we were specifically interested in whether Prime and/or SES were having a similar or different influence on men’s and women’s reproductive timing desires. An analysis of potential interactions did not reveal three-way interactions with Participant Sex, Prime, and either type of SES (ps > .70) or two-way interactions with Participant Sex and Prime (ps > .15) or Participant Sex and either type of SES (ps > .45). Thus, the effects of all factors were indistinguishable across male and female participants, meaning that, as in Experiment 1, mortality cues influenced men and women in a similar manner.

When to have first child—We first examined the influence of Prime and Current/Expected SES on the age at which people wanted to have their first child. Prime did not interact with Current/Expected SES ($p = .71$). However, a significant interaction did emerge between Prime and Childhood SES, $F(1, 178) = 9.99$, $p = .002$ (see left panel of Figure 2). As in the Study 2, the influence of mortality cues on reproductive timing depended on Childhood SES, but not on Current/Expected SES.

We next examined differences in desired age of reproduction for participants one standard deviation above and below the mean of Childhood SES. This analysis showed that people who grew up in subjectively disadvantaged economic environments (one standard deviation below the mean of Childhood SES) wanted to have children sooner in the mortality condition relative to the control condition, $\beta = -.22$, $t(178) = -2.18$, $p = .03$, $r^2_{sp}=.03$. Conversely, for people who grew up in relatively advantaged economic environments, mortality cues had the opposite effect: At one standard deviation above the mean of Childhood SES, people wanted to have children later in the mortality condition relative to the control condition, $\beta = .24$, $t(178) = 2.3$, $p = .023$, $r^2_{sp}=.03$.

When to get married—We next examined the influence of Prime and SES on the age at which people want to get married. Again, Current/Expected SES did not interact with Prime ($p = .47$). However, we did find a significant interaction between Prime and Childhood SES, $F(1, 178) = 12.80$, $p < .001$ (see right panel of Figure 2). At one standard deviation below the mean of childhood SES, desired age for marriage was lower in the mortality condition relative to the control condition, $\beta = -.25$, $t(178) = -2.39$, $p = .018$, $r^2_{sp}=.03$. Conversely, at one standard deviation above the mean of SES, desired age for marriage was higher in the mortality condition relative to the control condition, $\beta = .28$, $t(178) = 2.68$, $p = .008$ $r^2_{sp}=.04$.

Discussion

The current study replicated the very specific pattern of findings from Study 2, whereby the influence of mortality cues on reproductive timing again depended critically on a person's perceived childhood SES. For individuals who reported feeling poor as children, mortality cues produced a desire to have their first child sooner and get married sooner, consistent with shifting toward a faster life history strategy. Conversely, for individuals who reported feeling wealthy as children, mortality cues produced a desire to delay reproduction and delay getting married, consistent with shifting toward a slower life history strategy. Because delaying reproduction implies increased investment into somatic effort, we next examined whether individuals from higher SES backgrounds might respond to mortality cues by increasing somatic effort.

Study 4: Starting a Family Versus Furthering Education/Career

The final experiment aimed to provide some insight into the reason why mortality cues lead individuals from wealthier backgrounds to delay reproduction. We predicted that individuals who grew up in a resource-plentiful environment would respond to increased mortality by delaying reproduction because they would rather invest these resources in themselves. That is, such individuals should invest resources into somatic effort that would increase the payoffs for future reproduction. Consistent with favoring somatic effort over reproductive effort, we predicted that these individuals should delay reproduction to obtain more education, work experience, and other types of embodied capital that serve the same function as somatic investment (Kaplan et al., 2000). Thus, in the current study, we focus on the trade-off between current and future reproduction by pitting starting a family sooner against furthering one's education and career.

The second purpose of the study was to increase the validity of the childhood SES findings revealed in the first two experiments by using a different measure of SES. The first two experiments examined childhood SES by asking about a person's subjective childhood experience (e.g., "My family usually had enough money for things when I was growing up"). Although subjective childhood experience is likely to have important ramifications on adult life history strategies, we aimed to replicate the specific pattern of findings from Studies 2 and 3 using a more objective measure of childhood SES: household family income when growing up.

