

Sense of Control Under Uncertainty Depends on People's Childhood Environment: A Life History Theory Approach

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Past research found that environmental uncertainty leads people to behave differently depending on their childhood environment. For example, economic uncertainty leads people from poor childhoods to become more impulsive while leading people from wealthy childhoods to become less impulsive. Drawing on life history theory, we examine the psychological mechanism driving such diverging responses to uncertainty. Five experiments show that uncertainty alters people's sense of control over the environment. Exposure to uncertainty led people from poorer childhoods to have a significantly lower sense of control than those from wealthier childhoods. In addition, perceptions of control statistically mediated the effect of uncertainty on impulsive behavior. These studies contribute by demonstrating that sense of control is a psychological driver of behaviors associated with fast and slow life history strategies. We discuss the implications of this for theory and future research, including that environmental uncertainty might lead people who grew up poor to quit challenging tasks sooner than people who grew up wealthy.

Keywords: resource uncertainty, socioeconomic status, sense of control, life history theory, persistence

When faced with environmental uncertainty, people often respond in different ways depending on their childhood environment (Griskevicius et al., 2013; Griskevicius, Delton, Robertson, & Tybur, 2011; Griskevicius, Tybur, Delton, & Robertson, 2011; Hill, Rodeheffer, DelPriore, & Butterfield, 2013; White, Li, Griskevicius, Neuberg, & Kenrick, 2013). For example, a sense of economic uncertainty leads people from poorer childhoods to become more impulsive and seek immediate gratification, whereas it leads people from wealthier childhoods to become less impulsive and delay gratification (Griskevicius et al., 2013).

The evolutionary reasons for why people from different childhood backgrounds respond to uncertainty in this way are relatively straightforward. According to life history theory (Kaplan & Gangestad, 2005; Stearns, 1992), the nature of an individual's childhood environment disposes that individual to adopt a *fast* or a *slow* life history strategy (Belsky, 2012; Ellis, Figueredo, Brumbach, & Schlomer, 2009; Figueredo, Vásquez, Brumbach, & Schneider, 2004; Nettle, 2010). The behavioral tendencies associated with each strategy are especially likely to emerge in stressful contexts (Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011).

But although previous research has illuminated the evolutionary function of such behaviors (we know why they exist), much less is known about the psychological mechanism that drives them (we

do not know how they work). The current studies seek to identify the psychological process that leads people from different childhood backgrounds to respond to the same stressor in different ways. Building on the notion that environmental threats can be extrinsic and therefore uncontrollable or intrinsic and therefore controllable, we propose that people from different childhood backgrounds may perceive the same environmental threat as relatively controllable or uncontrollable. We therefore test how people's perceptions of control are influenced by environmental uncertainty as a function of their childhood environment.

Five experiments demonstrate that exposure to environmental uncertainty alters people's sense of control. The nature of this effect depends on a person's childhood background, with people from poorer childhood backgrounds perceiving that they have substantially less control over the environment compared to those from wealthier childhoods. Furthermore, we show that these differing perceptions of control statistically mediate the effect of environmental uncertainty on delay of gratification. In fact, temporarily boosting people's sense of control prevents people from poorer backgrounds from becoming more impulsive in uncertain conditions. This research contributes by demonstrating that sense of control is a psychological driver of behaviors associated with fast and slow life history strategies. These findings also have important implications for theory and future research, including that uncertainty might lead people who grew up poor to quit challenging tasks sooner than people who grew up wealthy.

Life History Theory: Fast and Slow Strategies

All organisms have limited resources. How organisms allocate those resources to various fitness-enhancing activities is studied by a branch of evolutionary biology known as life history theory

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(Kaplan & Gangestad, 2005; Stearns, 1992). According to life history theory, all organisms face tradeoffs regarding which fitness-enhancing activities to prioritize. For example, individuals face a key tradeoff between allocating resources to somatic effort versus reproductive effort. Somatic effort refers to investing resources in the growth and maintenance of one's body and mind, which includes the acquisition of knowledge, skills, and other types of embodied capital. Reproductive effort refers to allocating resources to activities that enhance the possibility of immediate reproductive success, such as intrasexual competition and mate acquisition. Whereas somatic effort is like building a savings account, reproductive effort is like spending from that account in ways to improve the likelihood of immediate reproductive success.

How a given individual resolves various life history tradeoffs reflects that individual's *life history strategy*. Life history strategies vary on a slow-to-fast continuum, with some individuals following slower and others following faster strategies (Ellis et al., 2009; Figueredo et al., 2004; Nettle, 2010; Promislow & Harvey, 1990). Slower strategies prioritize somatic effort over reproductive effort, meaning that they are associated with later sexual maturation and producing offspring at a later age. Conversely, faster strategies prioritize reproductive effort over somatic effort, meaning that they are associated with earlier sexual maturation and producing offspring at an earlier age (Belsky, Steinberg, & Draper, 1991; Ellis, 2004).

Fast and slow strategies have important consequences for many aspects of people's lives (Griskevicius et al., 2013; Sherman, Figueredo, & Funder, 2013; Sih & Del Giudice, 2012). An overarching distinction between fast versus slow strategists is their willingness to delay immediate gratification (Griskevicius, Tybur, et al., 2011). Slow strategists tend to be long-term planners who are willing to delay immediate gratification to increase future payoffs. By contrast, fast strategists tend to be short-term opportunists who take immediate benefits with little regard for long-term consequences (Chisholm, 1999; Daly & Wilson, 2005).

A central point of life history theory is that willingness to delay gratification is neither inherently good nor bad. Instead, the adaptiveness of fast and slow strategies depends on the environment (Belsky et al., 1991; Caudell & Quinlan, 2012). Faster strategies are adaptive in environments that are harsh and unpredictable (Ellis et al., 2009). Because the future is uncertain and delayed payoffs may never be realized in such environments, it is adaptive for organisms to enact faster strategies that increase the odds of reproducing sooner. Conversely, when harshness and unpredictability are lower or can be managed, slower strategies become adaptive (Ellis et al., 2009). Because the future is more predictable and individuals tend to live longer in such ecologies, it can be adaptive for organisms to enact slower strategies that delay immediate reproductive effort to invest in future outcomes.

Contingent Expression of Fast and Slow Strategy Behaviors

Individual differences in life history strategies develop partly in response to early-life experiences, with harsh and unpredictable childhood environments shunting individuals down faster trajectories (Belsky, Schlomer, & Ellis, 2012; Belsky et al., 1991; Del Giudice, Ellis, & Shirlcliff, 2011; Simpson, Griskevicius, Kuo, Sung, & Collins, 2012). For example, early-life environments characterized by higher levels of unpredictability and harshness

speed up the timing of individuals' physiological development and sexual maturation (Belsky et al. 1991; Ellis, 2004) while also predicting earlier ages at which people have their first child (Low, Hazel, Parker, & Welch, 2008; Nettle, Coall, & Dickins, 2011; Wilson & Daly, 1997). The effects of childhood environment on life history strategies persist even when controlling for genetic factors (Belsky, Houts, & Fearon, 2010; Tither & Ellis, 2008).

A proxy marker of exposure to harshness and unpredictability in early life is childhood socioeconomic status (SES; Chen & Miller, 2012; Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; White et al., 2013). Whereas *high*-SES childhood environments tend to be less harsh and less unpredictable, *low*-SES environments tend to be more harsh and more unpredictable (Brady & Matthews, 2002; Leventhal & Brooks-Gunn, 2000; Repetti, Taylor, & Seeman, 2002; Troxel & Matthews, 2004). For example, individuals growing up in lower SES environments experience higher levels of morbidity–mortality and have greater exposure to premature disability and death (Adler et al., 1994; Miller, Chen, & Parker, 2011). Low-SES children also have less stability in their day-to-day life and have more chaotic and unpredictable home environments (Evans, 2004; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005; Jensen, James, Boyce, & Hartnett, 1983; Matheny, Wachs, Ludwig, & Phillips, 1995). Thus, whereas individuals reared in lower SES environments are more likely to enact a faster life history strategy, those reared in higher SES environments are more likely to enact a slower strategy.

Building on nonhuman animal findings (Bagot et al., 2009; Champagne et al., 2008), Griskevicius and colleagues (Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011) proposed that people's childhood environment can sensitize life history strategies, whereby behavioral tendencies associated with slow versus fast strategies are especially likely to emerge in times of duress. Behavioral tendencies associated with fast and slow strategies may lie dormant when conditions are benign. For example, adults who experienced different childhood environments may often behave relatively similarly when *current* levels of stress are low. But these same individuals should diverge in life history–relevant behaviors when facing stress in their current adult environment.

Multiple findings have found support for the sensitization model of life history strategies (Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011; Hill et al., 2013; Piff, Stancato, Martinez, Kraus, & Keltner, 2012; White et al., 2013). For instance, reading news articles about environmental uncertainty led people from high-SES childhoods to exhibit slower strategy responses: They became less impulsive, took fewer risks, sought to delay reproduction, and prioritized quality over quantity. By contrast, people from low-SES childhood environments responded to the same environmental stressors by exhibiting the opposite pattern: They became more impulsive, took more risk, sought to have children sooner in life, and prioritized quantity over quality.

