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The Dark Side of Intuition: Aging and Increases in Nonoptimal Intuitive Decisions

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When making decisions, people typically draw on two general modes of thought: intuition and reason. Age-related changes in cognition and emotion may impact these decision processes: Although older individuals experience declines in deliberative processes, they experience stability or improvement in their emotional processes. Recent research has shown that when older adults rely more on their intact emotional abilities versus their declining deliberative faculties, the quality of their decisions is significantly improved. But how would older adults fare under circumstances in which intuitive/affective processes lead to nonoptimal decisions? The ratio bias paradigm embodies just such a circumstance, offering individuals a chance to win money by drawing, say, a red jellybean from one of two dishes containing red and white jellybeans. People will often choose to draw from a dish with a greater absolute number of winners (nine red beans and 91 white beans; 9%) than a dish with a greater probability of winning (one red bean and nine white beans; 10%) due to a strong emotional pull toward the greater number. We examined whether older adults (N = 30) would make more nonoptimal decisions on the ratio bias task than young adults (N = 30). We found that older adults did make more nonoptimal choices than their younger counterparts and that positive affect was associated with nonoptimal choices.

Keywords: aging, decision making, emotion, intuition

What do people do when a careful, rational analysis tells them to hold on to a certain stock but a strong hunch tells them to dump it? And what does one do when rational deliberation suggests calling it off with Julie to commit to Jane, but a powerful gut feeling suggests just the opposite? In other words, how do people make decisions when they experience conflict between rational analysis and intuitive impulses?

Such conflicts are perhaps best thought about in terms of the many dual-process or two-systems models of human thought that have been developed over the past quarter century. According to these models, intuition and reason are the product of two distinct modes of thought (Epstein, 1991; Evans, 2004, 2008; Kahneman, 2011; Kahneman & Frederick, 2002; Sloman, 1996; Strack & Deutsch, 2004). One mode—governed by what has been variously labeled the *experiential system* (Epstein, 1991), the *associative system* (Sloman, 1996), or simply *System 1* (Stanovich & West, 2000)—is said to be automatic, rapid, associative, affective, nonconscious, and effortless. The other—governed by what has been labeled the *rational system*, the *rule-based system,* or *System 2*—is said to be deliberate, slow, rule-based, conscious, and effortful. Although dual-process and two-systems accounts are not without their critics (Gigerenzer & Regier, 1996; Keren & Schul, 2009; Kruglanski & Gigerenzer, 2011; Kruglanski & Thompson, 1999), they have helped investigators achieve remarkable success at integrating disparate bodies of empirical research (see especially Kahneman & Frederick, 2002) and they better capture the kinds of conflicts mentioned above between intuitive impulses and rational calculations than alternative accounts. As Sloman (1996, p. 19) put it, "The fact that people are pulled in two directions at once suggests two forces pulling."

Of all the dual-process or two-systems accounts, Cognitive Experiential Self Theory (CEST; see Epstein, 1994) draws the sharpest distinction between intuitive/affective and analytic processes, a distinction that has been profitably explored with the ratio bias paradigm (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992; Pacini & Epstein, 1999). The paradigm offers participants a chance to win money or a prize by drawing, say, a red jellybean from a tray containing red and white jellybeans. Participants must first choose whether to draw from a small tray with one red bean and nine white beans or a larger tray with a greater number but lower percentage of winning beans—say, nine red beans and 91 white beans. The notable result is that people often choose the latter nonoptimal option, accepting less than a 10% chance of winning because the absolute number of winners exceeds the one

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in the small tray (Kirkpatrick & Epstein, 1992; Epstein & Pacini, 2000; Pacini & Epstein, 1999; Alonso & Fernández-Berrocal, 2003). Participants do so, furthermore, when the chances of drawing a winning jellybean are clearly labeled.

According to CEST, people's more extensive experience with absolute numbers makes the nonoptimal option "feel" more promising, even when participants rationally know better. Indeed, when participants choose the (nonoptimal) larger tray, they often report being aware that the smaller tray offers better odds. Nevertheless, a strong emotional pull toward the greater absolute number leads them to ignore what they know to be the more rational choice (see, e.g., Denes-Raj & Epstein, 1994). Thus, the ratio bias task elicits an intuition-reason conflict, with reliance on intuitive/affective processes leading to nonoptimal outcomes (Epstein, 1991). But what determines whether individuals will rely more on the intuitive/affective system or the analytic system when making such decisions?