Method

Participants—One hundred six undergraduate students (48 men, 58 women) at a large public university participated in the study for course credit. Mean age of participants was 19.2 years (SD = 1.23), and none of the participants were married or had children. All participants (Ps) came to the lab in small groups and were seated at computers between partitions.

Design and procedure—The study had two between-subjects prime conditions: mortality versus control. Mortality cues were primed using the same *New York Times* story as in the last two studies. As in the second experiment, the control condition had no prime. To minimize potential suspicions and demand characteristics, the same cover story was used.

Dependent measure: To assess the tradeoff between starting a family sooner versus delaying reproduction to invest in one's education and career, participants responded to three items: (a) "If you needed to choose, would you rather get married sooner OR focus on your career?" (b) "If you needed to choose, would you rather start a family sooner OR go to

graduate school for many years to further your education?" (c) "If you needed to choose, would you rather have children sooner OR further your career?" These three items were combined to create a family versus career index (α = .92).

SES: At the end of the study, participants indicated their household family income when growing up. Ps chose one of seven options: (a) $10,000 or less; (b) $10,001–$25,000; (c) $25,001–$40,000; (d) $40,001–$50,000; (e) $50,001–$75,000; (f) $75,001–$100,000; and (g) more than $100,000.

Results

We first investigated potential sex differences. As in Experiments 1 and 2, analyses did not reveal any two-way or three-way interactions of Participant Sex with any other factor in the model (all *p*s > .55). We next examined whether the Prime had a different effect on reproductive timing as a function of family income in childhood. Consistent with results from the first two experiments, the effect of Prime on the family versus career tradeoff was significantly moderated by childhood family income, $F(1, 102) = 10.75$, $p = .001$ (see Figure 3).

We next examined effects of Prime at high and low Childhood SES (one standard deviation above and below the mean of childhood family median income, respectively). At high Childhood SES, mortality cues produced a desire to further one's career and education at the cost of starting a family, $\beta = .42$, $t(102) = 3.27$, $p = .001$, $r^2_{sp} = .09$. Conversely, at low Childhood SES, mortality cues somewhat increased people's desire to start a family sooner at the expense of furthering one's career and education, $\beta = -.18$, $t(102) = -1.39$, $p = .169$, $r^2_{sp} = .02$. Although the effect for lower SES participants did not reach conventional levels of significance, Childhood SES did have a strong significant effect in the mortality condition, $\beta = .58$, $t(102) = 4.37$, $p < .001$, $r^2_{sp} = .16$ (see Figure 3).

Discussion

Despite using different methods to assess childhood resource scarcity, and despite drawing on a participant sample that differed in several ways compared to those in the first two experiments, the final study again replicated the specific interactive pattern of results identified in the earlier studies: The influence of mortality cues on the life history trade-offs between current and future reproduction differed as a function of a person's childhood economic environment. Mortality cues led people who grew up in wealthier households to want to delay reproduction, whereas those same cues led people who grew up in poorer households to trend in the opposite direction. In particular, increasing danger in the current environment led individuals from wealthier backgrounds to delay reproduction specifically to obtain more education or work experience—a pattern consistent with investing in somatic effort by building embodied capital rather than investing in current reproductive effort. Conversely, increasing danger in the current environment led individuals from poorer backgrounds to be somewhat less attracted to investing in future reproduction at the cost of current reproduction.

General Discussion

We examined whether variability in reproductive timing might reflect a deeper evolutionary logic. To answer these questions, we drew on life history theory—an evolutionary framework proposing that organisms' life history strategies fall on a continuum from slower strategies that focus on longer term goals and investment to faster strategies that focus on more immediate payoffs. Because life history theory predicts that the adoption of faster

versus slower strategies should be influenced by local mortality cues, we examined how experimentally priming mortality cues influenced reproductive timing.

