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DEVELOPMENTAL PSYCHOLOGY

Running Head: AGE DIFFERENCES IN EVALUATING OUTCOMES OF RISKY ACTIVITIES

What could go wrong?

No evidence of an age-related positivity effect when evaluating outcomes of risky activities

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Abstract

The age-related positivity effect—a preference for processing positive stimuli over negative stimuli—is posited by socioemotional selectivity theory to reflect a focus on emotional gratification in older age. Yet, the positivity effect has been investigated with stimuli, such as photographs of faces and visual scenes, that have little (to no) association with real-life consequences. Decisions that involve risk require evaluating valenced information that is associated with positive and negative possible outcomes. Older adults take fewer risks than younger adults when their decisions have possible negative consequences. The current research investigated whether the age-related positivity effect extends to cognitive processing of valenced information that is association with real-life consequences. In Experiment 1, participants generated possible outcomes of engaging in risky activities. In Experiment 2, participants identified as quickly as possible whether putative outcomes were relevant to risky activities. Diffusion model analysis was used to model the cognitive processes underlying age-related differences in processing of valenced information. In contrast with the age-related positivity effect, in Experiment 1, younger adults showed an initial focus on retrieving positive outcomes, which shifted to an initial focus on negative outcomes in older age. In Experiment 2, younger adults were faster and more accurate to identify positive than negative outcomes of risky activities—a tendency that dissipated in older age. In conclusion, the age-related positivity effect may not extend to cognitive processing of valenced information that is associated with real-life consequences. It is speculated that while older adults may often prioritize emotional gratification, they possess a repertoire of goals and switch between goals according to the nature of their task.

Keywords: aging, decision-making, emotional control.

Across adulthood, a multitude of changes occur (e.g., cognitive, physical, situational), and with these changes comes re-orientation in people's goals and priorities. One such developmental change that has received considerable attention is the *positivity effect*, which describes an age-related increase in preference for processing positive stimuli over negative stimuli and is proposed to result from goal re-orientation across adulthood (Charles & Carstensen, 2010; Reed & Carstensen, 2012). The positivity effect has been exhibited in a variety of tasks, including cognitive tasks involving visual attention (e.g., Mather & Carstensen, 2003; Steinmetz, Muscatell, & Kensinger, 2010) and memory (e.g., Charles, Mather, & Carstensen, 2003; Kennedy, Mather, & Carstensen, 2004). Yet, previous studies exploring age-related differences in cognitive processing of positive and negative information have focussed on stimuli, such as faces and features of hypothetical choice options, that have limited (to no) association with real-life consequences. Conversely, in their daily lives, people routinely make decisions (e.g., whether to walk home alone at night) that elicit evaluations of positive and negative information associated with positive (e.g., arrive home sooner) and negative (e.g., be attacked) consequences. A better understanding of the conditions under which the positivity effect occurs or does not occur is necessary to enrich our understanding of how adult developmental changes in goal orientation influence cognitive processing of valenced information. To this end, the current research investigates whether the age-related positivity effect extends to cognitive processing of stimuli that are associated with real-life consequences.

A wealth of research has documented an age-related positivity effect in cognitive processing of positive and negative stimuli (Reed, Chan, & Mikels, 2014). In a prototypical task, a photo of an emotional face is briefly displayed side-by-side with a neutral face before the appearance of a dot that appears randomly in one of the two face locations. Mather and Carstensen (2003) found that when the dot appeared in the location of the emotional face older adults (62–94 years) were faster to respond if it was a positive face and were slower to respond if it was a negative face in comparison with the neutral face. Conversely, younger adults (18–35 years) showed no attentional bias to the positive or negative faces (see also Charles et al., 2003). Thus, older adults demonstrated an age-related preference for emotionally gratifying stimuli (i.e., positive faces) and a bias against negative emotional stimuli (i.e., negative faces). Incorporating eye-tracking, Isaacowitz, Wadlinger, Goren, and Wilson (2006a) found that older adults (61–85 years) directed their gaze toward happy (i.e., positive) faces in the dot-probe task and away from sad (i.e., negative) faces when emotional faces were paired with neutral faces. Conversely, younger adults (18–24 years) showed an attentional bias against negative faces, but no attentional preference in their gaze toward positive faces (see also Isaacowitz et al., 2006b; Nikitin & Freund, 2011). The age-related positivity effect in attention allocation has also been supported by meta-analyses (Murphy & Isaacowitz, 2008; Reed, Chan, & Mikels, 2014).

Age-related differences in cognitive processing of positive and negative information extend to non-facial stimuli. Mather, Knight, and McCaffrey (2005) found that older adults spent more of their viewing time than younger adults inspecting positive features (e.g., gas mileage) of choice options (e.g., models of car) and less time inspecting negative features. In another study, participants could review attributes of hypothetical healthcare plans by opening corresponding boxes on a computer monitor with a mouse cursor (Löckenhoff & Carstensen, 2007; see also Löckenhoff & Carstensen, 2008). The boxes were color-coded to identify whether they contained information about a positive, negative, or neutral feature of the healthcare plans. In comparison with younger adults (22–39 years), older adults (62–93 years) preferentially inspected a greater proportion of positive compared to negative features.

The positivity effect has also been reported in studies of long-term and autobiographical memory (Charles et al., 2003; Kennedy et al., 2004). In one study (Charles et al., 2003), participants viewed a series of positive, negative, and neutral images (e.g., images of people, animals, nature scenes, inanimate objects) displayed on a computer screen. Later, participants were asked to describe the images they saw. Older adults recalled more positive images than negative images, whereas younger adults recalled a similar number of positive and negative images. As well as spending more of their viewing time than younger adults inspecting positive features of choice options and less time inspecting negative features, older adults also recall more positive features for their chosen options (Leigland, Schulz, & Janowsky, 2004; Löckenhoff & Carstensen, 2007; Mather, Knight, & McCaffrey, 2005). Age-related differences in recall of positive and negative stimuli may result from a preferential focus of attention during stimulus encoding, such that older adults, in comparison with younger adults, focus their attention more toward positive stimuli and away from negative stimuli. Age-related differences may also emerge during recall as older adults may more frequently reject negative memories and more frequently endorse positive memories.

Spaniol, Voss, and Grady (2008) had participants view positive, negative, and neutral photographs during an incidental study phase. In a later recognition test phase, participants were asked to indicate whether test items were among those they had seen previously (i.e., were old or new). The authors used diffusion model analysis (Ratcliff, 1978; Ratcliff & Rouder, 1998)—a cognitive modeling approach for decomposing behavior on two-choice reaction-time tasks—to examine the cognitive mechanisms underlying age-related differences in memory retrieval. An appealing aspect of diffusion model analysis is that it decomposes behavior into psychologically meaningful components. Within the diffusion model, drift rate, v, measures the rate of accumulation of evidence in favor of a response (i.e., 'new' or 'old'), where higher values indicate faster and more accurate responding, indicating greater memory strength. Drift rate is distinguishable from other parameters, including boundary separation, a, which measures the threshold for responding, reflecting a speed-accuracy trade-off, and nondecision time, T_{er}, which includes non-decisional components such as stimulus encoding and response execution. Accordingly, a higher drift rate for old versus new test items would indicate greater accessibility of pre-experimental memories, increasing speed and accuracy of recognition. Spaniol et al. (2008) discovered that older adults exhibited a higher drift rate for old versus new positive items than younger adults, suggesting that positive pre-experimental memories were more accessible to older adults. Moreover, this effect did not differ for faces, scenes, or words. The authors concluded that the age-related positivity effect for memory retrieval may result from greater accessibility of positive long-term memories among older adults.