An important feature of these experimental findings is that responses to current environmental stressors differ as a function of people's *childhood* SES more strongly than their current adult SES. Consistent with previous research (e.g., Belsky et al. 1991; Ellis, 2004), these experimental findings suggest that the childhood environment is particularly important in shaping adult life history strategies. In fact, the same diverging pattern also emerged as a function of people's level of oxidative stress (Griskevicius et al., 2013; White et al., 2013), which is believed to be a physiological marker of the

cumulative tumultuousness in one's environment throughout one's life (Gangestad, Merriman, & Emery Thompson, 2010).

In summary, people from high-SES childhood environments respond to stressors in their current adult environment by enacting a slower strategy, whereas people from low-SES childhood environments respond by enacting a faster strategy. The current research considered a psychological mechanism that could explain the process of how individuals from different childhood backgrounds respond to the same environmental stressor in different ways. We began by investigating the nature of two very different types of environmental threats.

Extrinsic Versus Intrinsic Threats

One of the most robust findings across species is that harsh and unpredictable ecologies favor organisms to adopt faster strategies (Chisholm, 1993, 1999; Roff, 2002; Stearns, 1992). For example, exposing Western toad tadpoles to cues indicating a high-predation environment produces a shift toward a faster life history strategy, leading the tadpoles to metamorphose faster (Chivers, Kiesecker, Marco, Wildy, & Blaustein, 1999). These kinds of high-predation ecologies reflect high levels of extrinsic mortality, where *extrinsic* threats refers to threats that are equally shared by all members of a population (Quinlan, 2010). High levels of extrinsic mortality mean that an organism cannot escape danger by changing its behavior. In the case of the tadpole, for example, there is nothing it can do to decrease the chances of being eaten, so its best evolutionary bet is to reproduce sooner. Accordingly, high extrinsic mortality favors faster strategies because no amount of somatic investment can shield individuals against such threats.

Extrinsic threats are critically different from intrinsic threats. *Intrinsic* threats refer to threats that are *not* equally shared by all members of a population (Quinlan, 2010). High levels of intrinsic mortality mean that an organism *can* avoid danger by investing in somatic effort. For example, consider juvenile three-spined sticklebacks, which are less likely to be predated upon if they are bigger rather than smaller. Exposure to high-predation environments leads juvenile sticklebacks to invest more in somatic growth because larger individuals are more likely to survive predation (Bell, Dingemanse, Hankison, Langenhof, & Rollins, 2011). Thus, ecologies with high levels of intrinsic threat such as those of sticklebacks favor slower life history strategies because investing additional resources in somatic effort can effectively shield individuals against uncertainty (Quinlan, 2010).

The distinction between extrinsic versus intrinsic threat is important because it highlights that different types of environmental threats favor different life history strategies. We propose that this distinction may be at the root of why some people respond to an environmental threat by enacting a faster strategy, whereas others respond by enacting a slower strategy. We hypothesize that individuals reared in harsh and unpredictable environments (low-SES childhoods) are more likely to perceive an environmental threat as extrinsic. When faced with environmental uncertainty, for example, such fast strategists may assume that they *cannot* shield themselves from this uncertainty. Conversely, individuals reared in less harsh and predictable environments (high-SES childhoods) may perceive the *same* threat as intrinsic. When faced with the same type of environmental uncertainty, such slow strategists may assume that they *can* shield themselves from this uncertainty by changing their behavior.

To investigate whether this possibility is plausible, we first conducted a pilot study, which is reported below. The findings from the pilot study served as the empirical foundation for deriving specific predictions for the five experiments presented later in the article.

Pilot Study: Perceiving the Same Threat as Extrinsic Versus Intrinsic

The pilot study examined whether individuals from lower SES childhoods are more likely to perceive an environmental threat as extrinsic and therefore unavoidable, whereas individuals from high-SES childhoods are more likely to perceive the same threat as intrinsic and therefore avoidable. Thirty-seven participants (13 men, 24 women) were recruited from Amazon's Mechanical Turk (MTurk) for participation in an online study in return for a small monetary payment. Mean age of participants was 32.0 years ($SD = 9.00$). Because past research has found that reading a news article about economic uncertainty leads people to behave in opposite ways depending on their childhood SES (Griskevicius et al., 2013), we examined whether people's perceptions of this article might differ depending on their childhood SES.

All participants first read the same economic uncertainty news article as used in previous research (Griskevicius et al., 2013). The article was titled "Tough Times Ahead: The New Economics of the 21st Century." Participants were told that the article had recently appeared in *The New York Times*, and the article was formatted to look like a web article from the *New York Times* website. The article described recent examples of economic turmoil and highlighted the increasing sense of economic uncertainty. Consistent with the cover story used in previous studies (Griskevicius et al., 2013; Hill, Rodeheffer, Griskevicius, Durante, & White, 2012), participants were told that the study was about memory. Participants were told that they would be asked to recall aspects of the article a few minutes after they had read it. In the meantime, they were asked to respond to other questions.

After reading the article, participants indicated the extent to which they thought the environment was difficult and uncertain. Specifically, they indicated their agreement with three items on a 7-point scale anchored at *Not at all* and *Definitely*: (a) Today's world is more unpredictable than before, (b) today's world is tougher than before, and (c) today's world is harsher than before. These three items were aggregated into an *uncertainty* index ($\alpha = .72$).

To assess whether people perceived this uncertainty as avoidable versus unavoidable, participants indicated their agreement with three other items using the same scale with the same labels: (a) I can do things to avoid many of the negative effects of this new reality, (b) I can engage in behavior to minimize the negative effects of the economy, and (c) I have the ability to cope with the increasing economic uncertainty. These three items were aggregated into an *avoidability* index ($\alpha = .75$).

Participants also indicated both their childhood SES and their current SES by reporting household income (e.g., Griskevicius et al., 2013; Griskevicius, Delton, et al. 2011; White et al., 2013). For childhood SES, participants responded to "What was your household income when you were growing up?" They were provided with eight response options: \$15,000 or less, \$15,001–\$25,000, \$25,001–\$35,000, \$35,001–\$50,000, \$50,001–\$75,000, \$75,001–\$100,000, \$100,001–\$150,000, and \$150,000 or more. Median childhood household income was \$25,001–\$35,000, with 43.0% of

participants indicating less than \$25,000 and 16.2% indicating more than \$75,000. Current SES was assessed by asking, "What is your current household income?" Participants were provided with the same response options. Median current household income was \$25,001–\$35,000, with 48.6% indicating less than \$25,000 and 8.1% indicating more than \$75,000.

Findings showed that exposure to the news article about economic uncertainty led people to perceive the environment as relatively uncertain ($M = 4.77$, $SD = 1.42$). Perceptions of uncertainty did not differ significantly among participants as a function of their childhood SES ($r = -.15$, $p = .37$) or their current SES ($r = .18$, $p = .29$). However, people's perceptions of being able to avoid uncertainty did differ as a function of their childhood SES. The wealthier the people's childhoods, the more they perceived the current uncertainty as avoidable ($r = .33$, $p = .049$). In fact, whereas people from poor childhood backgrounds were below the midpoint of the avoidability measure ($M = 3.68$ for people 1 SD below the mean of childhood SES), people from wealthy childhood backgrounds were above the midpoint of the avoidability measure ($M = 4.43$ for people 1 SD above the mean of childhood SES). Furthermore, this avoidability finding was stronger with regard to childhood SES rather than current SES. The relation between perceptions of avoidability and current SES did not reach significance ($r = .20$, $p = .24$), although it was expectedly in the same direction.

In summary, the pilot study showed a relation between childhood SES and perceptions of environmental uncertainty in adulthood as avoidable versus unavoidable. Whereas individuals from lower SES backgrounds perceived increasing levels of environmental uncertainty as relatively unavoidable, people from high-SES childhood environments perceived them as relatively avoidable. Consistent with past research, this effect was stronger for childhood SES than for current SES. Furthermore, all types of people perceived the environment as similarly uncertain. This means that although people from both low-SES and high-SES childhoods perceived the situation as uncertain, they differed in their perceptions regarding whether they could or could not do something about this uncertainty. These findings provide initial support for the idea that the same environmental threat might be perceived as extrinsic versus intrinsic depending on a person's childhood environment.

Life History Strategies and Sense of Control

A central difference between threats that are extrinsic versus intrinsic is an individual's ability to control his or her destiny. Whereas extrinsic threats are uncontrollable, intrinsic threats are controllable (Quinlan, 2010). Given that people from different childhood environments differ in the extent to which they perceive threats as extrinsic versus intrinsic, we propose that fast and slow strategists might respond to environmental uncertainty by differing in their sense of control.

Sense of control is the belief that an individual has the capability to shape his or her life (Gurin, Gurin, & Morrison, 1978; Kay, Whitson, Gaucher, & Galinsky, 2009; Lachman & Weaver, 1998). Sense of control has long been a topic of interest in psychology (Averill, 1973; Folkman, 1984; Skinner, 1996). We propose that sense of control might be the psychological driver of behavioral tendencies associated with fast and slow life history strategies.