The studies yielded several consistent findings. First, in three experiments, mortality cues had a markedly different effect on reproductive timing depending on whether people reported growing up in a relatively resource-scarce versus a resource-plentiful environment. Whether childhood SES was measured via recalled subjective feelings (Studies 2 and 3) or via recall of family household income (Study 4), mortality cues had diverging effects depending on a person's childhood SES environment. Indeed, despite the moderate correlation between childhood and current/expected future SES, it is noteworthy that the effects of mortality cues were contingent more on childhood SES than on current/future expected SES (see both Studies 2 and 3). This childhood-SES effect is consistent with recent medical research examining how stress influences health (e.g., Cohen et al., 2004; Galobardes et al., 2004; Miller et al., 2009), whereby stress in an adult person's environment has been shown to have a different effect on health as a function of the person's childhood SES but not as a function of current SES.

The other key findings across studies showed that mortality cues produced a desire to delay reproduction for people who grew up in relatively resource-plentiful environments. Further, mortality cues led these individuals to want to invest more in their own embodied capital (i.e., accumulated knowledge and skills), even if it meant delaying reproduction. This pattern of findings is consistent with a slower life history strategy, which entails delaying reproduction by investing in somatic effort that can be converted into reproduction at a later time. Conversely, mortality cues led individuals who grew up in resource-scarce environments to want to have children and get married at an earlier age. Even when presented with the option to invest in their own education or further career training, mortality cues still led these individuals to prefer to start a family sooner rather than investing in embodied capital.

In summary, the current research is the first to show experimentally that life history strategies—and the psychologies associated with different strategies—can shift as a function of mortality cues in a person's adult environment. It is important to note that this research shows that life history strategies do not appear to shift in a straightforward manner. Instead, mortality cues appear to shift strategies in a divergent manner as a function of one's childhood SES.

Human Life History Strategies and Possible Psychological Mechanisms

At first blush, the finding that mortality cues lead different individuals to adopt different life history strategies might appear puzzling. After all, consistent with the correlational finding in Study 1, the most direct prediction from life history theory is that higher mortality should lead most organisms to adopt faster strategies associated with earlier reproduction. Yet in three subsequent experiments, we found that mortality cues engendered faster strategies for some individuals (those from lower SES childhoods) but slower strategies for others (those from higher SES childhoods). Although the current research did not examine the proximate psychological processes underlying these divergent effects, we outline below the working model that has guided our research.

The first level of our working model concerns the influences of childhood environment. We suggest that there are likely to be critical differences between higher and lower childhood SES environments. For example, a lower SES childhood environment is likely to have more household stressors linked to unpredictability and harshness, such as multiple job changes and multiple residence changes, fluctuating employment status and resource availability, parental stress about resources, and fluctuating household membership (e.g., the coming and

going of a parent, step-parent, relative). Such harsh, unpredictable features are likelier to be relatively absent from higher SES childhoods. It is possible that early exposure to environmental factors related to unpredictability and harshness may sensitize life history parameters and set developmental trajectories, including shunting individuals down a slower or faster path (e.g., Mucignat Caretta, Caretta, & Cavaggioni, 1995). Such differential calibration in childhood may lead to differentiation between individuals' life history strategies in the face of ecological challenges.

The second level of our working model concerns distinctions between different types of mortality. The prediction from life history theory that greater mortality leads to faster life history strategies comes from a consideration of what is termed *extrinsic* mortality: causes of mortality that are random, unpredictable, and uncontrollable. This is distinguished from *intrinsic* mortality: causes of mortality that are relatively predictable and potentially avoidable. For example, intrinsic mortality could be decreased by investing in physical size, immune function, and knowledge or skills that could decrease intrinsic mortality. Unlike extrinsic mortality, intrinsic mortality is predicted to lead to the adoption of slower strategies. That is, because investment in somatic effort can, by definition, decrease intrinsic mortality risks, slower strategies are adaptive in such environments. Indeed, the main difference between extrinsic and intrinsic mortality is related to the key environmental dimension of unpredictability noted by Ellis et al. (2009).