The age-related positivity effect has been conceptualized within socioemotional selectivity theory (SST; Carstensen, 2006; Carstensen & Mikels, 2005; Charles & Carstensen, 2010; Reed & Carstensen, 2012)—a motivational theory of lifespan development. According to SST, people possess a constellation of goals, including goals related to instrumental needs and emotional gratification, that shift in priority across adulthood according to one's perceived time horizon. A person who perceives their time horizon as expansive or open-ended, as in early adulthood, prioritizes future-oriented instrumental goals, which may include learning new skills or acquiring knowledge. As a person approaches later stages of life, time horizons are perceived to shorten and priorities shift to present-focused goals, namely emotional gratification.

An important tenet of SST is that cognitive processing is driven by motivations in a top-down fluid manner as opposed to a bottom-up fixed manner by which age alone would determine goal priorities. As such, a person's goal priorities depend on their perceived time horizon rather than their age per se. Indeed, when older adults were asked to imagine that a new medical advance promises them an additional 20 years of life in good health, their social preferences shifted from indicating a preference to spend time with a familiar social partner to preferring to spend time instead with a novel social partner, indicating a motivational shift away from emotional gratification with an expanded time horizon (Fung, Carstensen, & Lutz, 1999; see also, Fredrickson & Carstensen, 1990). Conversely, when younger adults were asked to imagine that they would soon emigrate to another country, constraining their time horizon, their social preferences instead shifted toward a preference to spend time with a familiar social partner (Fung et al., 1999).

However, previous studies reporting an age-related positivity effect have focused on materials, such as photographs of faces, scenes, and words, and features (e.g., gas mileage) of hypothetical choice options (e.g., models of car), that are not associated with real-life consequences. Conversely, in real life, people routinely make decisions that involve risk with the possibility of positive outcomes that are beneficial or pleasurable and negative outcomes that are harmful or unpleasant. Taking a river rapid ride on a small boat, for example, may be thrilling and exhilarating, but could result in physical injury. Decisions about whether to engage in such risky activities involve a trade-off between the expected beneficial outcomes of a decision option (e.g., taking a river rapid ride) and the risk of negative outcomes (Weber, Blais, & Betz, 2002). This trade-off requires consideration of the possible positive (e.g., thrill, exhilaration) and negative (e.g., physical injury) outcomes. Thus, people often evaluate positive and negative information that is associated with possible positive and negative consequences of decision-making.

Older adults take fewer risks than younger adults when their decisions involve possible negative outcomes (Rolison, Hanoch, & Wood, 2012; Rolison, Hanoch, Wood, & Pi-Ju, 2014; Turner & McClure, 2003). In one task (Rolison, Wood, & Hanoch, 2017), participants were asked to indicate whether they would engage in activities (e.g., using an ATM machine in the street) before and after listening to audio extracts of media reports conveying information about possible negative outcomes (e.g., a report on ATM fraud). Participants also rated their emotional valence and arousal responses to the reports. Older adults were more responsive than younger adults to the negative information conveyed in the reports, indicating that they would forgo more activities in their subsequent decisions. These age differences in decision-making were attributable to stronger negative emotional responses experienced by older adults to the reports. Therefore, it is unclear whether older adults would exhibit the age-related positivity effect when processing positive and negative information that is associated with positive and negative real-life consequences. In contrast to an age-related positivity effect, older adults may actually focus more than younger adults on information about possible negative outcomes and less on information about possible positive outcomes as this relates to their willingness to take a risk.

No previous study has explored whether younger and older adults differ in their attentional processing of valenced stimuli when it is associated with possible real-life consequences. In Rolison et al. (2017), decision-making was assessed only in response to information about negative possible outcomes. However, it may be the case that older adults are more responsive or allocate more attentional resources than younger adults to all valenced stimuli, regardless of whether it is positive or negative. Hence, previous research has not explored whether there exist age-related differences in attentional processing of valenced stimuli that is associated with real-life consequences. A better understanding of the limits and nuances of the age-related positivity effect would help inform theoretical models, such as SST, about how adult developmental changes in goal orientation affect cognitive processing of valenced information. Namely, if the positivity effect does not extend to stimuli that is associated with possible real-life consequences then this would suggest that emotional gratification goals are not prioritized in older adulthood for all types of valenced information, and specifically not when valenced information is associated with real-life consequences to which older adults are known to be less willing to take a risk than their younger counterparts.

In Experiment 1, younger and older adults were asked to list possible outcomes of engaging in real-life risky activities. If the age-related positivity effect extends to valenced information that is associated with real-life consequences, then compared to younger adults, older adults should focus their attention on generating positive rather than negative possible outcomes. This finding would be consistent with previous reports of older adults focussing their attention on positive memories and away from negative memories during retrieval of studied material (e.g., Löckenhoff & Carstensen, 2007; Mather et al., 2005). If instead, the positivity effect does not extend to this type of valenced information, then younger and older adults may generate similar outcomes in terms of their valence or older adults may exhibit a negativity effect by focussing on generating negative rather than positive outcomes in comparison with younger adults, consistent with their lower willingness to take risks that involve a possibility of negative consequences.

In Experiment 2, participants were presented a sample of the positive and negative outcomes previously generated for risky activities by participants in Experiment 1 and irrelevant outcomes that had been generated for other activities. Participants' task was to decide as quickly as possible whether each putative outcome is relevant to an activity. If the age-related positivity effect extends to valenced information that is associated with real-life consequences (i.e., of engaging in risky activities) then older adults should be faster to respond to positive outcomes and slower to respond to negative outcomes in comparison with younger adults. This finding would be consistent with previous reports of an age-related shift in attentional focus toward processing positive information and away from processing negative information (e.g., Charles et al., 2003; Isaacowitz et al., 2006a; 2006b). However, as in the generation of possible outcomes (Experiment 1), the age-related positivity effect may reduce or reverse when participants are required to respond to positive and negative possible outcomes of engaging in risky activities, reflecting older adults' lower willingness to take risks.

The two-choice reaction-time methodology employed in Experiment 2 further enables modeling of the cognitive processes underlying age-related differences in processing of valenced information. As discussed earlier, Spaniol et al. (2008) used diffusion model analysis to decompose response times on a two-choice recognition memory task. The authors discovered that an age-related positivity effect in recognition memory resulted from greater accessibility of positive long-term memories in older adults, as indicated by a higher drift rate in the diffusion model. In their study, a higher drift rate reflected faster and more accurate responding to old (i.e., previously studied) versus new items in a test phase. Here, in Experiment 2, diffusion model analysis is employed to investigate cognitive processing of positive and negative outcomes of risky activities. Thus, differences in drift rate will indicate whether positive or negative possible outcomes are more readily brought to mind when imagining engaging in risky activities.

