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Does the thought of death accelerate a fast life history strategy?: Evaluating a mortality salience prime

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ABSTRACT

The characteristics of the developmental environment can have long-term effects on an individual's metabolism, stress-sensitivity, hormone levels, and gene expression. Life history theory suggests these outcomes can be broadly viewed as individual strategies along a continuum from 'fast' to 'slow', with stressful environments predisposing individuals towards faster, more short-term oriented strategies. Griskevicius et al. (2011a) reported an interaction between childhood socioeconomic status and a mortality prime when measuring economic impulsivity using a delay-discounting task. Specifically, participants who grew up in wealthier homes responded to a mortality prime by becoming less impulsive, while those who grew up less wealthy reacted to the prime by becoming more impulsive. The current study sought to replicate and expand upon these findings using a sample of university undergraduates (66 females and 19 males). Participants were exposed to a mortality prime, an anxiety prime, or a neutral prime before completing a questionnaire that included questions about childhood socioeconomic status and a delay discounting survey. When the results of the delay discounting measure were analyzed, no significant interaction between childhood environment and priming condition was observed. Thus, we failed to replicate the findings of Griskevicius et al. (2011a). We suggest that the limited saliency of the mortality prime may account for this discrepancy, and note that the results of other priming studies have often been difficult to replicate. Limitations and future directions for priming studies and life history research are discussed.

KEYWORDS

Life history, mortality salience, delay discounting, socioeconomic status, impulsivity

Life history theory provides a framework for explaining how organisms allocate energy, resources, and time to maximize optimal reproduction (Gadgil & Bossert, 1970). Resources, energy and even time are finite resources which are distributed in the face of trade-offs. Due to a combination of genetic factors and

environmental cues, each individual develops a life history strategy, which lies on a continuum from fast to slow (Bogaert & Rushton, 1989). An individual who has adopted a faster life history strategy will generally focus more effort on short-term gains and will tend to behave in ways that favor reproducing early and often. Those expressing a fast strategy tend to score higher on scales of risk-taking, sensation-seeking, and impulsivity (Copping, Campbell, & Muncer, 2013). Conversely, a slower life history strategy will involve placing greater emphasis on long-term health (somatic effort) and greater parental investment in a smaller number of offspring (Kaplan & Gangestad, 2005).

There is considerable variation between individuals in the expression of impulsivity, a preference for short-term gains, which can be viewed as one component of life history strategy. Genetic factors undoubtedly account for much of this variation, but the characteristics of the environment also play a significant role (Figueredo, Vasquez, Brumbach, & Schneider, 2004). Recent work in animals points to epigenetic changes set in motion by environmental cues during prenatal and early postnatal development as playing a role in the setting of life history strategy (Cameron, 2011). Thus, there may be a critical developmental window during which the biology of the organism remains flexible and sensitive to environmental signals.

One environmental characteristic that may act as a powerful signal during development is harshness, which is characterized by high morbidity rates, intrasexual competition, and resource scarcity. Unpredictability is a related dimension that reflects stochasticity in harshness over time. Life history theory predicts that harsh and unpredictable environments will lead to the adoption of a faster life history strategy (Ellis, Figueredo, Brumbach, & Schlomer, 2009). In particular, cues that reflect high mortality rates will tend to cause individuals to behave in ways that prioritize immediate financial gains and early reproduction, while avoiding any substantial long-term investment in any particular offspring or resource-related project. Consistent with this prediction, unpredictability and harshness during development has been linked to faster life history strategies in humans (Brumbach, Figueredo, & Ellis, 2009).