Given that different types of mortality should lead to different life history strategies, we suggest that danger cues experienced by human adults can be interpreted as either extrinsic or intrinsic. Thus, some people might categorize increasing mortality as intrinsic. This, in turn, would lead them to adopt a slower strategy: investing now in ways to avoid or wait out danger, necessarily delaying reproduction. However, others might categorize the same mortality cues as extrinsic. This, in turn, would lead them to adopt a faster strategy, given that their lifespan is expected to be shorter regardless of their energy investment strategy. Thus, we suggest that individuals who grew up in resource-plentiful environments might tend to categorize a mortality cue as indicating intrinsic mortality, whereas individuals who grew up in resource-scarce environments might tend to categorize the same mortality cue as indicating extrinsic mortality. Because of this difference in categorization, the two types of individuals may recalibrate their current strategies in very different ways, leading to the patterns observed in Studies 2–4.

We are currently in the early stages of understanding the ways in which human psychology integrates cues from adult and childhood environments to determine behavior, as well as understanding the evolutionary logic underlying this psychology (see Belsky, 2007; Belsky & Pluess, 2009; Boyce & Ellis, 2005; Ellis et al., 2005). Although we tentatively hypothesize the above scenario, future research is clearly needed to ascertain exactly how and why human psychology responds as it does.

Limitations and Future Directions

Although we consistently found moderating effects of childhood SES on mortality cues, the range of childhood SES from which we sampled was limited. On average, young adults enrolled in college tend to come from middle or upper level SES backgrounds. Sampling from a wider range of childhood SES may yield more powerful effects of childhood environment on reproduction. Our college sample also generally wanted to have kids a few years later than did the average American. This is not surprising given that college students are generally on a slower life trajectory compared with a noncollege sample. Nevertheless, the fact that we repeatedly find that perceived childhood SES moderates the effect of current mortality suggests that this effect is quite robust in this population and that cues related to relative and subjective childhood SES (e.g., how one compares oneself relative to peers or

others in one's environment) may be more important than absolute SES in calibrating adult life history strategies.

We also do not suggest that current or future expected SES is irrelevant to psychology and behavior, including responses to mortality cues. Because most of our participants were college students, it is possible that the construct of current/future expected SES is not as meaningful a measure as it would be for older, more settled individuals. Nevertheless, despite the moderate correlation between childhood and current/expected future SES in our studies, it is noteworthy that the effects of mortality cues were contingent on childhood SES rather than current/future expected SES. Future research is needed with more diverse populations to examine the potentially unique effects of childhood versus adult SES.

It is also notable that we found relatively few differences in reproductive timing for higher versus lower SES individuals in the control condition. This null effect may be a product of insufficient variance in SES within our sample. If one were to sample the lowest and the highest quartile of childhood SES in a broader population, one would likely find that wealthier individuals are following a slower strategy. A second possibility might arise because of the operation of two opposing effects. As discussed throughout this article, individuals living in harsh, unpredictable environments should have faster life histories relative to individuals from less harsh, more predictable environments. However, individuals from less harsh environments may have a greater energy budget. The effects of energy budget move in opposite ways from mortality: As one's total energy budget is larger, one can grow large more quickly and reproduce sooner, because the tradeoffs between growth and reproduction are not as severe as on a lower energy budget. Walker et al. (2006) showed that both effects occur among small societies, moving life history traits in opposite directions. Thus, it is possible that in the control conditions the effects of a harsh, unpredictable childhood environments (likely characteristic of low-SES participants) were counteracted by the effects of greater energy budgets (likely characteristic of high-SES participants). Only with the addition of an acute mortality threat were differences between levels of SES revealed. However, because food is cheap and plentiful, it is not clear whether any but the poorest Americans actually suffer from a restrained energy budget. Regardless, one of the key points of the current research is that mortality threat elicited divergent life history strategies, even when those strategies were not detectable in neutral conditions. This consistent finding suggests that the psychology and behavior associated with different life history strategies is especially likely to emerge in conditions that imply unpredictability and harshness. These findings are consistent with the way different attachment styles manifest in adult romantic behavior under conditions of stress (see Simpson & Belsky, 2008).