Experiment 1

Method

Participants

Fifty younger adults (56% female; age range 18-35 years, $M = 23.60$, $SD = 4.83$) and 50 older adults (54% male; age range 65-81 years, $M = 69.00$, $SD = 4.15$) were recruited from the university campus and local community. The sample size of 50 participants per age band is comparable with previous studies showing age-related differences in processing of positive and negative information (e.g., Mather & Carstensen, 2003). All older adults passed the mini mental state examination as a screen for cognitive impairment. Participants were compensated £5 (~$7.04 US dollars) for their participation, which lasted around 45 minutes. The majority of younger adults were students (n = 39, 78%). The remaining were in part-time (n = 8, 16%) or full-time (n = 3, 6%) employed. The majority of older adults were retired (n = 38, 76%), with the remaining in part-time employment (n = 10, 20%). Ethical approval for the study protocol was provided by the internal ethics review board (institution: University of Essex; title: The consideration of consequences across adulthood; protocol number: JR1604) All participants provided written informed consent prior to participating in the study.

Materials and procedure

Generating outcomes. The 24 scale items (see Appendix A for full list) included activities and behaviors in four life domains, including the recreational, health, financial, and social domains. The items were adapted from the Domain Specific Risk-Taking (DOSPERT) scale. The DOSPERT scale has been used extensively to study adult age-related differences in self-reported risk-taking across life domains (Blais & Weber, 2006; Rolison, Hanoch, Freund, in press; Rolison et al., 2014). However, some items of the DOSPERT, such as 'starting a new career in your mid-thirties' in the financial domain, were deemed less relevant to people in older age ranges and were replaced with activities that were less age specific, such as 'using your credit card to pay for an item on an unfamiliar website'. Other activities implied physical abilities that may be more limited in older age, such as abilities required for 'bungee jumping off a tall bridge' in the recreational domain, and were replaced with items that required less physical strength or agility, such as 'taking a ride through the countryside on the back of a high performance motorcycle'.

As new items were developed for the present purposes, it was important to ensure that the scale items broadly represented their intended life domain. In two waves of pilot testing, participants were asked to indicate for each item its most relevant life domain. In the first wave of pilot testing (n = 99; mean age = 39.24; *SD* = 15.10; 18-35 years, n = 55; 36-64 years, n = 38, $\geq$65 years, n = 6), a mean of 15.48 of the 24 items were allocated to the intended domain. Following further modifications to some scale items, in the second wave of pilot testing (n = 100, mean age = 37.61, *SD* = 13.62, $n_{18\text{-}35\ years}$ = 54, $n_{36\text{-}64\ years}$ = 43, $n_{65+\ years}$ = 3), a mean of 18.67 of the 24 items were allocated to the intended domain. Thus, the scale broadly reflects the intended life domains, indicating that it captures a broad range of risky activities and behaviors.

A printed booklet was produced for each participant containing eight of the risky activities, which consisted of two randomly selected items from each domain among the full list of 24 items. Eight items were deemed appropriate for the targeted participation time (i.e., $\leq$ 1 hour) and to limit effects of fatigue.

On each page of the booklet, participants were asked to imagine engaging in an activity (e.g., ‘betting on the outcome of a sporting event’) and to write down up to 20 things that might happen as a result of engaging in the activity. Loaded terms (e.g., consequence) were avoided throughout the participant instructions in favor of more neutral terms (e.g., outcome). To the right of each generated outcome, participants indicated whether it was a good, bad, or neutral outcome by circling a corresponding label and ranked its importance (value of 1 = most important) in determining whether they would engage in the activity.

Risk-taking attitudes. After generating outcomes for activities, participants were presented all 24 risky activity items and rated their risk behavior, risk perceptions, and expected benefits for each item in each of three sections of a printed booklet. The items were displayed in a randomly generated order for each section but were presented in the same order for each participant. The risk behavior, risk perceptions, and expected benefits sections of the booklet were presented in a randomly generated order for each participant. In the risk behavior section, participants rated on a 7-point scale, ranging -3 (‘Extremely unlikely’) to 3 (‘Extremely likely’), the likelihood they would engage in each activity if they were to find themselves in the depicted situation. In the risk perceptions section, participants were provided a definition of risk in lay terms and were asked to rate on a 7-point scale, ranging 0 (‘Not at all risky’) to 6 (‘Extremely risky’), how risky they perceived that it would be for them to engage in each activity. In the expected benefits section, participants rated on a 7-point scale, ranging 0 (‘No benefits at all') to 6 ('Great benefits'), the benefits they believed they would obtain from engaging in each activity. The participant instructions and rating scales were similar to those used in the DOSPERT scale, developed by Blais and Weber (2006).

Results

Envisioning outcomes of engaging in risky activities

Participants each generated a mean of 6.00 (*SD* = 1.82) outcomes per activity. Collectively, they produced a large variety of possible outcomes, generating a mean of 69.75 (*SD* = 14.51) unique outcomes per activity.[1] Consequently, few of the outcomes were generated by many participants, with each unique outcome being generated by a mean of 2.92 (*SD* = 0.49) participants.

Participants generated a mean of 2.57 (*SD* = 0.97) positive outcomes, 2.63 (*SD* = 0.93) negative outcomes, and 0.80 (*SD* = 0.61) neutral outcomes per activity. To test for effects of age, a Poisson loglinear analysis was conducted on the number of outcomes generated for activities. Few neutral outcomes were generated and thus were omitted from the analysis. Age (younger, older) and type of outcome (positive, negative) were included as predictors. The standard errors of the model coefficients were adjusted using a generalized estimating equation to account for repeated measures (i.e., activities) within participants. The analysis yielded no significant effect of age (odds ratio = 0.91, p = .109) or type of outcome (odds ratio = 1.04, p = .369) and no interaction. Regarding the importance rankings, participants ranked positive outcomes (M = 3.08, SD = 1.54) as more important for informing their decisions than negative outcomes (M = 3.78, SD = 2.01). To test for effects of age, a random effects linear regression analysis was conducted on the mean importance ranking for the positive and negative outcomes of activities. Random intercepts were included for participants

[1] Outcomes that differed in their wording, but conveyed the same meaning (e.g., "attacked by wild animals", "animal threatens you") were classified as a single outcome.

and fixed effects were included for age and type of outcome. The analysis confirmed a significant effect of type of outcome (b = 0.70, $p < .001$), but yielded no significant effect of age (b = -0.22, $p = .192$) or interaction.