An influential study conducted by Griskevicius et al. (2011a) sought to evaluate the relative influence of both the quality of the developmental environment and the situational context at the time of testing on one measure of life history strategy, specifically impulsivity on a delay discounting task. Childhood socioeconomic status (SES) was assessed using three questions: (a) “My family usually had enough money for things when I was growing up”; (b) “I grew up in a relatively wealthy neighborhood”; and (c) “I felt relatively wealthy compared to the other kids in my school.” A seven-point Likert scale was used to assess each participant’s level of agreement with each of the three items. These responses were then averaged to yield a composite childhood SES value for each participant. The situational context was manipulated using a priming condition. A fictitious New York Times article, titled ”Dangerous Times Ahead: Life and Death in the 21st Century”, was engineered to serve as a mortality salience prime. A neutral article about a man who lost his keys served as the control condition, while font and article length were controlled for. Participants were given one of the two articles and then asked

to complete a series of delay discounting questions such as "Do you want $_____ for sure OR a 75% chance to get $900?" and the options ranged from $20 to $550.

The results of Experiment 2 by Griskevicius et al. (2011a) revealed a crossover interaction effect, whereby participants who grew up in wealthier homes responded to a mortality prime by becoming less impulsive on the delay discounting task, while those who grew up less wealthy reacted to the prime by becoming more impulsive. One explanation for this effect is that each individual has a particular life history strategy set during early development, but that this strategy may only come to be expressed when it is triggered by an environmental challenge, in this case a mortality salience prime. Thus, the same prime can cause opposing strategies to be expressed in individuals from differing backgrounds. If this view is correct, it is vital that researchers work to understand the situational factors (e.g., cues indicating high mortality rates) that influence the expression of life history strategies, since failing to prompt the expression of these strategies using the proper cues will likely lead to null findings.

Further research on which types of mortality salience primes can influence the expression of impulsivity and related traits is needed in order for the field to progress. In the current study, we sought to replicate and expand upon the findings of Griskevicius et al. (2011a) using a composition-based priming condition. Since exposure to a mortality prime frequently leads to an increase in anxiety in participants, we added a priming condition designed to produce anxiety without increasing mortality salience. Thus, our participants were asked to write about one of three topics: death (mortality prime), dental pain (anxiety-provoking control), or watching a television rerun (neutral control) before answering a series of questions and completing a delay discounting task. Dental pain was chosen because it is a common, unpleasant experience that has been used as a control condition for mortality primes in previous research (Shatil, 2009). Watching a television rerun was used as a neutral control because it is also a common experience, but one that does not generally provoke anxiety.

METHODS

Eighty-five undergraduate students (19 men and 66 women) participated in the study. Upon entering the research lab, each participant was randomly assigned to one of the three priming conditions. The mortality salience condition (n =28) consisted of writing an open-ended response to both of the following questions: "Please briefly describe the emotions that the thought of your own death arouses in you," and "Please describe, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead." The anxiety condition (n=29) consisted of responding to "Please briefly describe the emotions that the thought of dental pain arouses in you," and "Please describe, as specifically as you can, what you think will happen to you as you experience dental pain," while the neutral condition (n =28) asked participants to "Please briefly describe the emotions that the thought of watching a re-run of a moderately interesting television program arouses in you," and "Please describe, as specifically as you can, what you think will happen to you as you watch that television program."

Childhood SES was assessed via the method previously used by Griskevicius et al. (2011a, 2011b). Participants were asked to indicate their agreement with three statements on a 7-point scale with anchors from 1 (strongly disagree) to 7 (strongly agree): (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." These three values were averaged to yield an overall childhood SES score.

Delay (a.k.a. 'temporal' or 'future') discounting was measured using a series of questions adapted from Bickel, Odum, and Madden (1999). Each item involved asking the participant to make a hypothetical choice between receiving $1000 after a delay period (*one week*, *one month*, or *one year*), or one of 27 monetary amounts *today* ($1000, $990, $960, $920, $850, $800, $750, $700, $650, $600, $550, $500, $450, $400, $350, $300, $250, $200, $150, $100, $80, $60, $40, $20, $10, $5, or $1). For each set delay period, these monetary amounts were varied systematically, first in descending and then in ascending order. The 'indifference point' (the point at which a participant's preference shifted from the smaller, immediate to the larger, future reward) was noted for both the ascending and descending series. More specifically, each participant's response pattern was reviewed and the point at which the preference changed from accepting today's reward to preferring the future reward was noted. The three indifference points for each participant, one for each delay period, were used to calculate overall delay discounting scores. We used the 'area under the curve' (AUC) method developed by Myerson, Green, and Warusawitharana (2001). This method estimates the area beneath the curve that occurs as relatively less value is placed on rewards at successive points in the future. Lower AUC scores are indicative of a steeper drop in value as the delay period increases. Thus, lower scores reflect higher levels of impulsivity (see Lempert et al., 2012 for a more detailed treatment of the process). In cases where the indifference point differed between the ascending and descending series, the midpoint between them was used.