Various theorists (e.g., Epstein & Pacini, 1999; King, Burton, Hicks, & Drigotas, 2007; Peters et al., 2006; Reyna & Brainerd, 2008) have considered different factors that may contribute to a greater reliance on the intuitive/affective system. For instance, Peters et al. (2006) proposed that individual differences in numeracy (the ability to understand and transform numbers and probabilities) play a role in determining whether individuals will rely on irrelevant affective sources (i.e., the number of winning beans) when making decisions. Indeed, they found that individuals who were less numerate (i.e., those who scored lower on a measure of numeric and probabilistic understanding) made significantly more nonoptimal choices on the ratio bias task.

In addition to individual difference factors such as numeracy, situational factors may determine whether the analytic versus intuitive/affective system is cued at the time of the decision (e.g., Epstein & Pacini, 1999; Inbar, Cone, & Gilovich, 2010). For instance, King, Burton, Hicks, and Drigotas (2007) proposed that incidental positive affect signals that all is well and that the current situation does not require careful analytic consideration, thus shifting individuals toward the intuitive/affective system. Indeed, positive affect has been found to promote reliance on intuitive/affective processing in multiple domains (King et al., 2007; King & Hicks, 2009). Most directly relevant to the question raised here, the role of positive affect in cuing the intuitive/affective system has been explored in the context of the ratio bias paradigm. In this research, positive affect was related to nonoptimal decision-making, such that participants who were given a positive mood induction were more likely to choose nonoptimally on the ratio bias task relative to those given a negative mood induction (Cone, Inbar, & Gilovich, under review).

Given the influence of positive affect, cognitive ability, and intuitive/affective processing on performance of the ratio bias task, it is a paradigm well suited to examining age differences in decision making. In particular, research on the psychology of aging has documented systematic declines in individuals' cognitive faculties over the course of their lives—declines that include numeracy (Donelle, Hoffman-Goetz, & Arocha, 2007), speed of processing (Salthouse, 1991), verbal and spatial working memory (Park et al., 1996), and reasoning and problem solving (Salthouse, 1996). Importantly, though, older adults do not exhibit age-related declines in all types of problem solving. For instance, they show certain improvements in everyday problem solving relative to the young, especially for social and emotionally charged problems (for a review, see Berg & Strough, 2011; Blanchard-Fields, 2007). Further hinting at a special role for emotion in the lives of older adults, the basic components of emotion change little with age, and the changes that do occur appear to shift toward the positive. In general, older adults do not differ from younger adults in their self-reports of emotional intensity or in emotional expressive behavior (for a review see Carstensen, Mikels, & Mather, 2006). However, older adults do report higher levels of positive affect and lower levels of negative affect relative to the young (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Carstensen et al., 2011; Charles, Reynolds, Gatz, 2001; Mroczek & Kolarz, 1998). Given these divergent developmental trajectories for deliberative cognitive processes and emotional processes, researchers have theorized that these changes may influence decision processes such that rational analytic faculties may show age-related degradation, whereas relatively automatic, experiential, and affective decision processes may be unaffected or may even improve with age (see Peters, Dieckmann, & Weller, 2011; Peters, Hess, Västfjäll, & Auman, 2007). This suggests that older adults might be more likely to choose nonoptimally in the ratio bias task.

In one study examining age differences in deliberative versus affective decision processes, participants were encouraged to rely more on their rational faculties when deciding among a series of health care alternatives, or instead to focus more on their feelings about the different options (Mikels et al., 2010). When older adults' decisions were based on deliberative analysis, their decision-making tended to suffer relative to those who focused primarily on their feelings about the choices, suggesting that older adults may be better served by their affective intuitions than by their declining ability to decide using more rational, deliberative strategies. In contrast, for younger adults, precisely the opposite decision strategy was the most effective: The more the younger adults tended to rely on their rational faculties, the higher the quality of their decisions.

The current study extends this reasoning and examines whether older adults tend to favor the more intuitive (and nonoptimal) option in the ratio bias task more than younger adults do. Additionally, given the influences of various cognitive factors and positive affect on the ratio bias, we explored how these influences may relate to nonoptimal choices. In particular, it is possible that age-related cognitive decline may make older adults less able to adequately process the numeric information in the ratio bias task. If so, then age differences on cognitive measures should be related to increases in nonoptimal choices. On the other hand, it is also possible that the tendency of older adults to experience more positive emotions might lead them toward the intuitive, nonoptimal option in this paradigm. If that is the case, then age differences in positive affect should be related to increased nonoptimal choices. We explored these possibilities as well.

