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Age differences in emotional responses to monetary losses and gains

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ABSTRACT

People of all ages face events that threaten their well-being, but theories of aging posit that older adults will cope better. In a gamble with randomly assigned losses (vs. gains), older adults reported relatively less negative and more positive emotions than younger adults, especially after losses (vs. gains). Avoiding preoccupation with negative thoughts was more likely among older (vs. younger) adults, and was related to less negative emotions after losses (vs. gains). A focus on limited time was associated with more positive emotions across all participants. Our findings may inform interventions that aim to promote emotional well-being across all ages.

Key words: Emotion regulation, action control scale, gamble, losses, aging

## AGE DIFFERENCES IN EMOTIONAL RESPONSES TO MONETARY LOSSES AND GAINS

People of all ages face life outcomes that may threaten their emotional well-being. Because many decisions involve uncertainty, even good decision makers will experience negative outcomes (Keren & Bruine de Bruin, 2003). Prospect theory posits that “losses loom larger than gains,” such that the decrease in well-being after a monetary loss is larger than the increase in well-being after a monetary gain of the same size (Kahneman & Tversky, 1979).

However, models of self-regulation (Kuhl, 1994; Kuhl & Goschke, 1994) have identified reliable individual differences in ‘avoiding preoccupation’ about losses, which involves volitional disengagement from negative thoughts that harm emotional well-being (Diefendorff, Hall, Lord, & Streat, 2000).<sup>1</sup> Such avoidance of preoccupation is part of a higher-order family of adaptive coping strategies involving acceptance, cognitive restructuring, focusing on the positive, and attention redeployment (Skinner et al., 2003). These coping strategies have also been referred to as secondary control strategies, because they focus on minimizing emotional responses to adverse events, while primary control strategies focus on reducing the experience of adverse events (Heckhausen & Schulz, 1995).

Indeed, correlational studies have shown that adverse life events have less impact on depression among individuals who avoid preoccupation than among individuals who remain ruminative (Baumann, Kaschel, & Kuhl, 2005; Rholes, Michas, & Shroff, 1989). In experimental research on self-regulation, participants are typically randomly assigned to positive or negative experiences, so as to examine causal effects on emotions and moderating effects of avoiding preoccupation (Koole & Jostmann, 2012). In one such experiment conducted with undergraduate students, avoiding preoccupation reduced negative feelings after failures and positive feelings after successes (van Putten, 2015). Another experiment in which undergraduate students were randomly assigned to failures and successes, avoiding

preoccupation was related to emotional verbalizations after failures but not after gains (Brunstein & Olbrich, 1985). Such experiments with random assignment to outcomes have not yet been conducted to examine, in age-diverse samples, the role of avoiding preoccupation in moderating emotional responses to losses vs. gains.

Life-span developmental psychology posits that, with age, people prioritize emotional goals (Carstensen, 2006), and use secondary control strategies to reduce emotional responses to negative experiences (Charles, 2010; Heckhausen & Schulz, 1995). Indeed, older adults report less negative thoughts and less negative emotions about stressful events (Brose, Schmiedek, Lövdén, & Lindenberger, 2011; Charles & Carstensen, 2008, Strough et al., 2016b). Older adults' tendency to avoid preoccupation with negative thoughts helps them to maintain better overall emotional well-being (Kessler & Staudinger, 2009; Torges, Stewart, & Nolen-Hoeksema, 2008). Better emotional control in older age has been associated with less intense negative and positive emotions (Diener, Sandvik, & Larsen, 1985; Lawton, Kleban, Rajagopal, & Dean, 1992), though the latter is not always consistent (Gross et al., 1997).

In young adults, avoiding preoccupation has been associated with making better decisions about 'sunk costs' or irrecoverable losses (van Putten, Zeelenberg, & van Dijk, 2010), seen in following economists' recommendations to 'cut your losses' by switching to an alternative with better prospects (Arkes & Blumer, 1985). That pattern holds in age-diverse samples (Bruine de Bruin, Strough, & Parker, 2014). Moreover, older adults' better sunk cost decisions may be explained by their stronger tendency to avoid preoccupation with losses (Bruine de Bruin et al., 2014). Indeed, older adults are less likely than younger adults to dwell on irrecoverable losses (Strough, Schlosnagle, & DiDonato, 2011; Strough et al., 2016a).