This process was repeated for each participant. However, the response patterns of some participants caused concern. These participants either had an inappropriate response pattern, such as switching indiscriminately between accepting the immediate and future rewards, or they failed to make a selection for each queried reward option. This caused a number of participants to have their delay discounting score dropped from the final analyses (n = 14).

All procedures had received prior approval from the Institutional Review Board. Participants completed all surveys in the laboratory on a computer running Checkbox Survey Software. Data were analyzed using IBM SPSS Statistics 23.

RESULTS

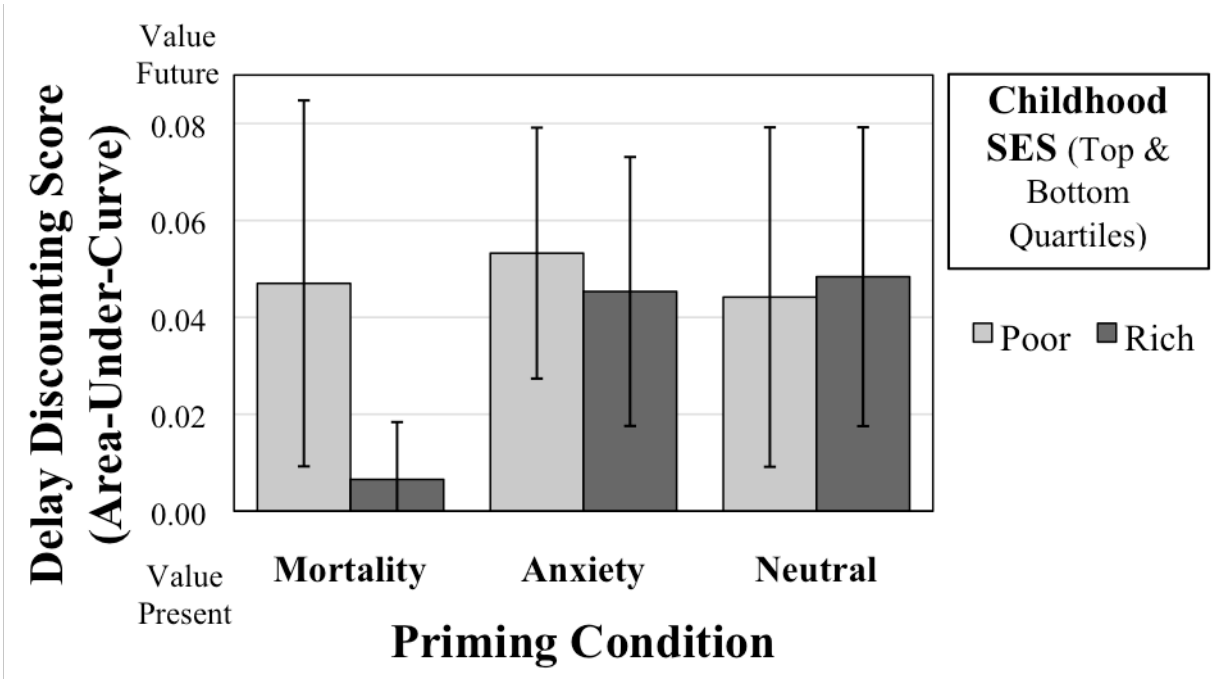
The mean age of the participants was 26.19 years with a standard deviation of 10.63 (positively skewed at 1.40). Four participants did not answer the SES questions, and 14 did not correctly complete the delay discounting series, leaving 68 valid responses.