The dependent measures used in our experiments—attitudes toward early reproduction, desired age at reproduction and marriage, and desire to start a family versus further a career—relate to critical decisions within an organism's life course. However, one can imagine the existence of an organism that implements its life history strategy without requiring explicit psychological representations of quantities such as "age to get married" and "age to reproduce." For instance, physiological mechanisms could calibrate the age of sexual maturity based on nutritional state, whereby the psychology responsible for initiating reproduction could come online whenever sexual maturity is reached. What reason is there to think that reportable, explicit attitudes toward reproduction play a role in calibrating actual reproduction? First, anthropological research among small-scale societies reveals that with increasing resources and increasing investment in embodied capital, people choose to have fewer children, and they choose to have them later (Kaplan & Lancaster, 2003). Moreover, many tribal communities use various plants that are believed to regulate reproductive life by causing temporary sterility or abortion during early stages of pregnancy (e.g., Jain, Katewa, Chaudhary, & Galav, 2004). Postnatally, people will sometimes, in

extreme circumstances, choose to regulate their reproduction through infanticide (Daly & Wilson, 1988). More generally, humans have complex adaptations that allow for planning for the future (e.g., Klein, Robertson, & Delton, 2010; Suddendorf & Corballis, 2007). Given the importance of reproduction, it would be surprising if conscious planning processes did *not* sometimes involve the integration of desires to start a family and have children. After all, it takes a great deal of planning to effectively prepare for, and care for, impending offspring. Future research could profitably investigate the specific psychological mechanisms involved in this process as it relates to reproduction.

In addition to informing decisions about reproductive timing, it is important to note that the evolutionary framework of life history theory has tremendous potential for helping explain and tie together the why and how of myriad psychological and behavioral phenomena. Such phenomena include risk preferences and delay of gratification (Griskevicius, Tybur, Delton, & Robertson, 2010; Nettle, 2009), women's career and education (Low et al., 2008), aggression (Griskevicius et al., 2009), as well as the many aspects of psychology and behavior that relate to life history trade-offs. One elegant feature of life history theory is its emphasis on context and individual differences, meaning that the theory is intrinsically linked to both personality and social psychology.

Another fruitful avenue for further research involves getting a better understanding of the specific features of environmental cues that are having the most powerful effects on regulating life history strategies. One likely possibility is that psychological mechanisms are differentially sensitive to the level of unpredictability and/or the level of harshness in the environment (Ellis et al., 2009). The pretest results for our mortality prime (see the Methods section of Study 2) shows that our manipulation increased both perceptions of unpredictability and perceptions of harshness ("dangerous"). Future research should attempt to tease apart these two potentially independent factors. Another fruitful avenue for future research involves getting better traction on the nature of sensitive periods in childhood for determination of life history strategies. For example, are different features of childhood environment related to different adult psychological and behavioral outcomes? At what ages are sensitivities the greatest? And do children have different sensitive periods for different types of environmental cues? All such questions can be informed by life history theory in conjunction with theoretical models in developmental, social, personality, and evolutionary psychology.

Life History Theory and Terror Management Theory

The hypotheses in this set of studies were derived from life history theory (Charnov, 1993; Roff, 1992; Stearns, 1992), from considerations of the relationship between life history theory and human psychology (e.g., Ellis et al., 2009; Kaplan & Gangestad, 2005), and from research on evolutionary social cognition (e.g., Ackerman et al., 2006; Fletcher, Simpson, & Boyes, 2006; Griskevicius, Goldstein, Mortensen, Cialdini, & Kenrick, 2006; Griskevicius et al., 2007; Haselton & Nettle, 2006; Kenrick, Griskevicius, Neuberg, & Schaller, 2010; Li et al., 2009; Maner et al., 2005; Navarrete et al., 2009; Schaller, Park, & Mueller, 2003). However, predictions regarding how mortality cues influence reproductive timing can also be generated by other theoretical perspectives.