According to socio-emotional selectivity theory, older adults' better well-being also reflects their future time perspective, which motivates them to make the most of the life they have left (Carstensen, 2006). However, limited future time perspective has been negatively

correlated with well-being measures (Grühn, Sharifian, & Chu, 2016; Hoppmann, Infurna, Ram, & Gerstorf, 2017; Kozik, Hoppmann, & Gerstorf, 2015), and may not account for age differences in emotions (Kessler & Staudinger, 2009). Even splitting future time perspective into a focus on future opportunities and a focus on limited time may not produce expected relationships with well-being measures (Kozik et al., 2015). Possibly, future time perspective is more relevant for emotional responses to short-term events rather than overall well-being.

A few studies have examined age differences in emotional responses to experienced losses or gains, but without random assignment to these outcomes. For example, older adults reported less negative emotions after their preferred candidate lost an election, and less high-arousal positive emotions after their preferred candidate won (Scheibe, Mata, & Carstensen, 2011). Another study examined anticipated and experienced emotional responses to gains and losses, in a reaction time task where outcomes depended on performance rather than random assignment (Nielsen, Knutson, & Carstensen, 2008). Reaction time trial difficulty was individually set to yield a hit rate of about 66%. Participants worked to earn money (in gain anticipation trials) or to avoid losing money (in loss anticipation trials). Age differences in emotion valence emerged only after unexpected outcomes, with older adults feeling less negative emotion change than younger adults after failing to earn money in a gain anticipation trial, and less positive emotion change after avoiding losing money in a loss anticipation trial (Nielsen et al., 2008; Samanez-Larkin et al., 2007). Restricted future time perspective and older age were correlated with less negative anticipatory emotion valence in loss anticipation, but not in gain anticipation (Nielsen et al., 2008). Due to the focus on anticipatory emotions, correlations of future time perspective with post-outcome emotions were not reported.

Here, we are the first to report on a gambling experiment that examined age differences in negative and positive emotions reported after a randomly determined monetary loss or gain.

We also considered age differences in avoiding preoccupation as well as in the two factors of future time perspective. Specifically, our research questions asked:

1. Are there age group differences in emotions reported after losses and gains?
2. Are there age group differences in avoiding preoccupation and future time perspective?
3. Do avoiding preoccupation and future time perspective moderate reported emotions after losses vs. gains?

## METHOD

### Participants.

We posted two advertisements on Amazon Mechanical Turk, with one targeting U.S. residents who were “between 18 and 28” and the other those “born before 1956.” Both advertisements were only sent to individuals with Amazon approval ratings of at least 80%, suggesting a history of high-quality survey responses. Interested individuals reported their age on an initial survey. They were eligible to be included in our final sample if their reported age met the age criteria and was the same as the age they reported in the demographic questions that followed the gambling experiment. Our final sample size ( $n=155$ ) was sufficient to detect intermediate effect sizes ( $\eta^2=.06$  or  $r=.24$ ) in two-sided tests with 80% statistical power and  $\alpha=.05$ . It included the 84 younger adults and 71 older adults who were among the 82.4% of eligible participants agreeing to play the gamble.<sup>2</sup> These younger and older adults reported significantly different ages ( $M=25.13$ ,  $SD=1.89$ , range 22-29 vs.  $M=62.80$ ,  $SD=3.60$ , range 59-76),  $t(153)=83.27$ ,  $p<.001$ . They were similar in terms of number of quarters gambled ( $M=3.31$ ,  $SD=2.12$  vs.  $M=3.21$ ,  $SD=1.99$ ),  $t(153)=-.30$ ,  $p=.77$ , reporting having at least a high school diploma (98.8% vs. 98.6%),  $\chi^2(1)=.02$ ,  $p=.89$  or at least a college education (52.4% vs. 46.4%),  $\chi^2(1)=.55$ ,  $p=.46$ , and reporting income above the median of \$15,000-\$30,000 per year (45.2% vs. 45.1%),  $\chi^2(1)=.00$ ,  $p=.98$ . Because there were fewer women in the younger than in the older age group (47.6% vs. 66.2%),  $\chi^2(1)=5.39$ ,  $p=.02$ , our analyses controlled for

gender. Perhaps because gender was not significantly related to dependent variables for each research question ( $p > .05$ ), controlling for gender did not affect our conclusions.