Method

Participants

Thirty younger adults (*M* age = 20.57) and 30 older adults (*M* age = 75.00) participated for payment or course credit. All participants were healthy and free of neurological and psychiatric disease. For more complete information about the sample, see

Table 1
Participant Characteristics by Age Group

Characteristic	Younger (N = 30) *M*	*(SD)*	Older (N = 30) *M*	*(SD)*	Statistic *t*	*p*
Age (in years)	20.57	(3.07)	75.00	(5.96)		
Sex	63% F, 37% M		70% F, 30% M			
Education (in years)	14.43	(2.43)	15.96	(2.74)	2.25	<.05
Scaled income	2.96	(1.07)	2.96	(0.88)	0.03	>.9
Vocabulary (WAIS-III)	48.23	(6.82)	46.70	(7.94)	0.80	>.4
Verbal fluency	71.37	(14.58)	62.83	(15.37)	2.21	<.05
Digit-symbol coding (WAIS-III)	97.93	(14.50)	60.70	(19.49)	8.40	<.001
Digit span (WAIS-III)	19.43	(4.20)	18.03	(4.16)	1.30	>.1
Numeracy	9.03	(2.08)	8.27	(2.77)	1.21	>.2
PANAS positive affect	2.44	(0.63)	3.44	(0.80)	5.19	<.001
PANAS negative affect	1.33	(0.46)	1.10	(0.21)	2.46	<.05

Note. Sex: F = Female, M = Male; Scaled Income: on a scale of 1–5 (1 = *lower income* and 5 = *upper income*); Vocabulary from the Wechsler Adult Intelligence Scale (WAIS−III; Wechsler, 1997): maximum score = 66; Digit-Symbol Coding from the WAIS−III: maximum score = 133; Digit Span from the WAIS-III: maximum score = 30.

Table 1. Including the demographic variables of sex, education and scaled income in the analyses did not change the pattern of the findings we report below, and therefore we do not discuss them further.

Materials

Ratio bias paradigm. Our task was modeled after one used by Denes-Raj and Epstein (1994). For each trial, participants were presented with a pair of transparent dishes: one large dish and one small dish. Each dish contained two colors of jellybeans (red and white) of varying proportions, and participants were told that one jellybean would be selected from the dish of their choosing. Each dish was labeled with information about the number of red and white jellybeans in the dish as well as the probabilities of drawing a red jellybean for that dish. Participants were told that some trials were "win" trials and other trials were "loss" trials. We included both win and loss trials to fully replicate Denes-Raj and Epstein (1994). On the win trials, participants were told they would win $1 if a red jellybean was selected from their chosen dish and nothing if a white jellybean was selected. On the loss trials, they were told they would lose $1 if a red jellybean was selected and nothing if a white jellybean was selected. One of the dishes (*small dish*) always contained one red jellybean and nine white jellybeans. The contents of the other dish (*large dish*) varied by trial: It always contained 100 jellybeans, but the number of red jellybeans varied between five and nine. In this way, the large dish always had a lower percentage of winners (or losers) but a greater number of winners (or losers) than the small dish. Past research has established that when choosing a dish from which to draw a jellybean, many college-age participants experience a conflict between what they know to be rational (e.g., the small dish with only one winner but better odds of winning) and a gut-level feeling about the large dish (e.g., with more winners but lower odds of winning; Epstein, 1991).

Positive and negative affect schedule−state version (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item measure of state affect. Participants were given instructions to rate the extent they were currently feeling each of the emotions listed on a 5-point scale from 1 (*very slightly or not at all*) to 5 (*extremely*). Averages of positive and negative items were calculated to obtain a mean positive score and mean negative score for each participant. The internal reliability for this sample was high for both the positive (α = .94) and negative subscales (α = .82).