Consider terror management theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986), which has generated much interesting research showing that reminders of one's eventual death ("mortality salience") influence a variety of outcomes. Although imagining one's death is not identical to cues connoting that one lives in a dangerous environment (our "mortality" primes), it is quite possible that both types of manipulations activate similar psychological mechanisms. Indeed, it is quite possible that one of the reasons why mortality salience manipulations produce powerful effects is because such manipulations might tap

the very same evolved mechanisms related to calibrating life history strategies. Nevertheless, it is difficult to see how TMT alone would predict the specific patterns of results obtained in our studies. For example, it is unclear why TMT would predict that the influence of mortality cues would be moderated by the availability of resources, in childhood or otherwise. Yet the two factors of mortality and resource availability are precisely the two environmental cues that are predicted to influence fast and slow life history strategies (e.g., Kaplan & Gangestad, 2005; Stearns, 1992).

Terror management theory has sometimes been presented as an evolutionary theory (Landau, Solomon, Pyszczynski, & Greenberg, 2007). However, evolutionary theorists have criticized the theory as implausible from an evolutionary perspective (Buss, 1997; Kirkpatrick, 1999; Navarrete, Kurzban, Fessler, & Kirkpatrick, 2004; Navarrete & Fessler, 2005). We agree that TMT is not a plausible evolutionary theory. Nonetheless, it may be possible to integrate life history theory and terror management theory to have each theory inform the other.

It is important to keep in mind that that terror management theory is a proximate theory of human psychology that focuses on self-esteem. TMT proposes that people sometimes manipulate their own self-esteem to neutralize the anxiety of impending death. Life history theory, by comparison, addresses the ultimate logic underlying responses to mortality threats, and it points to multiple proximate mechanisms regarding how mortality cues influence psychology and behavior. However, life history theory has little to say about how people might artificially boost their self-esteem to buffer against mortality threats. This means that one area of possible future research in which both theories could be used together might involve examining situations in which people desire to artificially boost their self-esteem. For instance, it may be beneficial to boost self-esteem when one's own developmental history (e.g., childhood SES) and current ecological circumstances necessitate greater confidence and certainty. Overall, the combination of both theories helps us understand more fully the multiple reasons—at multiple explanatory levels—regarding how, why, and when mortality cues have powerful effects on cognition and behavior.

Conclusion

There is much debate and controversy about the optimal time to start a family. As witnessed by the enormous cross-cultural and within-country variability in reproductive timing, however, there is no such thing as "the optimal time." For some people, for example, the mere idea of having a child at age 16 is seen as irrational and even irresponsible. Yet for others, the idea of waiting until age 35 to have children is seen as equally irrational and irresponsible (Geronimus, 1996).

When reproductive timing is considered from the broader evolutionary sciences framework of life history theory, it becomes clear that both seemingly irrational behaviors exhibit a deeper rationality (Kenrick et al., 2009), whereby having children early or late is reflective of individuals who are pursuing different life history strategies. Life history theory does not imply that a particular trait or behavior is "good" or "bad," just as it does not suggest that a fast or a slow strategy is intrinsically superior. Instead, the psychologies and behaviors associated with different life history strategies simply reflect the outputs of mental mechanisms designed to make the best of the circumstances in which individuals find themselves.

Finally, it is important to note that life history theory and the current research have tremendous implications for understanding changing patterns in human fertility and family size. For example, some parts of the world are experiencing overpopulation due, in part, to fast life history strategies. In these locations, the availability of resources cannot keep pace

with the growing population. Other parts of the world are experiencing underpopulation—including below-replacement fertility levels—reflecting very slow strategies. In these places, the social programs that protect and support an increasingly aging native population must be supported by an increasingly shrinking native workforce and/or through immigration. Our findings not only help explain why and how both extremes can happen but also inform potential interventions that could be crafted to shift life history strategies, thereby changing fertility patterns and family sizes.