#### Procedure and measures.

Human subjects approval was obtained from Leiden University. As noted, all participants completed an initial survey that confirmed that they met the age criteria.

Loss vs. gain. Participants received \$1.50, and an additional \$2 which they could bet in a “double or nothing” gamble adapted from Arkes et al. (1994).<sup>3</sup> To play the gamble, participants dragged and dropped a maximum of 8 quarters into a ‘betting area.’ The gamble provided a 50% chance of winning twice the betting amount, and a 50% chance of losing the entire amount. Thus, losses and gains were randomly assigned. The outcome was determined by rolling two virtual dice that simulated actual dice rolls. If participants rolled a total number less than 7, they lost. If they rolled an outcome of 7 or greater, participants won.

Reported emotions. Both in the initial survey, and after experiencing the outcome of the gamble, participants completed the Modified-Differential Emotions Scale (Frederickson, Tugade, Waugh, & Larkin, 2003). Ten negative items measured sadness, anger, stress, shame, contempt, disgust, embarrassment, guilt, hate, and fear. Ten positive items measured joy, amusement, awe, gratitude, hope, inspiration, interest, love, pride, and contentment. Each item presented three related emotions. For example, the item measuring joy asked: To what extent do you feel joyful, glad, or happy? Ratings were provided on 5-point scales including response options “not at all,” “a little bit,” “moderately,” “quite a bit,” and “extremely” (scored respectively as 1 through 5). Cronbach’s alpha revealed sufficient consistency to compute mean ratings of baseline emotions reported on the initial survey ( $\alpha = .91$  negative;  $\alpha = .93$  positive) and emotions reported after the gamble ( $\alpha = .94$  negative;  $\alpha = .94$  positive).

Avoiding preoccupation. After the gamble, participants completed 12 items about the tendency to avoid preoccupation with losses (Diefendorff et al., 2000). An example item

asked “When I’m in a competition and lose every time: (a) I can soon put losing out of my mind; (b) The thought that I lost keeps running through my mind.” Responses were consistent across items ( $\alpha=.82$ ), allowing the computation of a mean score.

Future Time Perspective. After the gamble, participants completed the Future Time Perspective scale (Lang & Carstensen, 2002), including 8 items about future opportunities (e.g., “Many opportunities await me in the future”) and 2 about limited time (e.g., “I have limited time left to live in my life”).<sup>4</sup> We added an item about limited time (e.g., “I feel the importance of time’s passing”; Cate & John, 2007; Strough et al., 2016b). Internal consistency was sufficient for averaging scores ( $\alpha=.91$  for future opportunities;  $\alpha=.80$  for limited time).

## RESULTS

### Are there age group differences in emotions reported after losses and gains?

As seen in Figure 1, initial Analyses of Variance that tested for age group differences in reported emotions (while controlling for gender) found that older adults reported significantly less negative emotions than did younger adults, both after losses and after gains. Older adults also reported significantly more positive emotions than did younger adults, but only after losses and not after gains. Additionally, older adults reported significantly less negative and more positive emotions at baseline, in the initial survey that was conducted before the gamble.

Our main analysis therefore tested for overall patterns seen in Figure 1, while controlling for baseline emotions, in addition to gender (see Method). That is, we conducted a mixed-model Analysis of Variance on reported negative and positive emotions. Between-subjects variables were age group (older vs. younger) and outcome (losses vs. gains). Negative and positive emotion type were entered as a within-subject variable. Baseline emotions and gender were controlled. A significant main effect of outcome,  $F(1, 148)=16.54$ ,  $\eta^2=.10$ ,  $p<.001$ , suggested that losses generally evoked less overall emotions than did gains ( $M=2.17$ ,  $SD=.52$  vs.  $M=2.25$ ,  $SD=.47$ ). However, this effect was qualified by a significant

interaction between outcome and type of emotion,  $F(1, 148)=60.32$ ,  $\eta^2=.29$ ,  $p<.001$ , such that losses evoked relatively more negative emotions than gains ( $M=1.48$ ,  $SD=.77$  vs.  $M=1.12$ ,  $SD=.26$ ) and relatively less positive emotions than gains ( $M=2.85$ ,  $SD=.96$  vs.  $M=3.39$ ,  $SD=.95$ ). Most importantly, age group differences in that pattern varied, as seen in a significant three-way interaction between age group, outcome, and type of emotion,  $F(1, 148)=8.14$ ,  $\eta^2=.05$ ,  $p<.01$ . That is, older (vs. younger) adults reported especially more negative emotions and less positive emotions after losses, with age differences in negative and positive emotions relatively less pronounced after gains (Figure 1). There were no other significant main effects or interactions ( $p>.05$ ).