The delay discounting measure (*N* =71) had a mean AUC score of .050 with a standard deviation of .038 (no significant skewness or kurtosis). Males (*M* =.030, *SD* =.029) were more impulsive than females (*M* =.056, *SD* =.039), and this gender difference was significant (*t* (36.57) = 2.923, *p*=.006).

The three childhood SES questions were averaged to create a Developmental SES variable (*M* =3.34, *SD* =1.30). Following the procedure used by Griskevicius et al. (2011a), we split our sample into quartiles based on composite childhood SES scores and used only the highest and lowest quartile in our analysis. Scores of 4.67 or higher comprised the 'rich' quartile (*N* =21), while scores of 2.33 or lower were considered to be in the 'poor' quartile (*N* =26).

A two-way ANOVA was used to examine the effects of developmental SES (rich vs. poor) and priming condition (mortality, anxiety, or neutral) on impulsivity as reflected by delay discounting scores. There was no main effect of priming condition (*F* (2,34) = 1.166, *p*=.462). There was no main effect of SES (*F* (1,34) = 1.473, *p*=.334). There was no significant interaction (*F* (2,34) = .766, *p*=.473). Thus, we failed to observe the expected interaction between mortality prime and childhood SES in predicting delay discounting rates. Figure 1 displays the mean delay discounting scores (± two standard errors of the mean) for each priming condition, split by childhood SES (rich vs. poor).

Figure 1: Impact of prime and childhood SES on delay discounting scores.



DISCUSSION

Life history theory predicts that signals indicative of a stressful or dangerous environment will tend to shift individuals towards a faster strategy that prioritizes short-term goals and early reproduction. The effect of these signals will generally be greater when they occur early in life, suggesting a critical developmental window during which the environment has its greatest impact on the biological variables associated with a fast vs. slow strategy. This may help to explain why people often react differently to unfavorable signals. For example, some may respond to a downturn in the economy by 'playing it safe' and adopting a low risk strategy, rather than adopting a more high-risk, short-term strategy as both life history theory and optimal foraging theory (MacArthur & Pianka, 1966) would predict.

The results of Griskevicius et al. (2011a) would seem to provide support for an interaction between early and later cues of environmental quality in predicting economic impulsivity. The authors reported that participants who grew up poor reacted to the mortality prime by increasing the degree of impulsivity they displayed, while those who grew up rich reacted to the same mortality prime with decreasing impulsivity. If such an interaction does exist, it is critical that researchers studying life history strategies take it into account, particularly given the absence of main effects from either childhood environment or the prime.

We were unable to replicate the results of Experiment 2 from Griskevicius et al. (2011a). There was no significant interaction between mortality prime and childhood SES in predicting area under the delay discounting curve. Furthermore, impulsivity did not vary systematically as a function of childhood SES or priming condition, as reflected by the absence of any significant main effects.

We suggest that our failure to replicate the previous study is primarily due to methodological concerns, rather than any conceptual flaws in the framework of life history theory. Although recent years have witnessed a great deal of empirical support for life history theory, research utilizing priming conditions has been far more problematic. In particular, there has been a persistent difficulty in terms of replicating significant effects resulting from exposure to primes (see Cesario, 2014). One reason may be that priming effects are highly sensitive to variations in experimental features and subject populations (Cesario, 2014). Thus, while our failure to replicate Griskevicius et al. (2011) does not necessarily cast doubt on the validity of the previous result, it does suggest that this result may not be generalizable across populations, situations, or even across slightly different mortality priming conditions.