While the analysis above indicates that younger and older adults did not differ significantly in the total number of positive and negative outcomes they generated for activities, they may have differed in their initial focus on positive or negative outcomes. If so, age-related differences may emerge in whether younger and older adults first generated a positive or a negative outcome for the activities. Regarding the first outcome generated, participants frequently produced a positive (48%) or negative (47%) outcome and rarely a neutral (5%) outcome. To test for effects of age on the first outcome produced, a mixed-effects logistic regression analysis was conducted on the first outcome generated for activities when a positive or negative outcome was produced. Neutral outcomes were omitted as few were generated. Random intercepts were included for participants and a fixed effect was included for age (younger, older). The analysis revealed a significant effect of age on the likelihood that a positive (rather than a negative) outcome was the first outcome produced (odds ratio = 0.62, $p = .024$). Figure 1 shows the estimated probabilities and confirms a tendency for younger adults to first generate a positive outcome and for older adults to first generate a negative outcome. This finding is in stark contrast with a body of existing research indicating an age-related shift from preferential processing of negative information toward positive information in older age (e.g., Reed et al., 2014).

Moreover, inspecting the importance rankings, participants ranked the first outcome they generated as more important ($M = 2.42$; $SD = 0.88$) than other outcomes ($M = 3.99$; $SD = 1.03$) in determining whether they would engage in the activities. A 2x2 mixed analysis of variance (ANOVA) was conducted on participants' mean rankings averaged across activities and included age (younger, older) and outcome order (first outcome, remaining outcomes) as factors. A significant effect of outcome order confirmed that the first outcome produced was ranked as more important on average than other outcomes ($F(1,98) = 155.36$, $p < .001$, $\text{eta}^2 = .61$). There were no other significant main effects or interactions. Further, younger and older adults both ranked the first outcome they produced as the most important of all outcomes for 45% of the activities.

Association between envisioned possible outcomes of risky activities and self-reported risk-taking

The risk behavior, risk perceptions, and expected benefits subscales demonstrated adequate internal consistency (Table 1). Table 1 provides the mean group values for the sub-scales and independent-samples *t*-tests comparing younger and older adults. Older adults re-ported a significantly lower risk-taking likelihood than younger adults and perceived greater risks and expected fewer benefits of engaging in the activities.

Table 2 provides the partial correlations between the factors generated for the activi-ties and the risk-taking subscales, controlling for age (as a continuous variable). These in-clude and the number of positive versus negative outcomes produced for activities as the first outcome ($n_{\text{positive outcomes}} - n_{\text{negative outcomes}}$), the number of positive versus negative outcomes produced per activity ($n_{\text{positive outcomes}} - n_{\text{negative outcomes}}$), and the mean importance ranking for positive versus negative outcomes (i.e., $M_{\text{positive outcomes}} - M_{\text{negative outcomes}}$). More frequently generating a positive versus a negative outcome as the first outcome and generating a greater number of positive versus negative outcomes overall were associated with higher risk-taking likelihood, lower risk perceptions, and greater expected benefits. A higher importance rank-ing for positive versus negative outcomes was associated with higher risk-taking likelihood and greater expected benefits. Thus, the outcomes participants generated for the activities and their ratings of their importance were associated with their ratings of risk perception, ex-pected benefits, risk-taking likelihood.

Multiple linear regression analyses were conducted to test for moderating effects of age on the association between the outcomes generated for activities and ratings on the risk-taking subscales. Age moderated the association between importance rankings for positive vs. negative outcomes and risk-taking likelihood ($\beta = .57$, $t = 2.87$, $p = .005$), such that the association was stronger among younger ($r(50) = -.63$, $p < .001$) than older ($r(50) = -.27$, $p = .058$) age groups. Age also moderated the association between importance rankings for positive vs. negative outcomes and expected benefit ratings ($\beta = .62$, $t = 2.89$, $p = .005$), such that the association was stronger among younger ($r(50) = -.62$, $p < .001$) than older ($r(50) = -.07$, $p = .651$) age groups. There were no other significant moderating effects of age. Thus, the association between the outcomes generated for activities and ratings on the risk-taking subscales differed with age only for importance rankings.

Summary

In sum, younger and older adults did not differ in the overall number of positive and negative possible outcomes they generated for risky activities, but did differ in whether the first outcome they generated was positive or negative. Younger adults tended to first generate a positive outcome for activities whereas older adults tended to first generate a negative outcome. Moreover, the first outcome generated tended to be rated as the most important in determining whether they would engage in the activity. In Experiment 1, participants evaluated possible outcomes of engaging in real-life risky activities. The current findings reveal adult age-related differences in processing of valenced information that extend beyond processing of stimuli, such as faces and visual scenes (e.g., Mather & Carstensen, 2003), that have little association with real-life decision-making consequences.

Experiment 2

In Experiment 1, younger and older adults did not differ in the overall number of positive and negative outcomes they generated when imagining engaging in real-life risky activities. However, younger adults did exhibit an initial focus on positive outcomes, as they were more likely to generate a positive than a negative outcome as the first outcome they generated for activities, and this tendency shifted to an initial focus on negative outcomes in older age. A focus on positive over negative outcomes was also associated with individual differences in self-reported risk-taking. In Experiment 2, a reaction time task is used to investigate younger and older adults' attentional processing of outcomes generated for the activities in Experiment 1.

Method

Participants

Fifty younger adults (44% female; age range 18-32 years, $M = 21.66$, $SD = 3.17$) and 49 older adults (55% female; age range 65-80 years, $M = 69.22$, $SD = 3.42$) were recruited from the university campus and local community. None of the participants who took part in Experiment 1 took part in Experiment 2. All older adults passed the mini mental state examination as a screen for cognitive impairment. Participants were compensated £5 (~$7.04 US dollars) for their participation, lasting around 30 minutes. Most younger adults were students (n = 40, 80%) and fewer were unemployed (n = 1, 2%) or full-time employed (n = 3, 6%). Most older adults were retired (n = 43, 88%), with the remaining in part-time employment (n = 6, 12%).

Materials and procedure

Outcome evaluation task. Participants were shown on a computer screen the risky activities used in Experiment 1 and for each activity were asked to decide as quickly as possible whether outcomes that appeared on screen are relevant to each activity. In the upper portion of the screen, participants were asked to imagine engaging in the activity that appeared in a box below. In the lower portion of the screen, they were asked whether the text that appeared in the box below referred to something that might happen to them if they were to engage in the activity above. The portions of the display were positioned to ensure the activity and outcome could be viewed simultaneously. Participants pressed either the 'd' (covered with a green label) or 'k' (covered with a red label) key on the computer keyboard to identify whether the outcome was something that could happen as a result of engaging in the activity. The participant instructions encouraged participants to respond as quickly and as accurately as possible.

For each activity, participants were presented 15 outcomes. Five were positive outcomes of the activity, five were negative outcomes of the activity, and five were irrelevant to the activity. All outcomes had been generated by participants in Experiment 1. A subset of the most frequently generated positive and negative outcomes for each activity were selected for use as stimuli. The positive outcomes selected for use in Experiment 2 had been generated by a mean of 15% of younger adults and a mean of 14% of older adults in Experiment 1. The negative outcomes selected for use in Experiment 2 had been generated by a mean of 13% of younger adults and a mean of 14% of older adults in Experiment 1. Independent-samples *t*-tests confirmed there were no significant differences in the frequency that the positive ($t(46) = 0.84$, $p = .403$) and negative ($t(46) = 0.71$, $p = .479$) outcomes that had been generated by younger and older adults in Experiment 1. Therefore, the positive and negative outcomes selected as stimuli equally reflected the outcomes generated by younger and older adults.