#### Are there age group differences in avoiding preoccupation and future time perspective?

We conducted three separate ANOVAs on avoiding preoccupation and the two factors of future time perspective, to examine effects of between-subjects variables for age group (older vs. younger), while controlling for gender. Avoidance of preoccupation was higher among older than among younger adults ( $M=6.83$ ,  $SD=3.35$  vs.  $M=5.17$ ,  $SD=3.28$ ),  $F(1, 152)=10.12$ ,  $\eta^2=.06$ ,  $p<.01$ . In regards to future time perspective, older adults saw significantly fewer opportunities than did younger adults ( $M=3.90$ ,  $SD=1.35$  vs.  $M=4.62$ ,  $SD=1.14$ ),  $F(1, 152)=14.18$ ,  $\eta^2=.09$ ,  $p<.001$ , but were not significantly different in focus on limited time ( $M=5.03$ ,  $SD=1.39$  vs.  $M=4.81$ ,  $SD=1.36$ ),  $F(1, 152)=1.21$ ,  $\eta^2=.01$ ,  $p=.27$ .

#### Do avoiding preoccupation and future time perspective moderate reported emotions after losses vs. gains?

Negative emotions. To test for moderation effects, we examined the three interactions of losses vs. gains with avoiding preoccupation, and the two factors of future time perspective, in a linear regression that predicted reported negative emotions, while including main effects, older vs. younger age group, baseline negative emotions, and gender. As expected, we found that avoiding preoccupation moderated the effect of losses vs. gains on negative emotions, as

seen in a significant interaction between losses vs. gains and avoiding preoccupation ( $B=.03$ ,  $se=.01$ ,  $t=3.54$ ,  $p<.01$ ). Additional separate linear regressions showed that increased avoidance of preoccupation was more strongly related to lower negative emotions after losses ( $B=-.05$ ,  $se=.02$ ,  $t=-2.16$ ,  $p=.04$ ) than after gains ( $B=.00$ ,  $se=.01$ ,  $t=.62$ ,  $p=.54$ ). There were no significant interactions between losses vs. gains and the future time perspective factors ( $B=.01$ ,  $se=.03$ ,  $t=.46$ ,  $p=.65$  for future opportunities;  $B=.04$ ,  $se=.03$ ,  $t=1.45$ ,  $p=.15$  for limited time). We found no other main effects or interactions, including no significant three-way interactions of age and losses vs. gains with avoiding preoccupation or either future time perspective factors after adding two-way interactions ( $p>.05$ ).

Positive emotions. We conducted a similar linear regression analysis for positive emotions. There was no significant interaction of losses vs. gains with avoiding preoccupation ( $B=-.02$ ,  $se=.01$ ,  $t=-1.26$ ,  $p=.21$ ), with a focus on future opportunities ( $B=.07$ ,  $se=.04$ ,  $t=1.75$ ,  $p=.08$ ), or with a focus on limited time ( $B=.03$ ,  $se=.04$ ,  $t=.83$ ,  $p=.41$ ). Yet, a focus on limited time showed a positive main effect before adding interactions to the model ( $B=.09$ ,  $se=.04$ ,  $t=2.33$ ,  $p=.02$ ). There were no other main effects or interactions ( $p>.05$ ).