We hypothesize that exposure to environmental uncertainty should lead people from poorer childhoods to have a lower sense of control compared to those from wealthier childhoods. This lower sense of control should serve to facilitate fast-strategy behaviors such as decreased willingness to delay gratification (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011). After all, if people feel that they have little control over what happens in their life, then an increased sense of uncertainty should lead them to discount the future and instead maximize more immediate rewards.

Conversely, when the environment is uncertain, people from wealthier compared to poorer childhoods should have a higher sense of control. Because individuals with a higher sense of control are more likely to effectively cope with stressors (Compas, Banez, Malcarne, & Worsham, 1991; Folkman, 1984; Frazier et al., 2011), a higher sense of control should serve to facilitate slow-strategy behaviors such as increased willingness to delay gratification (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011). After all, if people feel that they have control over what happens in their life (even when the environment is uncertain), such people should be more willing to delay immediate gratification in order to maximize long-term benefits.

There are additional reasons to believe that sense of control may be a key psychological driver of fast and slow life history behaviors. Past correlational findings suggest a link between sense of control and SES, with lower SES individuals having a lower sense of control (Adler et al., 1994; Gurin et al., 1978; Lachman & Weaver, 1998). Lower SES individuals also tend to explain events more in terms of causes external to them rather than within them (Kraus, Piff, & Keltner, 2009), and higher sense of control is associated with slow life history strategy outcomes such as higher academic achievement and better health (Lachman & Weaver, 1998; Langer & Rodin, 1976; Rodin, 1986; Seligman, 1975; Skinner, Wellborn, & Connell, 1990). We contend that the critical difference in sense of control between people from high-SES versus low-SES backgrounds emerge specifically in conditions of environmental uncertainty, whereby these differences in sense of control drive behaviors associated with fast and slow life history strategies.

Research Overview

Five experiments tested how exposure to economic uncertainty influences people's sense of control. Study 1 tested our central hypothesis: Exposure to uncertainty should lead people from poorer compared to wealthier childhoods to have a lower sense of control. Study 2 sought to replicate and extend this effect by showing that economic uncertainty alters perceptions of *personal* sense of control but not perceptions of other people's control of their lives.

Studies 3 and 4 tested whether sense of control is the psychological mechanism driving behaviors associated with fast and slow life history strategies. Study 3 tested whether sense of control statistically mediates the relationship between economic uncertainty and delay of gratification. Study 4 tested whether experimentally boosting people's sense of control would change how economic uncertainty influences delay of gratification. Finally, Study 5 investigated an important behavioral ramification of sense of control, testing how economic uncertainty influences persistence on a challenging task depending on a person's childhood environment.

Study 1: Economic Uncertainty and Sense of Control

Study 1 tested whether exposure to cues of economic uncertainty influences people's sense of control. We hypothesized that whereas people from different childhood backgrounds are unlikely to differ in their sense of control when current conditions are benign (in the control condition), exposure to uncertainty should lead people from poorer compared to wealthier childhoods to have a significantly lower sense of control.

Method

Participants. Ninety-five individuals (36 men, 58 women, and one who declined to indicate) were recruited for an online study using MTurk in exchange for a small monetary amount. Mean age of participants was 32.6 years ($SD = 11.97$).

Design and procedure. Participants were randomly assigned to one of two experimental conditions: economic uncertainty or control. In the economic uncertainty condition, participants viewed a series of photos with captions used in previous research that successfully manipulated economic uncertainty (Griskevicius et al., 2013; Hill et al., 2012). Specifically, participants viewed images depicting economic uncertainty, including unemployment lines, home foreclosure signs, and empty office buildings. Each visual image was accompanied by a brief caption such as "Despite some job gains, many big employers continue to downsize their workforce or lay off workers" and "The unemployment rate has remained high for years and shows little sign of going down any time soon." In the control condition, participants viewed a series of images depicting objects found in an office such as staplers, paper clips, and binders. The captions in the control condition described the objects in each photo.

As a cover story, participants were told that the session consisted of several different tasks related to visual information processing and memory. Participants were told that they would be given a memory test about the slideshow later in the session. To ostensibly allow a few minutes for memory decay after seeing the slides, participants responded to ostensibly unrelated questions about sense of control before being asked questions about memory.

Sense of control. Sense of control was measured using the established four-item measure from Lachman and Weaver (1998). Participants indicated their agreement with the following statements: (a) I can do just about anything that I really set my mind to; (b) whatever happens in the future mostly depends on me; (c) when I really want to do something, I usually find a way to succeed at it; and (d) whether or not I am able to get what I want is in my own hands. Responses for each item were provided on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). The four items were aggregated into a control index ($\alpha = .86$).

Childhood socioeconomic status. Childhood SES and current SES were assessed using established measures (see Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011; White et al., 2013). To assess childhood SES, participants indicated their agreement with three statements ($\alpha = .84$): "My family usually had enough money for things when I was growing up," "I grew up in a relatively wealthy neighborhood," and "I felt relatively wealthy compared to the other kids in my school." Participants also indicated their household income when growing up, as in the pilot study.

To assess current SES, participants indicated their agreement with three statements ($\alpha = .86$): "I have enough money to buy things I want," "I don't need to worry too much about paying my bills," and "I feel relatively wealthy these days." All responses were provided on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). The childhood SES and current SES measures were modestly correlated ($r = .37$), but a factor analysis indicated that these factors were empirically distinct as shown in multiple previous studies (Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011).

Results and Discussion

To test how economic uncertainty influenced sense of control, we used a general linear model (GLM) approach. Sense of control was entered as the outcome variable, condition (control vs. economic uncertainty) was entered as a dummy-coded categorical variable, and each type of SES was centered and entered as a continuous variable. Findings showed no significant main effect of condition or either type of SES. As depicted in Figure 1, however, analyses revealed the predicted interaction with condition and childhood SES. The same interaction emerged regardless of whether childhood SES was measured via the three-item relative SES index, $F(1, 91) = 8.56, p = .004, \eta_p^2 = .09$, or the childhood household income measure, $F(1, 91) = 3.73, p = .056, \eta_p^2 = .04$. Furthermore, this interaction remained significant even when current SES was entered in the model simultaneously, $F(1, 90) = 9.32, p = .003, \eta_p^2 = .09$. Current SES did not interact with condition.

We hypothesized that people from poorer compared to wealthier childhoods should have a significantly lower sense of control specifically in the economic uncertainty condition. Indeed, there was no difference in sense of control between the two groups in the control condition ($\beta = -.14, p = .34$). However, there was a significant difference in sense of control in the economic uncertainty condition. As seen in Figure 1, individuals from low-SES childhoods indicated a significantly lower sense of control than those from high-SES childhoods in the economic uncertainty condition ($\beta = .46, p = .002$).

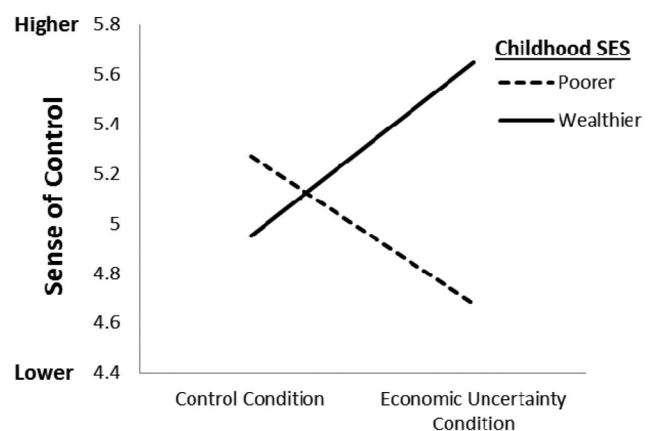


Figure 1. Sense of control as a function of exposure to economic uncertainty and childhood SES (Study 1). Graphed means represent one standard deviation above and below the mean of childhood SES. SES = socioeconomic status.

In addition, we also tested for effects of condition for individuals who grew up relatively wealthy or poor (at ± 1 *SD* from the mean of childhood SES) by testing the significance of simple slopes (Aiken & West, 1991). Findings showed people from wealthier backgrounds (at 1 *SD* above the mean of childhood SES) reported greater sense of control in the economic uncertainty relative to the control condition, $t(91) = 2.25, p = .027$. Conversely, people from poorer backgrounds (at 1 *SD* below the mean of childhood SES) reported lower sense of control in the economic uncertainty relative to the control condition, $t(91) = 1.90, p = .06$.

In summary, Study 1 showed that exposure to economic uncertainty had a markedly different effect on people's sense of control depending on their childhood environment. Whereas people from poor and wealthy childhood backgrounds did not differ in their sense of control in the control condition, economic uncertainty led people from poorer compared to wealthier childhoods to have a significantly lower sense of control. In addition, test of simple slopes showed that whereas economic uncertainty decreased sense of personal control for individuals reared in lower SES environments, it increased sense of personal control for individuals reared in higher SES environments. Consistent with past research (Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011; White et al., 2013), these diverging effects were driven by childhood SES rather than people's current levels of SES.

Study 2: Personal Versus General Sense of Control

Study 2 sought to conceptually replicate and extend the findings from the Study 1. Study 2 tested whether the effects of economic uncertainty are specific to people's *personal* sense of control as opposed to more general perceptions about other people's sense of control. We sought to disentangle these effects because it is possible that the findings in Study 1 simply reflect a general sense of pessimism or optimism, rather than personal control. If so, economic uncertainty should not simply lead to a shift in their personal sense of control; it should also lead people to feel that others have more or less control over the environment. But if environmental uncertainty alters only one's personal sense of control, as predicted by our model, then uncertainty should produce different patterns for personal and nonpersonal sense of control.