Younger and older adults also exhibited a high level of agreement about the valence of the selected positive and negative outcomes. The positive outcomes had been rated as positive by almost all younger and older participants who generated them in Experiment 1 ($M_{younger}$ = 97%; M_{older} = 98%) and the negative outcomes had been rated as negative on almost every occasion they were generated ($M_{younger}$ = 98%; M_{older} = 98%). Participants' importance rankings were also assessed for the selected outcomes to ensure that they had been rated as equally important to decision-making by younger and older adults. An independent-samples *t*-test conducted on the mean rankings for each activity confirmed no significant differences between younger and older adults in their ranking of the importance of the positive ($M_{younger}$ = 3.39; M_{older} = 3.07; $t(46) = 1.31$, $p = .197$) and negative ($M_{younger}$ = 3.98%; M_{older} = 3.94%; $t(46) = 0.11$, $p = .914$) outcomes. Therefore, the outcomes selected for use in Experiment 2 did not differ between younger and older adults in their perceived importance for decision-making.

Participants were randomly assigned to each complete 16 of the 24 activities, responding to 15 outcomes for each activity. Sixteen activities was deemed appropriate for the targeted participation time (i.e., $\leq$ 1 hour) and to minimize effects of fatigue. Activities were presented in a randomly generated order for each participant. Prior to beginning the first activity, participants completed a practice activity with 15 outcomes to familiarize them with the task.

Risk-taking attitudes. Participants completed the same 24-item risk-taking scale used in Experiment 1, assessing their self-reported risk behavior, risk perceptions, and expected benefits for each item in each of three sections of a printed booklet.

Results

In the outcome evaluation task, participants judged whether putative outcomes (positive, negative, irrelevant) generated by participants in Experiment 1 were relevant to activities. Traditionally, two-outcome response time tasks have been analyzed using analysis of variance (ANOVA) conducted separately on mean response time for correct responses and the proportion of correct responses. However, this piecemeal approach fails to integrate response time and accuracy, which can cause misleading results, especially for comparisons of younger and older adults. For example, Ratcliff, Thapar, and McKoon (2001) discovered that older adults' slower response time on a discrimination task was due to the older adults adopting a more conservative response threshold, rather than an age-related slowing of information processing—as indicated by the group differences in mean response time. Here, a cognitive modeling approach is adopted, using diffusion model analysis, to decompose behavior on the task into psychologically meaningful parameters. Before presenting the modeling results, the traditional analysis is briefly described.

Traditional analysis

Overall, the percentage of correct responses on the outcome evaluation task was 86% (*SD* = 8%). For many participants, accuracy was at least 90% (*n* = 41, 41%), and for most it was at least 75% (*n* = 93; 94%). A 2x2 mixed ANOVA was conducted on participants' mean percentage of correct responses, including age (younger, older) and type of outcome (positive, negative, irrelevant) as factors. A significant effect of type of outcome ($F(2,194) = 76.35$, $p < .001$, $\text{eta}^2 = .44$) indicated that participants more often correctly identified irrelevant outcomes (*M* = 97%) than they correctly identified positive (*M* = 84%) or negative (*M* = 79%) outcomes. There was no significant effect of age (M_{younger} = 87%; M_{older} = 87%; $F(1,97) = 0.10$, $p = .753$) and no interaction.

The overall mean reaction time was 1.06sec (*SD* = 0.23sec). A 2x2 mixed ANOVA was conducted on participants' mean reaction times to test for effects of age and type of outcome. The analysis indicated that older adults (*M* = 1.29sec) were significantly slower to respond than younger adults (*M* = 1.11sec; $F(1,97) = 13.93$, $p < .001$, $\text{eta}^2 = .13$). However, the analysis also yielded a main effect of type of outcome ($F(2,194) = 13.48$, $p < .001$, $\text{eta}^2 = .12$) and an interaction between age and type of outcome ($F(2,194) = 15.67$, $p < .001$, $\text{eta}^2 = .14$).

Among younger adults, reaction time was fastest for positive outcomes (M = 1.06 sec), followed by irrelevant (M = 1.12sec) and negative (M = 1.14sec) outcomes. Among older adults, reaction time was fastest for irrelevant outcomes (M = 1.19 sec), followed by positive (M = 1.32sec) and negative (M = 1.35sec) outcomes. Thus, younger adults appeared to show a reaction time advantage for positive outcomes, which was not apparent for the older adults.

Diffusion model analysis

Diffusion model analysis combines response time and accuracy and decomposes behavior into three psychologically meaningful parameters. Drift rate, v, measures the rate of evidence accumulation in favor of a response, where higher values indicate faster and more accurate responding. Boundary separation, a, measures an individual's response criterion, where higher values indicate a more conservative criterion (i.e., stronger evidence is required before a decision is made), indicating cautious responding. A third parameter, nondecision time, T_{er}, represents the nondecision component of response time, which includes stimulus encoding and execution of a motor response. In the outcome evaluation task, nondecision time can be understood as involving processing of the stimulus outcome presented on screen for an activity before evaluating whether it is relevant to the activity.

The EZ approach to diffusion model analysis, developed by Wagenmakers, van der Maas, & Grasman (2007), was adopted for the current data. The EZ approach accommodates small numbers of trials and high proportions of correct responses (Schmiedek, Oberauer, Wilhelm, Süß, & Wittmann, 2007; Wagenmakers et al., 2007). The three EZ diffusion model parameters were estimated separately for positive, negative, and irrelevant outcomes for each participant.

Drift rate (v)

Younger and older adults were faster and more accurate (i.e., higher drift rate) to identify irrelevant outcomes than relevant outcomes of activities, but differed in their drift rates according to the type of outcome (Figure 2). Inspecting Figure 2, younger adults exhibited a higher mean drift rate than older adults specifically for positive outcomes. A 2x2 mixed ANOVA was conducted on participants' drift rate values, including age (younger, old) and type of outcome (positive, negative, irrelevant) as factors. The analysis confirmed a significant effect of type of outcome ($F(2,194) = 138.64$, $p < .001$, $eta^2 = .59$). While there was no significant main effect of age ($F(1,97) = 0.26$, $p = .612$), age interacted with type of outcome ($F(2,194) = 9.05$, $p < .001$, $eta^2 = .09$). Independent-samples *t*-tests confirmed significant age group differences in drift rate for positive ($t(97) = 3.64$, $p < .001$) and irrelevant ($t(97) = 3.04$, $p = .003$) outcomes, but not for negative outcomes ($t(97) = 0.78$, $p = .437$).

Boundary separation (a)

Older adults adopted a more conservative response criterion (i.e., higher boundary separation) than younger adults for all types of outcome (Figure 2). This finding replicates earlier findings of more cautious responding in older age (Ratcliff et al., 2001). A 2x2 mixed ANOVA, including age (younger, old) and type of outcome (positive, negative, irrelevant) as factors, confirmed a significant effect of age ($F(1,97) = 9.53$, $p = .003$, $eta^2 = .09$). There was also a significant effect of type of outcome ($F(2,194) = 94.12$, $p < .001$, $eta^2 = .49$), indicating a more conservative response threshold for irrelevant outcomes than for positive and negative outcomes (Figure 2). As such, participants required more evidence to reject an irrelevant outcome than they required to accept a relevant outcome. There was no significant interaction.