Assessments of cognitive ability. To compare the cognitive abilities of the older and younger adult samples as well as to examine potential influences on decision making performance, we included several cognitive measures: (a) vocabulary (by having participants provide brief verbal definitions of a number of words ranging in difficulty; Wechsler, 1997); (b) verbal fluency (a measure of executive function in which participants name as many items they can think of in one minute that start with the letters F, A, & S); (c) speed of processing (using the *Digit-Symbol Coding Task* in which participants match symbols to digits as quickly as possible; Wechsler, 1997); (d) short-term memory (STM) (using the *Digit-Span Task* in which participants hold in mind and then repeat digit strings; Wechsler, 1997); and (e) numeracy—that is, their ability to process risk estimates and probability (using the 11-item *Numeracy Scale*; Lipkus, Samsa, & Rimer, 2001). See Table 1 for the means and standard deviations for these measures.

Procedure

Participants were told that they would be playing a "game of chance" in which they would draw a jellybean from one of two dishes containing red and white jellybeans. They were given 10 one-dollar bills in play money and were told that on each draw they would have an opportunity to win or lose $1 if a red jellybean was drawn from their chosen dish. They were told that they would acquire whatever winnings they ended up with in real money, but that they would not have to pay for any negative balance.

There were 12 trials. Five were "win" trials, on which participants were told that if a red jellybean was drawn from the chosen dish they would earn an additional $1 in compensation for the experiment. Five were "loss" trials, on which participants were told that if a red jellybean was drawn, they would lose $1. We also included two additional "win" trials to boost morale, following the precedent established by Denes-Raj and Epstein (1994). On these trials, the odds of winning were substantially higher: The small dish consisted of 10% red jellybeans and the large dish consisted of 45% red jellybeans. The sequence of win−loss trials for each participant was varied and counterbalanced according to a Latin Square design.

On each trial, the experimenter presented the two dishes and announced whether the trial would be a "win" or "loss" trial. Each dish was labeled with information about the number of red and white jellybeans and the probability of drawing a red jellybean for each dish. The experimenter also verbally reiterated this information (i.e., number of each type of jellybean and probability of drawing a red jellybean) when presenting the dishes at the start of each trial. Participants then chose a dish, whereupon the experimenter shielded the selected dish from view and scrambled the jellybeans. The participant then blindly drew a jellybean. If a red jellybean was drawn, participants were paid $1 on "win" trials and were required to pay $1 on "loss" trials.

After all 12 trials were run, participants completed the battery of questionnaires and cognitive measures described above.[1]

Results

We indexed participants' dish choices in several ways. First, we examined the number of participants in each age group who chose nonoptimally at least once. Next, we calculated the percentage of time that participants selected the less optimal dish. Following Denes-Raj and Epstein (1994), we categorized the magnitude of the discrepancy in the probability of selecting a red jellybean from the large and small dishes into mild and extreme magnitudes of discrepancy. That is, trials in which the large dish contained eight or nine red jellybeans were categorized as "mild" because there was a relatively small discrepancy between the probabilities of drawing a red jellybean from the small dish (10%) and the large dish (8% and 9%). Trials in which the large dish contained five to seven red jellybeans were categorized as "extreme" because of the larger discrepancy between the probabilities of drawing a red jellybean from the small dish (10%) versus large dish (5% to 7%). We separately calculated the percentage of time that participants chose nonoptimally for mild and extreme trials.

Consistent with our hypothesis, a higher proportion of older adults (90%) than young adults (53%) chose to select from the nonoptimal dish at least once, $\chi^2(1, N = 60) = 9.93$, $p < .005$. See Figure 1.

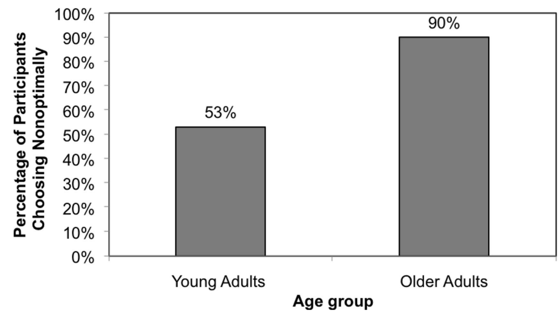

Figure 1. The percentage of participants choosing nonoptimally at least once between age groups.