In addition, Study 2 also examined whether environmental uncertainty would produce the same diverging pattern of findings of sense of control using a different validated measure of control used in behavioral economics (Dew & Xiao, 2011). We hypothesized that this more financially focused measure of personal control would show the identical diverging pattern of findings as the more general personal control measure used in Study 1.

Method

Participants. Eighty-four individuals (27 men, 57 women) from MTurk participated in exchange for a small monetary amount. Mean age of participants was 33.8 years ($SD = 11.76$).

Procedure. The experiment had a 2 (condition: economic uncertainty and control) \times 2 (type of control: personal control and others' control) mixed design. Condition was a between-subjects variable; type of control was a within-subjects variable.

In the economic uncertainty condition, participants read the same news article as used in the pilot study (based on Hill et al., 2012, and Griskevicius et al., 2013). In the control condition, participants read an article about doing laundry. The control article goes through the steps of doing laundry, including measuring the detergent, finding the correct setting on the washing machine, and switching the clothes from the washer to the dryer. Past research has found that this manipulation produces a neutral affective state (Griskevicius, Shiota, & Nowlis, 2010). The current study used the same cover story as past studies, which is described in the pilot study.

Sense of control. To assess sense of control, participants responded to a six-item measure of sense of personal financial control adapted from the validated Financial Management Behavior Scale (Dew & Xiao, 2011). Specifically, the items were (a) to what extent are you able to control how much debt you have, (b) to what extent are you in control of your spending, (c) to what extent are you able to control how much money you save each month, (d) how capable are you of paying all your bills on time, (e) how capable are you of saving some money each month, and (f) how capable are you of staying within your spending budget? Responses were provided on a 7-point scale with anchors 1 (*not at all*) to 7 (*very capable/very much in control*). The six items were aggregated to form a *personal control* index ($\alpha = .89$).

To assess others' sense of control, participants responded to the same six items, except that each item was reworded to reflect other people's behaviors. Specifically, (a) to what extent are other people able to control how much money they save each month, (b) to what extent are other people able to control how much debt they have, (c) to what extent are other people in control of their spending, (d) how capable are other people of paying all their bills on time, (e) how capable are other people of saving some money each month, and (f) how capable are other people of staying within their spending budget? Responses were provided on a 7-point scale anchored at 1 (*not at all*) and 7 (*very capable/very much in control*). The six items were aggregated to form an *others' control* index ($\alpha = .85$).

Childhood socioeconomic status. To assess childhood SES, participants were asked, "What was your household income when you were growing up?" Participants were provided with eight options: \$15,000 or less, \$15,001–\$25,000, \$25,001–\$35,000, \$35,001–\$50,000, \$50,001–\$75,000, \$75,001–\$100,000, \$100,001–\$150,000, and \$150,000 or more. Median childhood household income was \$35,001–\$50,000, with 25.0% of participants indicating less than \$25,000 and 21.5% indicating more than \$75,000. In addition, participants also indicated their relative SES via the same three items as in Study 1. Current SES was assessed by asking, "What is your current household income?" Participants were provided with the same eight response options. Median current household income was \$35,001–\$50,000, with 29.8% indicating less than \$25,000 and 12% indicating more than \$75,000.

Results and Discussion

We again used a GLM approach to test our predictions. Type of control was entered as categorical within-subject variable, condition was entered as a between-subjects categorical variable, and each type of SES was centered and entered as a continuous variable. Findings showed no main effects of condition or either

type of SES. However, as depicted in Figure 2, analyses revealed the expected three-way interaction with condition, type of control, and childhood SES. The same interaction emerged regardless of whether childhood SES was measured via household income, $F(1, 80) = 9.59, p = .003, \eta_p^2 = .11$, or via the three-item relative SES index, $F(1, 80) = 8.88, p = .004, \eta_p^2 = .10$. There was no significant three-way interaction with current SES, condition, and type of control, $F(1, 80) = .57, p = .45$. To test our specific predictions, we next performed separate analyses for each type of control.

For *personal* sense of control, there was no significant main effect of economic uncertainty or either type of SES. However, findings revealed the predicted Condition \times Childhood SES interaction, $F(1, 80) = 10.14, p = .002, \eta_p^2 = .11$. There was again no difference in sense of personal control between the two groups in the control condition ($\beta = -.22, p = .16$). However, there was a significant difference in the economic uncertainty condition. As seen in Figure 2, individuals from low-SES childhoods showed a lower sense of personal control than those from high-SES childhoods in the economic uncertainty condition ($\beta = .41, p = .007$).

Tests of simple slopes again revealed that people from wealthier backgrounds (1 *SD* above the mean of childhood SES) felt significantly *more* control in the economic uncertainty condition than in the control condition, $t(80) = 2.04, p = .044$. Conversely, people from poorer backgrounds (1 *SD* below the mean of childhood SES) felt significantly *less* control in the economic uncertainty than in

the control condition, $t(80) = 2.54, p = .012$. Furthermore, despite a moderate correlation between childhood SES and current SES ($r = .29$), the effects of economic uncertainty once again did not vary as a function of current SES. And the Condition \times Childhood SES interaction remained significant even when current SES was entered in the model simultaneously, $F(1, 79) = 11.16, p = .001, \eta_p^2 = .12$.

In contrast to the findings for *personal* sense of control, economic uncertainty produced a very different pattern of findings for *others'* sense of control. Analyses did not reveal any interactions with childhood SES ($p = .91$) or with current SES ($p = .18$). As seen in Figure 2, economic uncertainty led everyone to perceive that other people would have slightly less control, although this main effect did not reach significance ($p = .21$).

In summary, despite varying the manipulation of economic uncertainty and varying the measure of personal control, Study 2 conceptually replicated the very specific finding from Study 1. Economic uncertainty once again led people to have a lower sense of control for individuals reared in lower SES compared to higher SES environments. In addition, Study 2 showed that this effect is specific to people's personal sense of control rather than their more general perceptions about everyone's level of control.

Study 3: The Mediating Role of Sense of Control

Study 3 investigated whether sense of control statistically mediates behaviors associated with fast and slow life history strategies. As discussed earlier, life history theory highlights that fast and slow strategists differ in impulsivity, with fast strategists being less willing to delay gratification relative to slow strategists (Ellis et al., 2009; Figueredo et al., 2004). Accordingly, multiple experimental studies have shown that whereas people from high-SES and low-SES childhoods generally do not differ in impulsivity in benign conditions (in the control experimental condition), exposure to environmental uncertainty leads people from low-SES childhoods to become significantly more impulsive compared to people from high-SES childhoods (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011). Study 3 therefore tested whether the effect of economic uncertainty on impulsivity is statistically mediated by psychological shifts in sense of control.

Method

Participants. One-hundred and fifty individuals (56 men, 94 women) from MTurk participated for a small monetary amount. Mean age of participants was 32.9 years ($SD = 12.05$).

Design and procedure. Participants were randomly assigned to an economic uncertainty or a control condition, both of which were manipulated via the same photo slideshow as in Study 1. Sense of personal control was assessed using the same set of six items as in Study 2 ($\alpha = .90$).

Impulsivity. To assess delay of gratification, we used established measures of impulsivity from past research (Green & Myerson, 2004; Griskevicius et al., 2012). Participants made a series of five choices (presented in random order) between receiving a specific amount of money tomorrow versus receiving a larger amount of money 33 days from now. For example, do you want \$28 tomorrow OR \$62 in 33 days? The amount to be received tomorrow varied from \$28 to \$58, whereas the amount to be

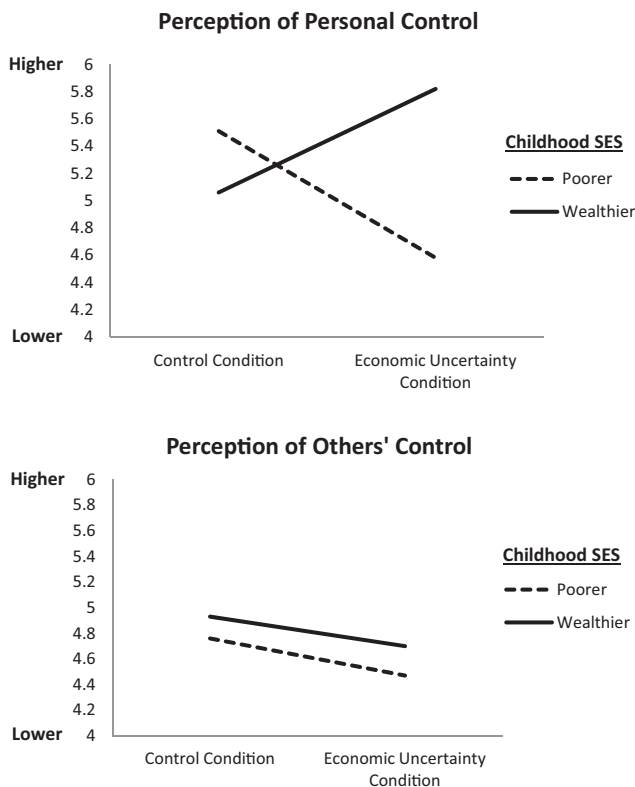


Figure 2. Perceptions of personal control and others' control as a function of economic uncertainty and childhood SES (Study 2). Graphed means represent one standard deviation above and below the mean of childhood SES. SES = socioeconomic status.

received in 33 days varied from \$62 to \$87. Responses were aggregated into an *impulsivity* index ($\alpha = .85$).