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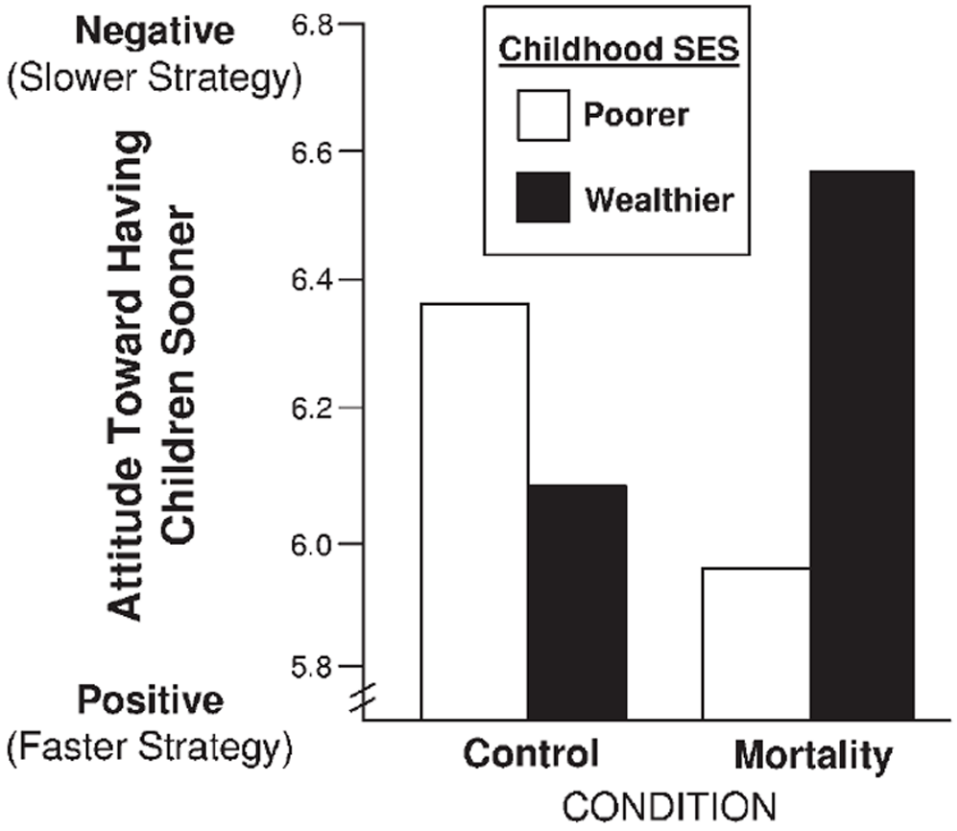

Figure 1.
Attitudes toward having children sooner as a function of mortality cues and childhood socioeconomic status (SES; Study 2). Graphed means represent a median split of relative childhood SES.