Nondecision time (T_{er})

Older adults exhibited a longer nondecision time than younger adults across the three types of outcomes (Figure 2), indicating that they took longer in general to encode the stimulus outcome and execute a response. A 2x2 mixed ANOVA, including age (younger, old) and type of outcome (positive, negative, irrelevant) as factors, confirmed a significant effect of age on nondecision time ($F(1,97) = 12.27$, $p = .001$, $eta^2 = .11$). The analysis also yielded a significant effect of type of outcome ($F(2,194) = 8.46$, $p < .001$, $\text{eta}^2 = .08$) and an interaction between age and type of outcome ($F(2,194) = 6.04$, $p = .003$, $\text{eta}^2 = .06$). Independent-samples *t*-tests confirmed significant age group differences for positive ($t(97) = 4.49$, $p < .001$) and negative ($t(97) = 3.07$, $p = .003$) outcomes, but not for irrelevant outcomes ($t(97) = 1.75$, $p = .084$).

Association between attentional focus on outcomes of risky activities and self-reported risk-taking

The three risk-attitude subscales exhibited reasonable levels of internal consistency (Table 1). Inspecting the mean group values for the subscales and the independent-samples *t*-tests comparing younger and older adults, older adults reported significantly lower risk-taking likelihood, perceived greater risks, and expected fewer benefits for the activities.

Table 2 provides the partial correlations between the three diffusion model parameters and the risk-taking subscales, controlling for age (as a continuous variable). For each of the three parameters, values for negative outcomes were subtracted from the values for positive outcomes. A higher drift rate for positive versus negative outcomes was associated with higher risk-taking likelihood and lower perceived risk. A higher boundary separation for positive versus negative outcomes was associated with higher risk-taking likelihood and lower perceived risk. Finally, a longer nondecision time for positive versus negative outcomes was associated with lower risk-taking likelihood, higher perceived risk, and fewer expected benefits. Thus, participants' responding to possible outcomes of risky activities was associated with their ratings of risk perception, expected benefits, risk-taking likelihood.

Multiple linear regression analyses were conducted to test for moderating effects of age on the association between the diffusion model parameter values and ratings on the risk-taking subscales. Age moderated the association between nondecision time for positive vs.

negative outcomes and expected benefit ratings (β = .38, t = 2.12, p = .036), such that the association was stronger among younger (r(50) = -.45, p = .001) than older (r(49) = -.03, p = .836) age groups. There were no other significant moderating effects of age. Thus, the association between the diffusion model parameter values and ratings on the risk-taking subscales differed with age only for nondecision time.

Summary

In sum, younger adults were faster and more accurate than older adults to identify positive outcomes of risky activities, indicated by an age difference in drift rate, but did not differ in their responding to negative outcomes. Moreover, a higher drift rate for positive versus negative outcomes was associated with a higher self-reported likelihood of engaging in the activities and lower perceived risk. These novel findings reveal an opposing age-related tendency to the positivity effect reported in a large body of previous research (e.g., Murphy & Isaacowitz, 2008; Reed et al., 2014). Furthermore, individual differences in processing of positive and negative stimuli were associated with individual differences in risk perception and self-reported risk-taking, which indicates that age-related differences in processing of valenced information also map onto perceptions and behavioral intentions that inform decision-making.

General Discussion

Previous research has revealed an age-related positivity effect in cognitive processing of positive and negative stimuli (Charles et al., 2003; Kenedy et al., 2004; Mather & Carstensen, 2003). Yet, these studies have focussed on stimuli, such as photos of faces and visual scenes, that have little association with real-life consequences. The current experiments investigated whether the age-related positivity effect extends to valenced information that is associated with real-life consequences. In opposition to an age-related positivity effect, the current experiments reveal novel age-related tendencies in the cognitive processing of valenced information that map onto perceptions and behavioral intentions for real-life decision-making scenarios.

In Experiment 1, participants generated possible outcomes (e.g., ‘experience the culture’, ‘lose belongings’) of activities (e.g., ‘traveling to an unfamiliar country’). In stark contrast with the age-related positivity effect, younger adults showed an initial focus on retrieving positive outcomes and this tendency shifted to an initial focus on negative outcomes in older age. In Experiment 2, younger adults were also faster to identify positive outcomes of activities than they were to identify negative outcomes—a tendency that dissipated in older age. The current evidence suggests that the age-related positivity effect does not extend to valenced information, such as possible outcomes of engaging in risky activities, that is associated with real-life consequences.

According to socioemotional selectivity theory (SST; Carstensen, 2006; Reed & Carstensen, 2012), people possess multiple goals that shift in priority across adulthood. The age-related positivity effect is important to the main tenets of SST as it is consistent with a notion that in later life priorities shift toward present-focussed goals that emphasize emotional gratification, characterized by a preferential focus on positive stimuli over negative stimuli. Employing a novel methodology, the current experiments reveal an opposing preference for processing positive stimuli over negative stimuli in younger age that reverses in older age. However, the current findings to not challenge the central tenets of SST. Rather, the findings extend SST and our understanding of adult developmental changes in goal orientation by identifying an important case in which the positivity effect does not occur. As discussed in more detail later, the current findings suggest that older adults alter their priorities within their repertoire of goals, depending on the nature of their current task. This possibility, which is not one of the tenets of SST, opens a new door to future enquiries that will lead to novel insights into adult age-related differences in goal orientation.

The current findings also reveal new insights into how age-related differences in cognitive processing of valenced information influence behavior. A key proposition of SST is that an attentional focus on positive stimuli over negative stimuli promotes well-being in older age (Mather & Carstensen, 2003; Reed & Carstensen, 2012). There exists some support for this assertation. For example, Kennedy et al. (2004) found that older nuns, but not younger nuns, reported being in a more positive mood after answering questions about their personal memories. In the current investigation, whether participants focused their cognitive processing on positive outcomes or on negative outcomes of engaging in real-life risky activities was associated with their risk perceptions, expected benefits, and self-reported likelihood of engaging in the activities. This finding suggests that age-related differences in processing of valenced information associated with real-life consequences influences perceptions and behavioral intentions that inform decision-making. Together, these findings indicate that goal selection and prioritization across adulthood may be adaptive for enhancing well-being and decision-making.