Childhood socioeconomic status. Childhood SES was measured using the established family resource scale (Rindfleisch, Burroughs, & Denton, 1997). This validated measure assesses the extent to which people feel they had adequate or inadequate resources when they were growing up, including clothing, spending money, and food ($\alpha = .88$). Participants also reported their childhood SES via the same two measures as used in the first two studies.

Results and Discussion

Sense of control. We first tested the effects of economic uncertainty and childhood SES on sense of control. There was no main effect of condition on control. However, we found a significant main effect of childhood SES on sense of control, $F(1, 147) = 8.04, p = .004, \eta_p^2 = .05$, with people from higher SES backgrounds reporting greater perceptions of control.

As depicted in Figure 3, a GLM analysis once again revealed a significant interaction between condition and childhood SES as measured via the family resource scale, $F(1, 146) = 9.04, p = .003, \eta_p^2 = .06$.¹ Consistent with findings from Study 1 and Study 2, there was no difference in sense of control between the two groups in the control condition ($\beta = -.02, p = .89$). However, in the economic uncertainty condition, people from poorer backgrounds felt a significantly lower sense of control than people from wealthier backgrounds ($\beta = .45, p < .001$). Test of simple slopes once again revealed that people from wealthier backgrounds felt *more* control in the economic uncertainty condition than in the control condition, $t(146) = 1.69, p = .094$. Conversely, people from poorer backgrounds felt *less* control in the economic uncertainty than in the control condition, $t(146) = 2.57, p = .011$. Thus, Study 3 conceptually replicated the findings from Study 1 and Study 2 regarding sense of control.

Impulsivity. We next tested the effects of economic uncertainty and childhood SES on impulsivity. Findings showed no main effects of condition or childhood SES. However, as expected, a GLM analyses revealed a significant interaction between condi-

tion and childhood SES, $F(1, 146) = 4.01, p = .047, \eta_p^2 = .03$. Consistent with previous findings (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011), there was no difference in impulsivity between the two groups in the control condition ($\beta = .09, p = .41$). However, in the economic uncertainty condition people from poorer backgrounds were more impulsive than people from wealthier backgrounds ($\beta = -.23, p = .048$). Thus, Study 3 conceptually replicated the pattern of findings regarding impulsivity found in past research (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011).

Mediation. We next tested whether the effect of economic uncertainty on impulsivity is statistically mediated by changes in sense of control. Because this mediational effect depends on childhood SES, the proper analysis is mediated moderation (Muller, Judd, & Yzerbyt, 2005). Thus, we used the bootstrapping procedure from Hayes (2012, Model 8) and the corresponding SPSS PROCESS macro to test for mediated moderation.

Figure 4 presents a visual depiction of the mediated moderation model. As described earlier, the interaction of childhood SES and economic uncertainty predicted sense of control (Path a: $b = .47, p = .003$), and impulsivity (Path c: $b = -.44, p = .047$). Furthermore, sense of control predicted impulsivity (Path b: $b = -.29, p = .009$). A 5,000-resample bootstrap revealed a significant indirect effect of economic uncertainty and childhood SES on impulsivity via sense of control ($b = -.11, SE = .07, 95\% \text{ CI } [-.29, -.01]$). Because the confidence interval does not include 0, this means that the effect of economic uncertainty on impulsivity was statistically mediated by sense of control. Furthermore, the effect of the interaction of childhood SES and economic uncertainty on impulsivity became nonsignificant once sense of control was entered in the model (Path c': $b = -.33, p = .14$).

In summary, Study 3 showed that sense of control statistically mediated a behavior (impulsivity) associated with fast and slow life history strategies. People from poorer childhoods became more impulsive than those from wealthier childhoods in the face of uncertainty *because* they felt a lower sense of control. This provides the first evidence that sense of control appears to be a psychological driver of behaviors associated with fast versus slow life history strategies.

Study 4: Experimentally Boosting Sense of Control

Study 3 showed that sense of control statistically mediated the effect of economic uncertainty on impulsive behavior. Study 4 sought to experimentally manipulate sense of control by inducing a temporarily higher sense of control and testing the effect of economic uncertainty on impulsivity. If sense of control is the psychological mechanism driving the effect of economic uncertainty on impulsivity, we predicted that boosting people's sense of control would turn off the effect of uncertainty for people from low-SES childhood backgrounds.

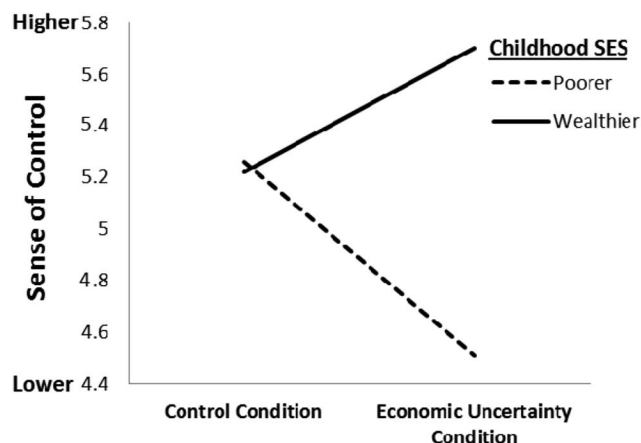


Figure 3. Sense of control as a function of economic uncertainty and childhood SES (Study 3). Graphed means represent one standard deviation above and below the mean of childhood SES. SES = socioeconomic status.

¹ The other measures of childhood SES produced the same pattern of findings, but the interactions did not reach conventional levels of significance ($p = .17$ and $p = .18$).

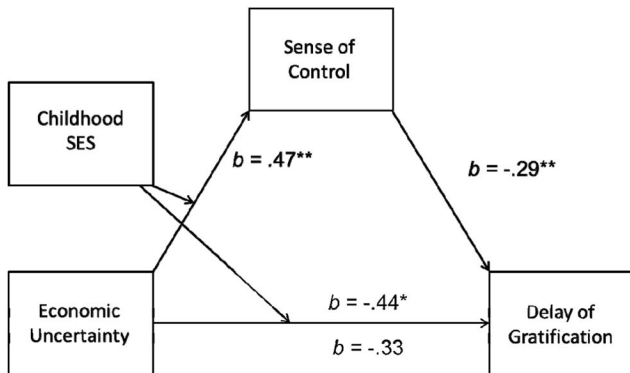


Figure 4. Mediated moderation model showing that the effect of economic uncertainty on delay of gratification is mediated by sense of control (Study 3). All path coefficients represent unstandardized regression weights. SES = socioeconomic status. * $p < .05$. ** $p < .01$.

Method

Participants. Ninety-nine participants (45 men, 54 women) were recruited via MTurk in exchange for a small monetary amount. Mean age of participants was 36.4 years ($SD = 14.42$).

Design and procedure. The study had three between-subjects conditions: control, economic uncertainty, and economic uncertainty *plus sense of control boost*. The study used the same manipulation as in Study 2, in which participants read a news article. Both of the uncertainty conditions used the same article about economic uncertainty. However, in the uncertainty *plus sense of control boost* condition, participants were first asked to recall and describe a time when they felt they were in complete control of a situation. This task was based on Whitson and Galinsky (2008), where it was shown to increase people's sense of control. Thus, just prior to inducing a sense of uncertainty, participants experienced a boost in their sense of control in this condition. To maintain methodological consistency between both economic uncertainty conditions, in the basic economic uncertainty condition, participants were also asked to recall and describe an event that did not entail boosting their sense of control. Participants in this condition were asked to describe an ordinary purchase transaction in the past 1 week. Finally, in the control condition, participants did not undergo any task.

Childhood SES and current SES were assessed using the same measures as in Study 2, and impulsivity was measured using the same procedure as in Study 3.

Results and Discussion

An omnibus test with all three experimental conditions and childhood SES did not reveal a significant interaction, $F(2, 93) = 2.07$, $p = .13$. However, we first sought to examine whether the current study replicated the specific pattern of findings obtained in Study 3 in the control and the economic uncertainty conditions. As in Study 3, we predicted that people from different childhood backgrounds would not differ in their impulsivity in the control condition but that people from poorer compared to wealthier childhoods should be more impulsive in the economic uncertainty condition. As expected, GLM analyses revealed the predicted

interaction between condition and childhood SES, $F(1, 67) = 4.36$, $p = .041$, $\eta_p^2 = .06$.² Also as expected, the interaction with condition and current SES was not significant, and the interaction with condition and childhood SES remained significant even when both types of SES were entered in the model simultaneously, $F(1, 66) = 4.67$, $p = .034$, $\eta_p^2 = .07$.