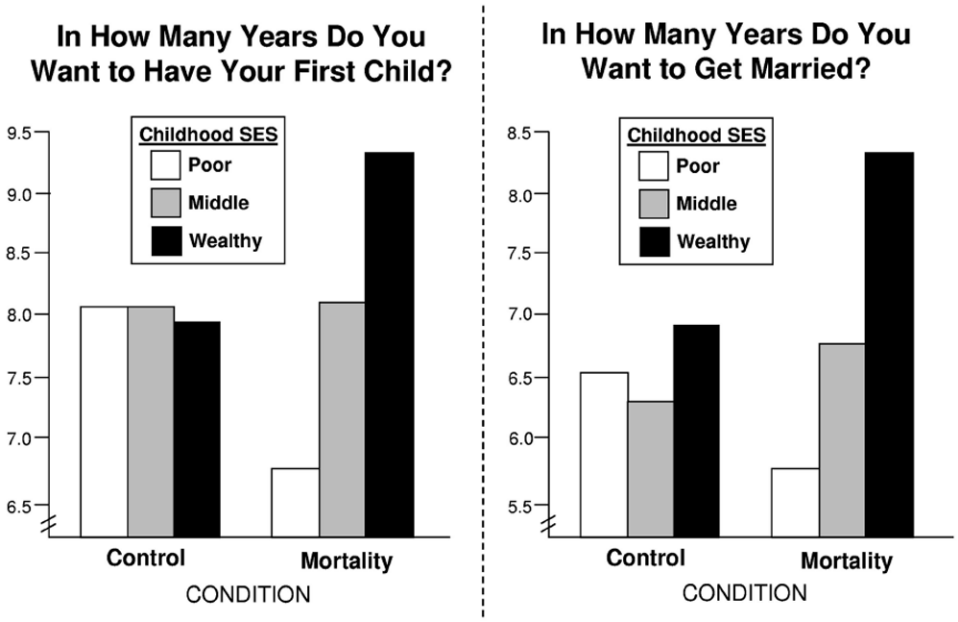

Figure 2.
Number of years in which young adults want to have their first child and get married as a function of mortality cues and childhood socioeconomic status (SES; Study 3). Graphed means represent a trichotomous split of childhood SES.

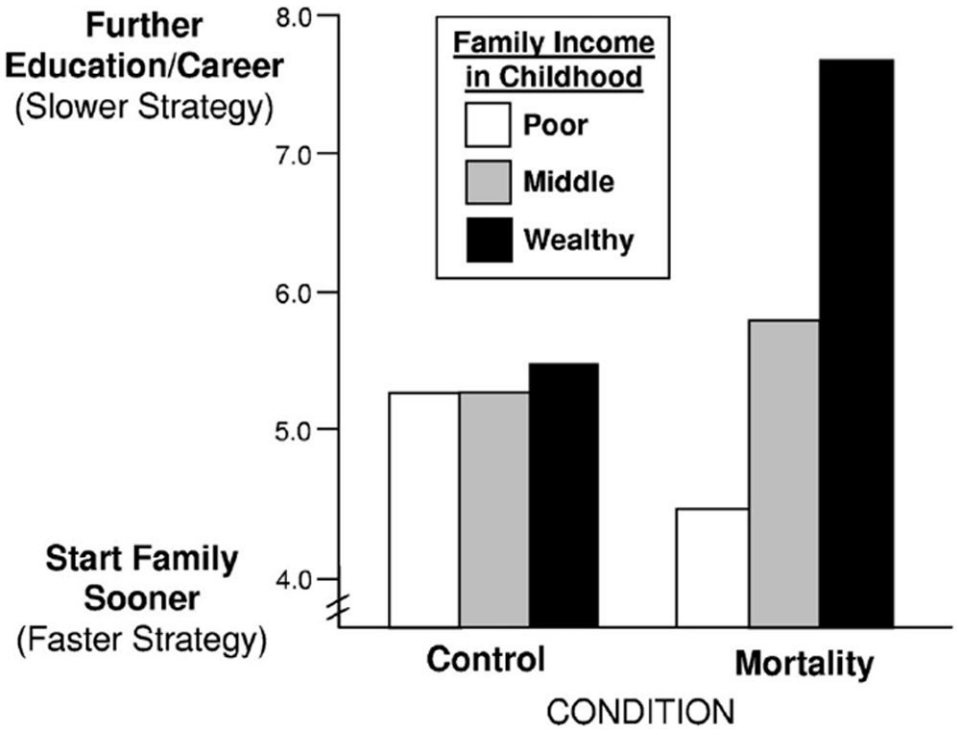

Figure 3.
The tradeoff between starting a family sooner versus investing in one's education and career. The figure shows desires in this trade-off as a function of mortality cues and family income when growing up (Study 4). Graphed means represent a trichotomous split of childhood family income.