A handful of prior studies have found little (or no) evidence of the age-related positivity effect in memory recall (Depping & Freund, 2013; Grühn, Smith, & Baltes, 2005; Majerus & D'Argembeau, 2011). One proposed explanation is that methods used in these studies impose task-specific demands that impede or disrupt goal-orientation, typically by focussing attention on performance accuracy (Reed & Carstensen, 2012; Reed et al., 2014). For example, in the Grühn et al. (2005) study, participants were instructed to recall from a prior study list as many words as possible, which may have focussed participants on performance-related goals. Here, younger and older adults did not differ in the total number of positive and negative outcomes they produced for activities. Relatedly, Beyth-Marom, Austin, Fischhoff, Palmgren, and Jacobs-Quadrel (1993) investigated adolescents' beliefs about the possible outcomes of engaging in risky activities. Adolescents typically exhibit higher levels of risk-taking behavior than adults (Steinberg, 2008). Beyth-Marom et al. asked the adolescents to list possible positive and negative outcomes of risky activities (e.g., 'your friends ask you to come along with them for a drive after a party where everyone has been drinking'). They also asked adults, some of whom were parents of the adolescents, to list possible outcomes they envisioned for an adolescent. Both age groups generated more negative than positive outcomes, but surprisingly, adolescents and adults generated a similar number of positive and negative outcomes. Seemingly, risk-taking tendencies during adolescence do not appear to result from a failure to consider negative possible outcomes of actions nor from a focus on positive possible outcomes. As such, adolescents and adults appear to possess similar beliefs or knowledge about the possible outcomes of engaging in risky activities.

However, here, age differences did occur with regard to participants' initial focus on positive and negative outcomes. Crucially, participants who generated more positive (than negative) outcomes as their first outcome for activities independently reported a higher likelihood that they would engage in the activities and perceived fewer risks and expected greater benefits of engagement. In Experiment 2, faster responding to positive (versus negative) outcomes—as indicated by drift rate—was associated with a higher reported likelihood of engaging in the activities and lower risk perceptions. Thus, the first outcome participants generated in Experiment 1 and their evaluations of outcomes in Experiment 2 were associated with their attitudes toward risk-taking in terms of their self-reported likelihood to take a risk, their risk perceptions, and expected benefits. Therefore, it is unlikely that the methods employed in the current experiments imposed tasks-specific demands that focussed participants on task-related goals in a way that has been observed in other studies (e.g., Grühn et al., 2005). Any such disruption to goal-orientation and focus on task-related goals should have eliminated the association between the types of outcomes participants generated (Experiment 1) and their evaluations of outcomes (Experiment 2) and their attitudes toward risk-taking.

Why did younger and older adults differ in the first outcome they generated for activities, but did not differ in the overall numbers of positive and negative outcomes they generated? One possibility is that tasks that require participants to list outcomes of activities assess knowledge of the possible outcomes rather than tendencies to consider positive and negative outcomes when deciding whether to engage in an activity. From a young age, individuals likely become aware of the typical outcomes associated with many risky activities, such as engaging in unprotected sex or driving a vehicle under the influence of alcohol. Age differences in risk-taking may depend not on the extent of an individual's knowledge of the possible outcomes of an activity, but on tendencies to retrieve possible outcomes from memory during decision-making. Indeed, memory retrieval is an essential component of various kinds of decision-making and the same brain regions that are involved in memory retrieval are also involved in decision-making (Euston, Gruber, & McNaughton, 2012). The willingness to take a risk may result from a tendency to retrieve from memory positive rather than negative possible outcomes of engaging in an activity. Hence, younger and older adults in Experiment 1, and adolescents and adults in the Grühn et al. study (2005), may not have differed in the overall numbers of positive and negative outcomes they generated as this measure partially reflects their knowledge of all possible outcomes, which may differ little with age. Inspecting the first outcome participants generate for an activity may provide a better assessment of age differences in the types of outcomes that people automatically retrieve from memory when deciding whether to engage in an activity.

The current findings indicate that the age-related positivity effect may not extend to valenced information that is associated with real-life possible consequences. While the age-related positivity effect is robust, supported by two meta-analyses (Murphy & Isaacowitz, 2008; Reed et al., 2014), other findings in the literature also suggest that under specific circumstances the positivity effect does not occur. In one study, participants inspected positive and negative features of vacation options (Depping & Freund, 2013). When told that they would later assess the options for their readability, older adults showed the typical positivity effect in their memory recall of the features. Conversely, when told that they would later make decisions about the travel options, older adults no longer showed the positivity effect in their memory recall. Together, these findings suggest that older adults may adopt a goal-driven focus on emotionally gratifying stimuli, but adopt alternative goals either when valenced information is associated with real-life possible outcomes or can inform later decisions. A fruitful direction for future research would be to further explore the cognitive mechanisms involved in older adults' switching between goals in their processing of valenced information. This line of enquiry would further enrich our understanding of how adult developmental changes in goal orientation influence cognitive processing of positive and negative information.

A range of risky activities were designed for the present purposes, capturing a broad spectrum of real-life activities in four domains of life. Recent research has revealed that adult age-related differences in self-reported risk-taking differ across life domains (e.g., recreational, financial, social, health; Rolison et al., 2014; in press). Namely, risk-taking behavior decreases more sharply with age in some domains (e.g., recreational) than in others (e.g., social). The current experiments did not permit an examination of possible domain differences in the types of outcomes younger and older adults generate for activities and their evaluations of outcomes. This was due to a focus on a broad range of real-life activities at the expense of an adequate number of items within each domain. Future research could explore the possibility of domain differences by using a larger set of items within each domain, such as by focussing on a smaller number of domains. In the current experiments, the first outcome participants generated and their evaluations of outcomes were associated with their self-reported risk-taking, risk perceptions, and expected benefits. Thus, domain differences in risk-taking are likely to map onto domain differences in the types of outcomes that people generate and their evaluations of those outcomes.

In conclusion, the current investigation reveals that despite the robust nature of the age-related positivity effect it may not extend to cognitive processing of valenced information that is associated with real-life consequences. Older adults may exhibit present-focused goals and prioritize emotional gratification, as proposed by socioemotional selectivity theory (Carstensen, 2006; Charles & Carstensen, 2010), but also appear to switch to alternative goals, depending on the nature of their task.

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Table 1. *Mean group risk-taking likelihood, risk perceptions, and expected benefits of younger and older adults.*

	Cronbach α	Younger adults *M*	Younger adults *SD*	Older adults *M*	Older adults *SD*	Independent-samples *t*-value
Experiment 1						
Risk behavior	.84	0.40	0.89	-0.36	0.68	4.82***
Risk perceptions	.83	2.97	0.68	3.51	0.65	4.11***
Expected benefits	.83	3.04	0.69	2.52	0.64	3.90***
Experiment 2						
Risk behavior	.80	0.17	0.75	-0.43	0.73	4.04***
Risk perceptions	.84	3.09	0.63	3.50	0.76	2.92**
Expected benefits	.83	3.16	0.59	2.41	0.68	5.86***

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 2. *Correlations involving risk-taking likelihood, risk perceptions, and expected benefits.*

	Risk behavior	Risk perceptions	Expected benefits
Experiment 1			
First outcome (positive – negative)	.39***	-.29**	.26**
Importance ranking (positive – negative)	-.46***	.19	-.34***
Number of outcomes (positive – negative)	.38***	-.28**	.24*
Experiment 2			
Drift rate (v) (positive – negative)	.38***	-.32**	.18
Boundary separation (a) (positive – negative)	.25*	-.25*	.12
Nondecision time (T_{er}) (positive – negative)	-.44***	.32***	-.23*