To examine this tendency in more detail, we conducted a 2 (age: older vs. young) × 2 (frame: win vs. loss) × 2 (magnitude: mild vs. extreme) mixed model analysis of variance (ANOVA) of the percentage of time participants chose nonoptimally. The percentages are presented in Table 2. This analysis yielded the predicted main effect of age, with older adults ($M = 35.7\%$, $SD = 24.4$) making significantly more nonoptimal choices than young adults ($M = 18.1\%$, $SD = 22.3$)—nearly twice as many, in fact, $F(1, 58) = 8.54$, $p < .01$, $\eta_p^2 = .12$. Consistent with Denes-Raj and Epstein (1994), we also found a main effect of frame, such that participants chose nonoptimally more often on the win trials ($M = 31.4\%$, $SD = 29.5$) than on the loss trials ($M = 22.4\%$, $SD = 30.4$), $F(1, 58) = 4.29$, $p < .05$, $\eta_p^2 = .069$. Also consistent with Denes-Raj and Epstein (1994), we found a main effect of magnitude, such that participants chose more nonoptimally when the probability discrepancies were mild ($M = 30.4\%$, $SD = 30.2$) than when they were extreme ($M = 23.3\%$, $SD = 26.6$), $F(1, 58) = 3.86$, $p = .054$, $\eta_p^2 = .062$. Finally, we found a magnitude by frame interaction, whereby the main effects of magnitude and frame were driven by an increase in nonoptimal choices in the win condition when the magnitude was mild, $F(1, 58) = 4.19$, $p < .05$, $\eta_p^2 = .067$. There were no other main effects or interactions, indicating that younger and older adults were equally affected by frame and magnitude.

To examine whether the main effect of age on nonoptimal responding was related to age-related changes in cognitive ability, we reran the analysis above with verbal fluency and digit symbol scores as covariates, the two measures on which older adults showed decline.[2] The main effect of age remained significant when controlling for these measures of cognitive ability, $F(1, 56) = 4.33$, $p < .05$, $\eta_p^2 = .072$, indicating that the age difference in nonoptimal responding is not associated with age-related cognitive decline.

Finally, given the association between positive affect and experiential processing, and the age-related changes in positive affect described above, we ran a few additional analyses. First, we examined the correlations between the number of nonoptimal choices made by participants and their PANAS scores. Although negative affect was not related to the number of nonoptimal choices, $r(57) = -.17$, $p > .19$, higher positive affect scores were significantly correlated with the number of nonoptimal choices made, $r(57) = .48$, $p < .001$. Second, and as can be seen in Table 1, older adults reported higher positive affect on the PANAS. We therefore then reran the 2 × 2 × 2 ANOVA reported above with positive affect included as a covariate and found that the main effect of age was no longer significant, $F(1, 54) = 1.34$, $p > .25$,

[1] Participants also completed the Rational Experiential Inventory, a 40-item self-report measure that assesses people's natural inclinations and ability to process information rationally or experientially (Pacini & Epstein, 1999). This measure did not yield any significant effects nor did it interact with any of the other measures or qualify any of the reported results and so it is not discussed further. These null effects are consistent with the decidedly mixed findings on the connection between REI scores and performance on the ratio bias task in the existing literature (Reyna & Brainerd, 2008; Reyna, Nelson, Han, & Dieckmann, 2009).

[2] In addition, when this analysis is run with all cognitive measures including those on which older adults did not show decline, the main effect of age still remained significant, $F(1, 53) = 7.08$, $p < .05$, $\eta_p^2 = .12$.

Table 2
Percentage of Nonoptimal Choices Between Age Groups

	Age				
	Young		Old		
Age	Win	Loss	Win	Loss	Average
Mild	28.3 (40.9)	11.7 (25.2)	48.3 (40.4)	33.3 (44.2)	30.4 (30.2)
Extreme	18.9 (28.6)	13.3 (31.1)	30.0 (30.8)	31.1 (30.2)	23.3 (26.6)
Average	23.6 (28.4)	12.5 (25.8)	39.2 (29.0)	32.2 (31.8)	

Note. Standard deviations are in parentheses.

$\eta_p^2 = .024$.[3] Thus, the main effect of age on nonoptimal choices in the ratio bias task appears to be associated with the heightened positivity of the older adults. Underscoring the important role of positive affect in nonoptimal choices, the main effects of frame and magnitude, as well as their interaction, were likewise no longer significant.

Because the older adults made more nonoptimal choices, one would expect them to earn less money across trials. That is exactly what happened: The younger adults won an average of $1.07 and the older adults won an average of $0.47, $t(58) = 1.99$, $p = .052$.