To test our specific predictions, we next examined the relation between childhood SES and impulsivity in each condition. As expected, there was no difference in impulsivity between the two groups in the control condition ($\beta = -.03$, $p = .85$). However, as seen in Figure 5, individuals from low-SES childhoods were more impulsive than those from high-SES childhoods in the economic uncertainty condition ($\beta = -.49$, $p = .004$). Thus, Study 4 replicated the precise pattern from Study 3 for how economic uncertainty influences impulsivity as a function of childhood environment.

To test the novel prediction in the current study, we next examined whether economic uncertainty had a different effect on impulsivity depending on whether participants first experienced a boost in their sense of control. To test this, we focused on the control condition and the economic uncertainty *plus sense of control boost* condition. A GLM analysis showed that there was no Condition \times Childhood SES interaction, $F(1, 61) = .64$, $p = .43$. People from poor childhood backgrounds did not differ in their impulsivity in the control condition compared to the economic uncertainty *plus sense of control boost* condition, $t(61) = .43$, $p = .67$ (see Figure 5). Furthermore, consistent with our predictions, people from poor childhoods were not significantly different from people from wealthy backgrounds in impulsivity in the economic uncertainty *plus sense of control boost* condition ($\beta = -.20$, $p = .31$).

In addition, we compared impulsivity among people from lower SES childhoods in the two different uncertainty conditions. As depicted in Figure 5, the means show that people from poorer backgrounds were less impulsive in the uncertainty *plus sense of control boost* condition than in the general uncertainty condition, although this decrease did not reach conventional levels of significance, $t(58) = -1.20$, $p = .23$. Although the pattern is in the predicted direction, a potential reason for why the differences between the two uncertainty conditions did not reach statistical significance is lack of power. A more substantial reason is that the sense of control boost was not effective for all people in the study. Thus, while the control boost might have reduced impulsivity in some individuals, it might not have reduced it in all people. Future research is needed to test for this possibility. Nevertheless, when people were given a control boost in the uncertainty condition, they did not differ in impulsivity compared to the control condition.

In summary, Study 4 provided initial evidence that boosting people's sense of control turned off the effect of economic uncertainty on impulsivity for individuals from poor childhood backgrounds. Whereas economic uncertainty led people from low-SES childhoods to be more impulsive compared to people from high-SES childhoods, providing people from low-SES childhoods a

² The other measures of childhood SES produced the same pattern of findings, but the interactions did not reach conventional levels of significance (e.g., $p = .25$).

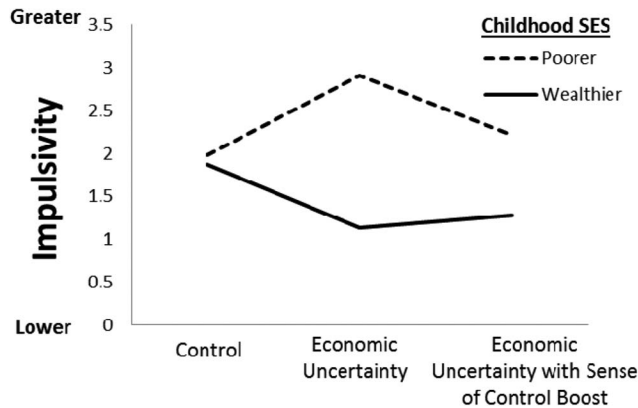


Figure 5. Impulsivity as a function of economic uncertainty and childhood SES (Study 4). Graphed means represent one standard deviation above and below the mean level of childhood SES. SES = socioeconomic status.

temporary boost in their sense of control erased the difference in impulsivity. Taken together with the mediational evidence in Study 3, Study 4 provides additional evidence that sense of control is a psychological driver for how uncertainty influences impulsivity.

Study 5: Sense of Control and Persistence

The first four studies showed that environmental uncertainty alters people's sense of control and that it does so differently depending on a person's childhood environment. An important contribution of this robust finding is that it provides insight into the underlying psychological drivers of fast versus slow life history strategy behaviors such as impulsivity. But this finding also suggests implications for another important behavior. Sense of control is believed to be related to persistence, which is the amount of effort people are willing to expend on challenging tasks (Bandura, 1989). Past research found that individuals with a higher sense of control are more likely to persist through challenges such as difficult academic tests, leading them to attain higher academic achievement (Seligman, 1975; Skinner et al., 1990). Conversely, people with a lower sense of control are more likely to withdraw, retreat, or otherwise become passive (Skinner, 1996).

The link between sense of control and persistence suggests that environmental uncertainty might have a different effect on persistence depending on whether a person grew up in a poor or a wealthy environment. Study 5 therefore tested whether economic uncertainty influences persistence behavior on a challenging task. Given that people from low-SES versus high-SES childhoods experience lower personal control when faced with uncertainty, we predicted that people from low-SES childhoods should persist less compared to those from high-SES childhoods when exposed to environmental uncertainty, leading them to quit earlier. In addition, Study 5 tested whether sense of control statistically mediates the effect of environmental uncertainty on persistence.

Method

Participants. Seventy-three students (47 men, 26 women) at a large public university participated in the study in exchange for

partial course credit. Mean age of participants was 20.5 years ($SD = 2.09$). All participants came to the lab in small groups and were seated at computers either in separate rooms or between partitions.

Design and procedure. The study had two between-subjects conditions: economic uncertainty and control. Economic uncertainty was manipulated by asking participants to recall and briefly describe a situation in which they felt uncertain about their finances (based on Wichman, Brunner, & Weary, 2008). In the control condition, participants were asked to recall and describe an ordinary purchase transaction in the past 1 week. Childhood SES was assessed using the same measure as in Study 3.

Persistence. To assess persistence, all participants worked on an unsolvable task commonly used to assess persistence (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Vohs, Mead, & Goode, 2006). Participants were first shown complex geometric figures consisting of multiple straight lines connected to each other in a specific pattern. They were then given a pencil and multiple sheets of paper and were told to try to retrace the figures in their entirety without lifting the pencil from the paper or retracing any lines (an impossible task for the figures). Participants were instructed that when they finished the tasks or if they decided to stop working on the tasks, they could proceed to the next part of the study by clicking a button on the computer. The dependent measure was the total time (in seconds) participants persisted in trying to solve the unsolvable tasks.

To test whether the effect of persistence is statistically mediated by sense of control, participants' sense of control was assessed using the same six items as in Study 2 and Study 3.

Results and Discussion

Across conditions, participants spent an average of 190.1 s ($SD = 115.1$) trying to solve the task before giving up.³ Given the open-ended nature of this task, preliminary analyses showed that the raw data were skewed (z score of skew = 5.73). Therefore, we conducted a Shapiro-Wilks test to check for normality, which indicated that the data were not normally distributed, $W(73) = 0.87$, $p < .001$. To correct for this, we performed a log-transformation on the data to obtain normal distribution, following previous research that used a similar task (Egan, Hirt, & Karpen, 2012). No outliers were removed. After the transformation, the data were no longer skewed (z score of skew = -0.18). Furthermore, a Shapiro-Wilks test for normality indicated that the data were now normally distributed, $W(73) = 0.99$, $p = .90$.

Sense of control. We first examined the effect of economic uncertainty on sense of control. A GLM analysis once again revealed a significant interaction between condition and childhood SES as measured via the family resource scale, $F(1, 69) = 7.24$,

³ The mean time spent on the persistence task in our study is lower than those reported by Baumeister et al. (1998). We believe this is because of a critical difference in the procedure. In Baumeister et al., participants were explicitly told that they would need to wait about 15 min for the next part of the study right before the persistence task was administered. We believe that the 15-min duration set expectations for the participants for how long they should work on the persistence task. In contrast, our procedure did not explicitly indicate any specific duration. Instead, participants were simply told that they could work on the task until they had finished or decided not to work on it anymore.

$p = .009$, $\eta_p^2 = .09$.⁴ As expected, there was no difference in sense of control between people from poor versus wealthy childhoods in the control condition ($\beta = -.22$, $p = .18$). However, in the economic uncertainty condition people from poorer backgrounds felt less sense of control than people from wealthier backgrounds ($\beta = .38$, $p = .021$). Test of simple slopes revealed that people from wealthier backgrounds felt *more* control in the economic uncertainty condition than in the control condition, although this effect did not reach conventional levels of significance, $t(69) = 1.34$, $p = .185$. Conversely, people from poorer backgrounds felt significantly *less* control in the economic uncertainty than in the control condition, $t(69) = 2.48$, $p = .015$. Thus, Study 5 again found the same effect of uncertainty on sense of control as in Studies 1–4.

Persistence. We next tested the effect of economic uncertainty on persistence. Just as for sense of control, a GLM analysis revealed a significant Condition \times Childhood SES interaction, $F(1, 69) = 4.18$, $p = .045$, $\eta_p^2 = .06$ (see Figure 6). There was no difference in persistence between people from poor versus wealthy childhoods in the control condition ($\beta = -.15$, $p = .39$). However, as seen in Figure 6, in the economic uncertainty condition, people from poorer backgrounds persisted for a significantly shorter time than people from wealthier backgrounds ($\beta = .35$, $p = .034$). Thus, environmental uncertainty led people from low-SES childhoods to quit the challenging task earlier than those from high-SES childhoods. (The persistence patterns remained identical when analyzing the skewed data without any transformations, which again produced an interaction, $p = .036$, but the effect in the economic uncertainty condition did not reach conventional levels of significance, $p = .126$, when the data were not corrected for skew.)