## DISCUSSION

People of all ages face life outcomes that may threaten their emotional well-being. Theories of aging posit that older adults are more likely than younger adults to implement secondary control strategies to dampen their negative emotions after experiencing adverse events, perhaps in part because uncontrollable events become more common in older age (Charles, 2010; Heckhausen & Schulz, 1995). Here, we were the first to randomly assign older and younger adults to losses and gains so as to examine causal effects of outcomes on emotions and moderating effects of emotion regulation strategies. Older adults reported relatively less negative and more positive emotions than younger adults, especially after losses (vs. gains). Self-reported preoccupation with intrusive thoughts was also less strong in

older than in younger adults. Avoiding preoccupation moderated negative emotions to losses (vs. gains) across both age groups, such that it reduced negative emotions especially after losses. The role of future time perspective factors was less pronounced, but a focus on limited time was associated with increased positive emotions over baseline, across all participants. The latter finding is in line with socio-emotional selectivity theory (Carstensen, 2006), but contrasts to reports that limited time perspective is related to lower well-being (Grühn et al., 2016; Hoppmann et al., 2015). Perhaps a limited time perspective only helps with maintaining positive emotions in the face of short-lived experiences, such as our all-or-nothing gamble. Yet, variations in measures may also explain differential findings (Hoppmann et al., 2015).

Our findings suggest that older adults' better emotional well-being (Kessler & Staudinger, 2009; Lawton et al., 1992; Scheibe et al., 2011) may partly reflect their better ability to avoid negative thoughts, especially after losses. Indeed, it has been suggested that older adults are more likely than younger adults to use secondary control strategies to dampen their negative emotions after adverse experiences (Charles, 2010; Heckhausen & Schulz, 1995). Possibly, older adults develop those strategies as they experience more uncontrollable adverse life events, including physiological decline (Blanchard-Fields & Irion, 1988; Folkman, Lazarus, Pimley, & Novacek, 1987; Heckhausen & Schulz, 1995).

A question that arises from our research is whether age differences in reported emotional responses to losses and gains would affect subsequent behavior. In hypothetical decisions, older adults' tendency to avoid preoccupation with negative thoughts about losses may explain why they are more likely than younger adults to switch away from 'sunk cost' options rather than to throw good money after bad (Bruine de Bruin et al., 2014; Strough et al., 2011). A meta-analysis found that age-related differences were more pronounced when learning about losses and gains from experienced rather than described decisions (Mata, Josef, Samanez-Larkin, & Hertwig, 2012). Yet, when learning from experienced decisions, older

adults were also more likely than younger adults to switch away from options that had led to disappointing outcomes (Worthy, Otto, Doll, Byrne, & Maddox, 2015). Older adults' reduced emotional reactivity to anticipated losses could also lead to age differences in subsequent decisions (Löckenhoff et al., 2011; Nielsen et al., 2008; Samanez-Larkin et al., 2007), such as why they tend to be more risk seeking in choices between a sure loss and a risky gamble (Mather et al., 2012; Mikels & Reed, 2009; though see Weller, Levin, & Denburg, 2011).

Our study had several limitations. First, experienced losses and gains were relatively small. It has been posited that more severe stressors may yield opposite age differences in emotional reactivity compared to more minor stressors, as older adults' strategies become ineffective and their reduced physiological flexibility is taxed (Charles, 2010). Yet, small daily hassles and uplifts are also important for emotional well-being (Kanner, Coyne, Schaefer, & Lazarus, 1981). Second, our findings may not generalize to expected losses and gains, which may not yield age differences in emotions (Löckenhoff, O'Donoghue, & Dunning, 2011; Nielsen et al., 2008). Third, cross-sectional designs preclude conclusions about how emotions develop with age (Lindenberger, van Oertzen, Ghisletta, & Hertzog, 2011; Maxwell & Cole, 2007; Schaie, 1983). Fourth, Amazon Mechanical Turk's online samples may not be representative, with our sample reporting higher levels of education than the overall US population (Ryan & Bauman, 2016). Yet, Mturk samples tend to reveal patterns in decision making that are similar to those observed in student and community samples (Goodman, Cryder, & Cheema, 2013; Paolacci, Chandler, & Ipeirotis, 2010). A final limitation is that we had no measure of participants' use of beta blockers or other medications that may have affected their emotions.

Nonetheless, research into understanding age differences in avoiding preoccupation, future time perspective, and emotions brings the promise of explaining changes in emotional

well-being and associated outcomes across the lifespan. Ultimately, such findings may inform the development of interventions that benefit people of all ages.