Although our design was similar in most respects to Experiment 2 of Griskevicius et al. (2011a), there are some key differences that should be noted. The first is the nature of the priming conditions. The previous paper made use of modified New York Times articles reporting on either increased crime and mortality, or a neutral topic. Given that our participants are primarily from Baltimore city, which receives regular media coverage concerning high rates of homicides and violent crimes, we did not expect that another such news article would have an appreciable effect. Thus, we instead opted to have participants write open-ended responses

concerning the thought of death. As control conditions, some participants were asked to write about dental pain (anxiety without mortality) or watching a TV rerun (no anxiety / no mortality). The responses generated by the participants indicated that they did give serious thought to the assigned topics. Some participants in the mortality condition responded with a sense of dread (e.g., "I think that I would be nervous and scared, simply because I don't know how or when I am going to die.", "Is it painful? Do we know we are dead? Is it scary? Do we ever wake up? Are any of the religions true?"). Others framed their responses in terms of religious beliefs (e.g., "As I die, my flesh will be destroyed and my spirit will be lifted. I will stand before God. My physical body will be gone and my spirit will live forever"). Although our priming conditions did not produce significant effects, it seems unlikely that a mortality prime in the form of a news article would have had any greater impact on our participants than the open-ended form. Nevertheless, there are inherent limitations in using a priming condition to increase mortality salience. At no point were the participants confronted with any immediate threat to their survival or longevity, as ethical considerations would preclude this approach. Thus, we cannot rule out the possibility that our mortality prime was simply not salient enough to have an appreciable impact on our sample.

Our measure of discounting was also somewhat different from that used by Griskevicius et al. (2011a). The format of the questions was similar, but we utilized a more comprehensive array of temporal and monetary choices. While the previous study used a delay period of 90 days, we used periods of one week, one month, and one year. For the immediate reward condition, we used 'today', rather than 'tomorrow' as in the previous study. Reward amounts in the Griskevicius paper ranged from $100 to $170, while ours varied from $1 to $1000. Finally, we presented the varying amounts in both ascending and descending order and used the average crossover points to calculate the area under the discounting curve, whereas the previous paper only assessed the number of times a participant chose the future reward. All of these modifications to the delay discounting scale were based on previous research and would be expected to strengthen, rather than weaken, the validity of the resulting scores.

As the name suggests, life history theory is concerned with the cumulative effects of a lifetime of experiences on an individual's biology and behavior. As such, the relative impact of individual events will vary considerably for each organism. Given this complexity, perhaps it is not surprising that research attempting to connect particular environmental cues to behavioral outcomes often yields inconsistent findings. We applaud the work of Griskevicius et al. (2011a) as a worthwhile attempt at understanding the relative impact of early and later cues on current behavior. However, our results indicate that their findings may not be applicable across populations and situations.

Neither the current study nor Griskevicius et al. (2011a) found a significant main effect of childhood SES on impulsivity in the absence of the mortality prime. However, life history theory predicts that, all other variables controlled for, growing up poorer should lead to higher rates of impulsivity. Thus, it is worth examining whether there may be problems with the validity of the measures used. While there has been a considerable amount of research using similar delay discounting scales, the three childhood SES questions have only been utilized in a limited number of

studies (Griskevicius et al. 2011a, 2011b). Furthermore, there was limited inter-item reliability across the three questions. Responses to the first question, "My family usually had enough money for things when I was growing up," were not significantly correlated with responses to the second question, "I grew up in a relatively wealthy neighborhood," (r (79) =.119, p= .289), nor to responses on the third question, "I felt relatively wealthy compared to the other kids in my school," (r (79) =.182, p=.104). This raises the possibility that these items may reflect distinct constructs that only weakly map onto overall developmental SES. Future research should include additional independent measures of childhood SES in order to refine these self-report questions in ways that enhance their reliability and validity.

In conclusion, we did not find support for the interaction reported by Griskevicius et al. (2011a). We suggest that the effects of mortality priming conditions are often weak and inconsistent across participants. Additionally, we suggest that the current measure of childhood SES may be inadequate for capturing the full range of variation in this construct. Future research should address these concerns and seek to develop better measures for variables relevant to life history research.

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