Mediation. We next tested whether the effect of economic uncertainty on persistence is mediated by changes in sense of control. Because this mediational effect depends on childhood

SES, the proper analysis is mediated moderation (Muller et al., 2005). Thus, as in Study 3, we used the bootstrapping procedure from Hayes (2012, Model 8) and the corresponding SPSS PROCESS macro to test for mediated moderation.

Figure 7 presents a visual depiction of the mediated moderation model. As described earlier, the interaction of childhood SES and uncertainty predicted sense of control (Path a: $b = .75$, $p = .009$), and persistence (Path c: $b = .41$, $p = .045$). Furthermore, sense of control predicted persistence (Path b: $b = .17$, $p = .035$). A 5,000-resample bootstrap revealed a significant indirect effect of uncertainty and childhood SES on persistence via sense of control ($b = .104$, $SE = .06$, 95% CI [.01, .26]). Because the confidence interval does not include 0, this means that the effect of uncertainty on persistence was statistically mediated by sense of control. Furthermore, once sense of control was entered in the model, the effect of the interaction of childhood SES and uncertainty on persistence became nonsignificant (Path c': $b = .31$, $p = .15$; see Figure 7).

In summary, Study 5 showed that environmental uncertainty influences persistence behavior and that it does so differently depending on people's childhood environment. Whereas people from poorer and wealthier childhoods persisted for a similar amount of time in the control condition, people from poorer childhoods quit the task considerably earlier when there was environmental uncertainty. In addition, Study 5 showed the effect of environmental uncertainty on persistence is statistically mediated by sense of control. This means that exposure to uncertainty led people from poor childhoods to become less persistent because they felt that they had less control over the situation than people from wealthier backgrounds.

General Discussion

Past research found that environmental uncertainty leads people to behave differently depending on their childhood environment. For example, economic uncertainty leads people from poor childhoods to become more impulsive while leading people from wealthy childhoods to become less impulsive. We examined the psychological mechanism driving such diverging responses to uncertainty. Five experiments showed that environmental uncertainty changes people's behavior by altering their sense of control. Uncertainty led people from poor childhoods to feel that they have less control, but it led people from wealthy childhoods to feel that they have more control. Consistent with past research (Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011; Hill et al., 2013; White et al., 2013), the effects of environmental uncertainty were stronger for people's childhood SES rather than their current SES.

Meta-Analysis of Findings Across Studies

We showed that the effect of environmental uncertainty on sense of control persisted across studies with diverse samples of participants and varied measures of childhood SES. Nevertheless, the effects were stronger for some measures of childhood SES than

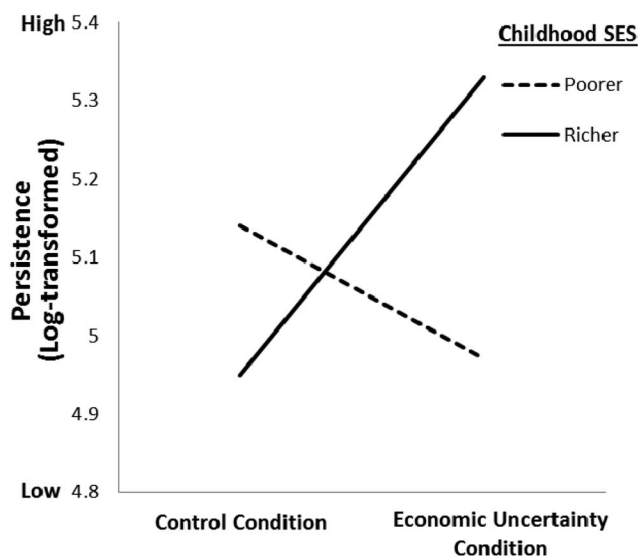


Figure 6. Persistence on a difficult task (log-transformed) as a function of economic uncertainty and childhood SES (Study 5). Graphed means represent one standard deviation above and below the mean level of childhood SES. SES = socioeconomic status.

⁴ The other measures of childhood SES produced the same pattern of findings, but the interactions did not reach conventional levels of significance (e.g., $p = .19$).

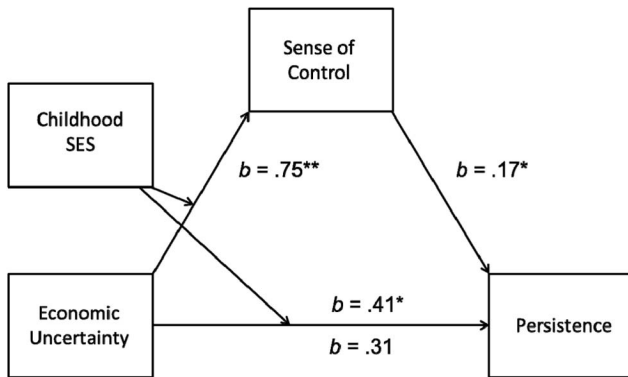


Figure 7. Mediated moderation model showing that the effect of economic uncertainty on persistence is mediated by sense of control (Study 5). All path coefficients represent unstandardized regression weights. SES = socioeconomic status. * $p < .05$. ** $p < .01$.

for others in different studies. To test for robustness, we aggregated the findings across all measures of childhood SES that were collected across all studies that measured sense of control (Studies 1, 2, 3, and 5; $N = 402$). For each study, we standardized and combined all the collected childhood SES measures, which we entered as a centered continuous predictor in the analysis.

Analyses revealed a robust interaction with uncertainty and childhood SES, $F(1, 398) = 17.40$, $p < .001$, $\eta_p^2 = .04$. There was no difference in sense of control between people from different childhood SES in the control condition ($\beta = .06$, $p = .36$). However, in the uncertainty condition, individuals from low-SES backgrounds reported significantly lower sense of control compared to those from high-SES backgrounds ($\beta = .43$, $p < .001$). Tests of simple slopes revealed that uncertainty led people from wealthier backgrounds to have a higher sense of control compared to the control condition, $t(398) = 2.36$, $p = .019$. Conversely, uncertainty led people from poorer backgrounds to have a lower sense of control, $t(398) = 3.54$, $p < .001$. Thus, despite the variability of childhood SES measures across the studies, the aggregated analysis provides strong evidence in support of our predictions.

Psychological Mechanism

We also found that changes in sense of control statistically mediated the relationship between environmental uncertainty and impulsive behavior (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011). People from poorer childhoods became more impulsive than those from wealthier childhoods in the face of uncertainty *because* they felt a lower sense of control. Furthermore, the effect of economic uncertainty on increased impulsivity was turned off by providing people raised in low-SES environments with a temporary boost in their sense of control. Taken together, these studies provide evidence that sense of control is a key psychological mechanism driving behaviors associated with fast and slow life history strategies.

Finally, because sense of control has known links to persistence behavior, we examined whether economic uncertainty influences the amount of effort people expend on a challenging task. Exposure to economic uncertainty led people from low-SES childhoods

to spend significantly less time working on a difficult task than people from high-SES childhoods. When facing adversity, people from poor childhoods decreased persistence on a challenging task, quitting the task 25.6% earlier than people from wealthy backgrounds. To our knowledge, this is the first experimental demonstration showing that environmental uncertainty has different effects on persistence depending on whether people grew up in wealthy versus poor environments.

Taken together, these studies suggest that people from poor versus wealthy childhood backgrounds behave differently in response to environmental uncertainty because they differ in their sense of control. In conditions of uncertainty, people from lower SES childhoods feel that they cannot control their environment, whereas people from higher SES childhoods feel that they can control their environment. By highlighting the important role that sense of control plays in the psychology of behaviors associated with fast and slow life history strategies, the current studies contribute to the growing literature on life history theory and human behavior (e.g., Del Giudice, 2009; Figueredo et al., 2006; Nettle et al., 2011), as well as to the literature on evolutionary social cognition more broadly (e.g., Ackerman et al., 2006; Delton, Cosmides, Robertson, Guemo, & Tooby, 2012; Durante, Griskevicius, Hill, & Perilloux, 2011; Hill & Durante, 2011; Maner, Miller, Moss, Leo, & Plant, 2012; Maner, Miller, Rouby, & Gailliot, 2009; Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010; Navarrete, McDonald, Molina, & Sidanius, 2010; Neuberg, Kenrick, & Schaller, 2010; Tybur, Lieberman, Kurzban, & DiScioli, 2013).

Implications, Limitations, and Future Directions

Sense of control. These studies point to sense of control as a psychological driver of behaviors associated with different life history strategies. A limitation of the current findings is that they show a psychological mechanism only between sense of control and impulsivity. Future research is needed to examine other behaviors associated with life history strategies, but there is good reason to believe that sense of control is likely to play a central role.