Discussion

Recent research in the adult life span literature has pointed to dissociations in the developmental trajectories of declining deliberative processes, on the one hand, and maintained or enhanced affective processes on the other (see Carstensen et al., 2006; Peters et al., 2011). Although aging is accompanied by cognitive decline, the emotional lives of older adults are characterized by increased positivity (see Carstensen & Mikels, 2005). Previous research also has linked positive affect to experiential and intuitive processing, as well as nonoptimal decisions on the ratio bias task (Cone et al., under review; King et al., 2007; King & Hicks, 2009). In the study reported here, we explored whether these two effects—age-related shifts in the balance of cognitive and emotional processing on the one hand and the impact of positive affect on performance on the other—would be reflected in older adults making more nonoptimal choices than younger adults on the ratio bias task. We found that older adults were indeed more likely than younger adults to choose the intuitively appealing but nonoptimal option instead of the option that offered the best chance of winning. This effect held whether subjects stood to win or lose from the gamble and irrespective of the magnitude of the difference in the probabilities of the two options. The results also held when controlling for cognitive function, indicating that these results are not related to age-related cognitive changes. Instead, an analysis of participants' PANAS scores indicated that the effect of age on nonoptimal choice was related to age-related increases in positive affect. The fact that age-related performance in this paradigm was related to participants' emotional states (that is, their positive affect scores) but not with various measures of cognitive functioning (e.g., cognitive ability, numeracy) is most likely a reflection of the tendency for older adults to give more weight to emotional information than younger adults do (Carstensen & Mikels, 2005; Carstensen et al., 2006; Mather & Carstensen, 2005).

One aspect of the decision context that can be counted on to influence the balance of intuitive and analytic decision processes is the manner in which choices are presented. We found such an effect, with participants being more likely to choose the nonoptimal dish on win trials than loss trials. But we did not find a frame by age interaction. Although some previous studies have found age differences in framing, the overall pattern in the literature is mixed (Mata, Josef, Samanez-Larkin, & Hertwig, 2011; Peters et al., 2011). Mata, Josef, Samanez-Larkin, and Hertwig (2011) suggest that older adults may respond differently to framing manipulations than younger adults when the relevant probabilities are learned from experience, but not when they are explicitly provided. The current task falls in the latter category, and the present results fit the pattern outlined by Mata et al. (2011). However, it is also worth noting that the frame interaction was no longer significant when controlling for positive affect, consistent with the theoretical perspective of Strough, Karns, and Schlosnagle (2011) who emphasize the role of affective processes in framing. Indeed, in related research on framing, Cheung and Mikels (2011) found a positive relationship between positive affect and risk seeking. The current results are thus consistent with the idea that affect impacts the effect of framing on choice, while providing support for the experience versus description distinction.

Although the older adults in our study made more nonoptimal choices than the younger participants, previous research has established that there are circumstances in which older adults' reliance on emotional and intuitive processes works to their benefit and leads them to better decisions (e.g., Bruine de Bruin, Parker, & Fischhoff, 2012; Mikels et al., 2010; Strough, Mehta, McFall, & Schuller, 2008). More research is therefore needed to establish when age-related changes in reliance on intuitive versus rational processes will lead to superior or inferior performance. Nevertheless, the current findings suggest that when facing choice dilemmas like those posed at the beginning of this article, older adults might be more inclined to follow their hunches and intuition rather than a rational analysis, and their inclination to do so may be related to their generally more increased positivity. What is clear at present is that whether older adults are likely to outperform or underperform their younger counterparts is likely to be influenced by both the precise nature of the task at hand, and the fit between the environment in which respondents' intuitions were "tuned" and the characteristics of the current decision (Kahneman & Klein, 2009). Research on these influences can help us understand when age and experience leads to wisdom and when, as we saw here, it leads older people to lose their way.

[3] Given that we also found an age-related decrease in negative affect on the PANAS, we ran the analysis including negative affect as a covariate. The main effect of age remained significant when controlling for negative affect, $F(1, 54) = 7.83$, $p < .01$, $\eta_p^2 = .13$. This finding indicates that the main effect of age on nonoptimal choices is exclusively related to age-related changes in positive affect and not negative affect. A formal mediation analysis led to the same conclusion, showing that positive affect fully mediates the relationship between age and nonoptimal choices. However, given the potential problems associated with mediation analyses involving cross-sectional data (Lindenberger, von Oertzen, Ghisletta, & Hertzog, 2011), any such claim of mediation should be interpreted with caution.

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