#### FOOTNOTES

1. The survey also measured the other Action Control measure (avoiding hesitation, or enduring after challenges; Diefendorff et al., 2000) and need for cognition (Cacioppo & Petty, 1982). We did not include these here, as they are not central to coping with losses. Including them in analyses for research question 3 did not alter reported findings ( $\alpha=.05$ ).
2. Although older adults may be more likely than younger adults to prefer sure gains over gambles (Mather et al., 2012), the percent agreeing to gamble did not differ between age groups,  $\chi^2(1)=.83$ ,  $p=.36$ . Both in the full sample and within each age group, those who gambled and those who did not were similar in reported age, reported emotions before the decision to gamble, focus on future opportunities, and focus on limited time ( $p>.05$ ).
3. Participants learned about the additional \$2 (on top of \$1.50) when initially invited, or just before the gamble. Taking that timing into account had no effect on reported emotions, or on age differences in emotional responses to losses and gains (Research question 1;  $p>.05$ ).
4. The item “many opportunities await me in the future” was inadvertently repeated. The mean score across the future opportunities factor was similar whether the second occurrence of this item was included or excluded ( $r=1.00$ ,  $p<.001$ ). Our analyses excluded the second occurrence of this item, which did not affect our findings ( $p>.05$ ).

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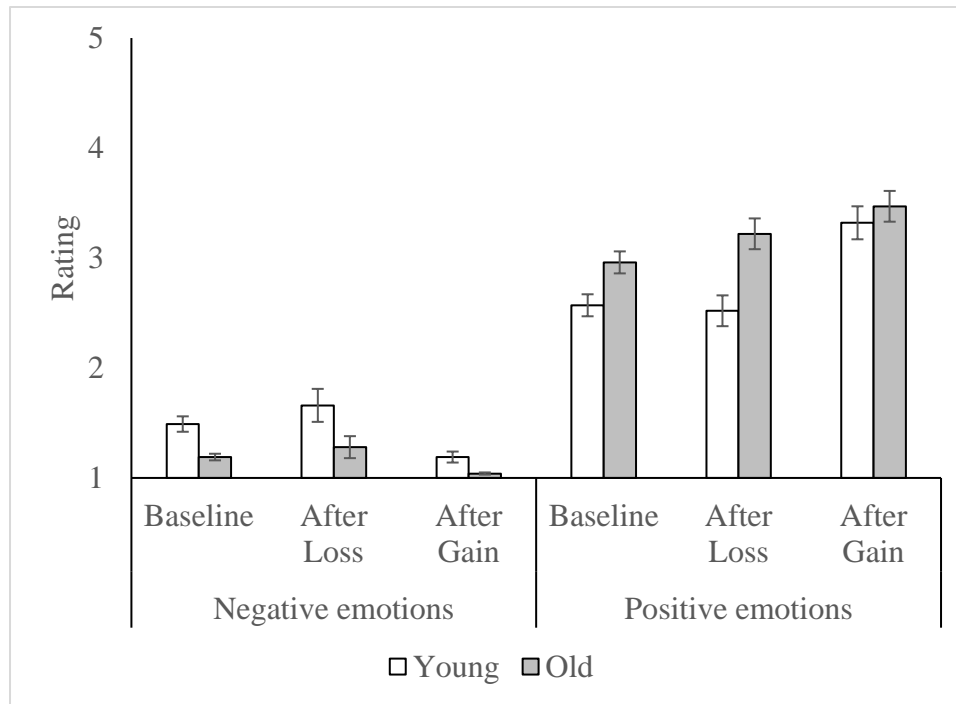
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Figure 1: Ratings of reported emotions.



Note: Error bars denote standard errors. While controlling for gender, significant age differences emerged for negative emotions at baseline,  $F(1, 152)=10.57, \eta^2=.07, p<.01$ , after losses  $F(1, 67)=3.99, \eta^2=.06, p<.05$ , and after gains  $F(1, 82)=6.33, \eta^2=.07, p=.01$ , as well as for positive emotions at baseline,  $F(1, 152)=8.19, \eta^2=.05, p<.01$ , and after losses,  $F(1, 67)=10.39, \eta^2=.13, p<.01$ . No significant age differences were found for positive emotions after gains,  $F(1, 82)=.59, \eta^2=.01, p=.44$ .