Sense of control may help explain why environmental uncertainty leads fast and slow strategists to diverge when it comes to risk taking, reproductive timing, and valuation of quantity versus quality (Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011; White et al., 2013). Given that conditions of uncertainty lead fast strategists to feel that they have less control, such environments should lead these individuals to prioritize immediate reproductive effort, which includes taking more risks for larger immediate payoffs and having children sooner. A lower sense of control should also lead people to prioritize offspring quantity over quality, since investing additional resources into quality will not help shield against (uncontrollable) uncertainty. By contrast, given that slow strategists feel that they have more control over their life, they should prioritize somatic effort, which includes taking fewer risks for immediate payoffs and delaying reproduction. A higher sense of control should also lead people to prioritize offspring quality over quantity, since investing additional resources into quality can help shield against (controllable) uncertainty.

Consideration of sense of control also opens avenues for investigating the links between life history theory and many other important behaviors. For example, consider planning behavior. Planning includes everything from taking the time to plan one's purchases and

make a grocery list to planning for retirement. To the extent that having a sense of control makes it more worthwhile for people to invest time and effort into planning, fast and slow life history strategists are likely to differ in important ways when it comes to making plans.

Systematic errors in judgment. The current findings also have interesting implications for the types of errors fast versus slow strategists make in judgment and decision making. Consider two types of errors a person can make about being in control over a given outcome. One type of error is that a person believes that he has control over an outcome even though he actually does not (e.g., think of someone believing that he can make it rain by doing a special dance). Another type of error is that a person believes that he does not have any control over an outcome even though he actually does (e.g., think of someone believing that the SAT or GRE is a pure test of innate ability and therefore something for which one cannot study).

Our findings suggest that fast and slow strategists might systematically make different types of errors in the face of ambiguously uncertain conditions. One of the most intriguing findings in the present studies is that slow strategists sometimes felt that they had *more control* when conditions were *more uncertain*! This increased perception of control is often likely to be an irrational error in judgment. But this error might actually stem from an adaptive bias when viewed from the perspective of error management theory (Haselton & Buss, 2000; Haselton & Nettle, 2006), which highlights that organisms are disposed to make the types of errors that minimize evolutionary costs. When facing ambiguous conditions, for example, it may have been adaptive for slow life history strategists to err on the side of assuming that they have control over the situation, which would serve to motivate slow strategy behaviors. Conversely, it may have been adaptive for fast strategists to err on the side of assuming that they do not have control over situation, which would serve to motivate fast strategy behaviors.

Future research is poised to examine the links between error management theory and life history theory. For example, consider how life history strategies might be related to religion and belief in supernatural deities. In the face of ambiguous evidence for the existence of God, for instance, some individuals may be disposed to err on the side of assuming that such a deity exists, while others may be disposed to err on the side that such a deity does not exist (see Kay, Gaucher, McGregor, & Nash, 2010; Whitson & Galinsky, 2008). The intersection of life history theory and error management theory provides a rich avenue for future research.

Environmental uncertainty. The current research examined the psychological and behavioral consequences in response to environmental uncertainty. This term refers to environments that are harsh and unpredictable (Ellis et al., 2009), which are the types of environments believed to shape life history strategies. Harsh and unpredictable environments reflect ecologies that pose higher likelihood of death or injury from starvation, predation, or disease. For example, an environment can be harsh and unpredictable because resources are scarce or because of high mortality dangers from predation (Ellis et al., 2009).

A limitation of the present studies is that they focused only on the consequences of economic uncertainty, which reflects a harsh and unpredictable environment stemming from resource scarcity. Although future research is clearly needed, there is good reason to believe the present findings reflect the consequences of a more general environmental uncertainty rather than something unique to eco-

nomic uncertainty. Past experimental work testing life history hypotheses has independently manipulated economic uncertainty and mortality threat. Across multiple studies, both manipulations produced identical and rather specific patterns for impulsivity and for risk taking (Griskevicius et al., 2013; Griskevicius, Tybur, et al., 2011). This past work supports the idea that the current findings are unlikely to reflect something specific to economic uncertainty per se but are more likely to reflect an underlying environmental uncertainty, which indicates a harsh and unpredictable environment as delineated by life history theory (Ellis et al., 2009).

Childhood environment and SES. Our studies consistently found that exposure to environmental uncertainty leads people to diverge in their psychology and behavior based on their childhood SES, not their current SES. This specific pattern is consistent with much past research (Griskevicius et al., 2013; Griskevicius, Delton, et al., 2011; Griskevicius, Tybur, et al., 2011; Hill et al., 2013; White et al., 2013), and it highlights the important role of childhood environments for shaping life history strategies (Del Giudice et al., 2011). A limitation of the current studies is that childhood environment was measured retrospectively. Future experimental research is needed with participants on whom researchers have nonretrospective and accurate information about those participants' childhood environment. Nevertheless, past studies have documented a strong link between adults' retrospectively reported childhood SES and their actual SES in childhood (Cohen, Janicki-Deverts, Chen, & Matthews, 2010; Duncan, Ziol-Guest, & Kalil, 2010), lending additional confidence to the validity of the present studies.

Another consistent finding across our studies was that people from different childhood backgrounds did not differ in their sense of control in the control conditions. One possibility is that our control conditions were not reflective of normal, daily life for people who grew up in stressful childhood environments. Instead, such individuals may feel psychologically stressed and uncertain during many different points during a given day. This suggests that the effects of SES in past research may be driven by individuals who felt stressed at the moment of the study.

Given the important role of the childhood environment, future research is particularly poised to examine which specific environmental features have the strongest bearing on life history strategies. After all, childhood SES is merely a proxy measure of a slew of different environmental factors to which people may have been exposed during development. Recent developmental work suggests that exposure to unpredictable environments appears to be critical in determining life history outcomes in young adulthood (Belsky et al., 2012; Simpson et al., 2012). Experimental research is needed to test whether and how individuals who have been exposed to specific environmental features during their development respond to environmental stressors in adulthood. And given that there are important individual differences in susceptibility to environmental influences (Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011), future research is well positioned to identify specific types of individuals whose life history strategies might be most affected by their childhood and their current environment.

Finally, the current studies also contribute to growing research on the influence of SES on psychology and behavior (e.g., Côté, Piff, & Willer, 2013; Kraus et al., 2009; Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012; Piff, Stancato, Côté, Mendoza-Denton, & Keltner, 2012). This recent work is grounded in the idea that SES influences behavior similarly to culture and has focused

mostly on the influences of adult SES. Future research is needed to better understand how childhood SES and adult SES might work together to influence behavior. For example, consider a person who grew up poor in a culture of low-SES but became wealthy as an adult and now lives in a culture of high-SES. Consistent with the idea of SES as culture, this person might generally behave in a manner consistent with high-SES. However, we would predict that conditions of environmental uncertainty should lead childhood SES to have a more pronounced influence on behavior. As deftly expressed by hip-hop mogul Curtis "50 Cent" Jackson, who experienced a drastic shift in SES from childhood to adulthood, "You can take me out of the hood, but you can't take the hood out of me" (Robinson & Johnson, 2003). Future research examining the specific ways chaos and environmental uncertainty influence psychology and behavior as a function of both childhood and current SES is likely to be fruitful (see Piff, Stancato, Martinez, et al., 2012).

Persistence and interventions. The last study provides evidence that life history strategies may be related to persistence. Exposure to uncertainty led people from low-SES childhoods to quit a challenging task 25.6% sooner than people from high-SES childhoods. More research is obviously needed, but this finding might serve as a springboard for future research.

Persistence is directly tied to myriad important outcomes, including self-control, academic achievement, substance abuse, criminal behavior, healthy eating, and overspending. Future research is poised not only to examine the links between life history theory and these outcomes but also to investigate intervention strategies for how to prevent individuals from poor childhoods from quitting challenging tasks in the face of adversity. For example, fast strategists might not be adversely affected by economic uncertainty if they are given more control (or at least more perception of control) over their environment, as demonstrated in Study 4. Likewise, sense of control might also be increased through providing more schooling, since education can serve to help explain how one's actions influence the world around us.

Conclusion

There is a critical distinction between life history theory and almost all traditional theories in social science. From a more traditional perspective, behaviors associated with a slow life history strategy are generally considered to be good and desirable, whereas behaviors associated with a fast strategy are generally considered to be bad and undesirable. In fact, we ourselves implicitly made this assumption in the previous paragraph, in which we suggested an intervention for how to make fast strategists behave more like slow strategists.

Although the validity of this assumption might appear to be self-evident, life history theory highlights that neither fast nor slow strategies are inherently good or bad (Ellis et al., 2012). In fact, life history theory explicitly predicts that a fast strategy can be adaptive and beneficial in certain conditions. While growing up in a harsh and unpredictable environment is likely to be debilitating for performance on slow-strategy tasks like the SATs, growing up in such environments is likely to be beneficial on tasks geared to assess skills more advantageous for fast strategists. Future research is poised to examine how growing up poor may actually provide an advantage, with fast strategists objectively outperforming slow strategists on certain tasks. But while some of these tasks have yet to be examined, others are already being studied. Consider, for example, that the persistence task

in the final study was impossible. No matter how long people persist and no matter how much they believe that they have control over the outcome, in reality they have no control and will never succeed. Although past research has viewed persistence on such impossible tasks as good and desirable, the adaptive behavior is to quit, since persisting on the task is not all that different from dancing in hopes that it will start raining. Time and energy are limited resources, and sometimes it is adaptive to stop expending effort on an endeavor one cannot control in order to pursue more promising opportunities.

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