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

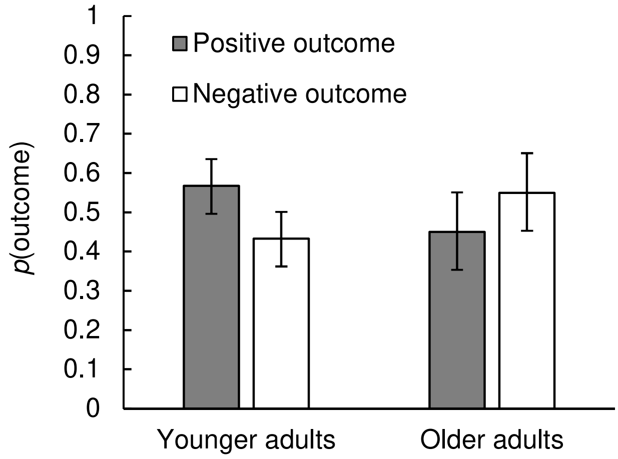

Figure 1. Estimated probabilities of first generating a positive or negative outcome for activities among younger and older adults. The vertical bars indicate the 95% confidence intervals around the estimated probability.

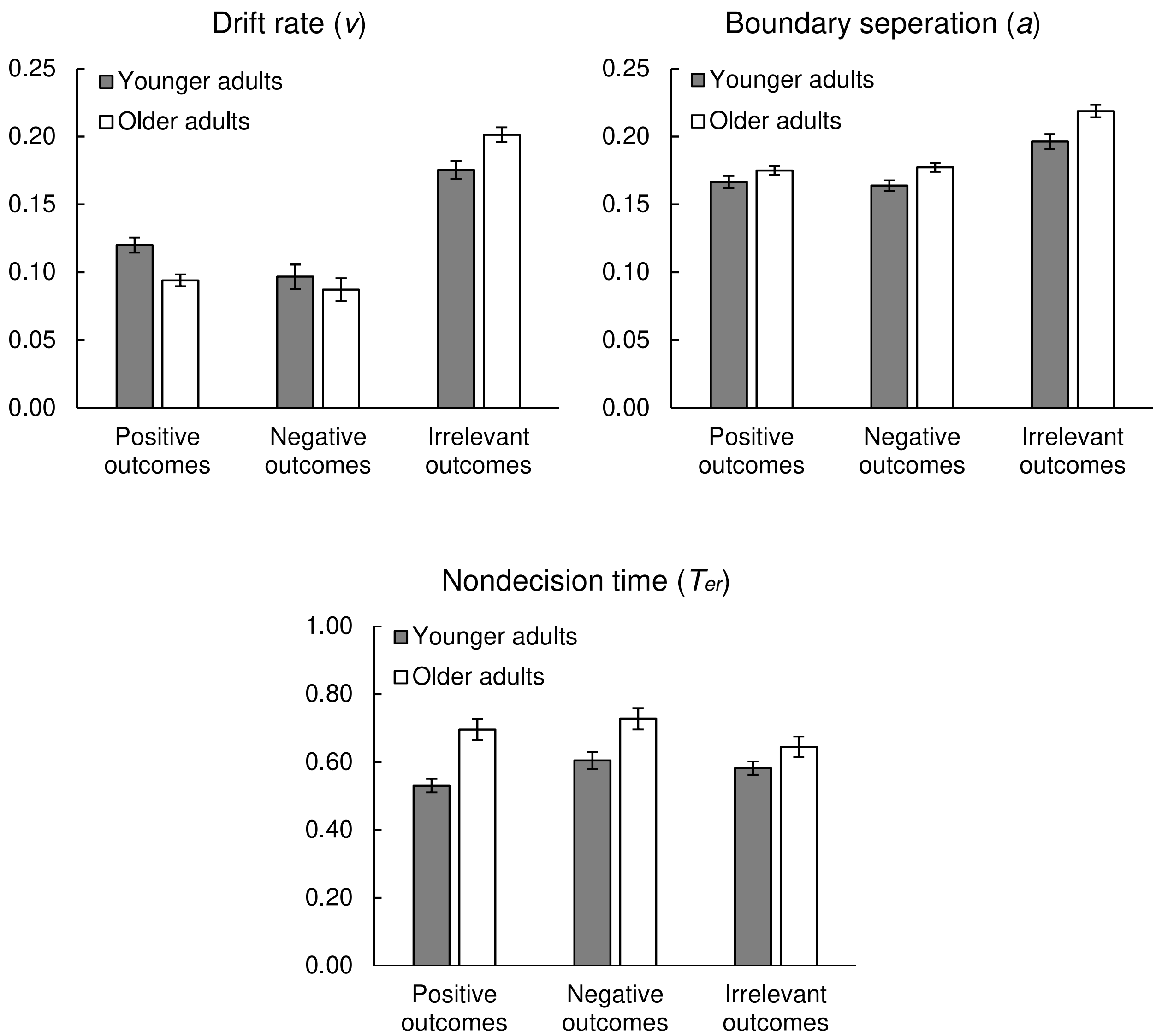

Figure 2. Mean group drift rate (v), boundary separation (a), and nondecision time (T_{er}) values for positive, negative, and irrelevant outcomes among younger and older adults. The vertical bars indicate the 95% confidence intervals around the estimated probability.

Appendix A: Risky activity items

Table A1 provides the 24 items used to assess risk-taking attitudes and for which participants generated outcomes in Experiment 1 and evaluated outcomes in Experiment 2. Items 1, 5, 7, 8, 9, 13, 14, 16, 17, and 24 were adapted from the DOSPERT scale, developed by Blais and Weber (2006).

Table A1: *Risk-taking attitudes scale items*

Life Domain	Questionnaire Item
Recreational	1. Going camping in the wilderness
	2. Taking a ride through the countryside on the back of a high performance motorcycle
	3. Going winter swimming in an icy lake as part of a sporting event
	4. Traveling alone in an unfamiliar country
	5. Taking a river rapid ride on a small boat
	6. Petting a lion in a nature reserve as part of a demonstration to tourists
Social	7. Admitting your tastes are different from those of a friend
	8. Disagreeing with an authority figure or person of influence on a major issue
	9. Moving to a city far away from your close friends and family
	10. Speaking at a debate club in your local community
	11. Speaking your views on a controversial issue with people who are unfamiliar with you
	12. Joining a social club at the local community centre to make new friends
Financial	13. Betting on the outcome of a sporting event
	14. Investing in a speculative but potentially lucrative stock on the stock market
	15. Using your credit card to pay for an item on an unfamiliar website
	16. Investing a small amount of your income or savings in a potentially highly lucrative new start-up firm
	17. Betting a day's income or savings at the horse races
	18. Investing some of your savings in the stock market on the recommendation of your financial advisor
Health	19. Starting a new intense exercise routine
	20. Using a sun bed in a tanning studio to top up your vitamin D levels
	21. Taking a ride home in a taxi that doesn't have seatbelts
	22. Joining a weekly high energy exercise class at your local gym
	23. Taking an unfamiliar medication while on holiday abroad
	24. Drinking heavily on a weeknight