Age Attenuates the Negativity Bias in Reframing Effects

Jehan Sparks and Alison Ledgerwood
University of California, Davis

Abstract: A growing literature on reframing effects has identified a robust negativity bias: Under many circumstances, people's attitudes change less when framing switches from negative to positive (vs. positive to negative). Like other basic psychological biases, this one is often assumed to reflect a general human tendency, but there are theoretical reasons to expect boundary conditions on when and for whom it operates. In this paper, we zero in on age as one important potential moderator, and test competing predictions from different perspectives. Using a large, highly-powered dataset that synthesizes across multiple past studies (N = 2,452; ages 18-81), we fit multi-level models to test the moderating impact of age on reframing effects, as well as single-shot framing effects. We found that (consistent with socioemotional selectivity theory), the negativity bias in reframing attenuated as age increased. We discuss implications for the aging literature and for understanding valence biases more broadly.

Keywords: sequential framing, reframing, negativity bias, aging, socioemotional selectivity theory

A growing body of research suggests that framing an object in positive or negative terms can influence not only people's immediate evaluations of that object (Kühberger, 1998; Levin, Schneider, & Gaeth, 1998), but also the extent to which those evaluations change later on (Boydstun, Ledgerwood & Sparks, in press; Ledgerwood & Boydstun, 2014; Sparks & Ledgerwood, 2017). Specifically, research on *reframing* suggests that in many contexts, negative frames "stick" in the mind and resist the influence of a subsequent frame: Whereas it is relatively easy for people to switch from thinking about something in positive terms to thinking about it in negative terms, it is cognitively more difficult for them to switch from negative to positive (Ledgerwood & Boydstun, 2014; see also Klein & O'Brien, 2016). People's attitudes therefore often change less in response to reframing when a negatively framed object is reframed in a positive way, compared to when a positively framed object is reframed in a negative way (Boydstun et al., in press; Ledgerwood & Boydstun, 2014; Sparks & Ledgerwood, 2017).

Just as basic valence framing effects (e.g., evaluating an object more favorably when it is framed positively vs. negatively) are often assumed to reflect general human tendencies, negativity biases in reframing have been assumed to reflect a general and functional human tendency to prioritize negative over positive information (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Kahneman & Tversky, 1979; Ledgerwood & Boydstun, 2014; Rozin & Royzman, 2001; see also O'Brien & Klein, 2017). When effects this basic are demonstrated, scholars tend to assume that they are universal—but this assumption is often unjustified (Henrich, Heine, & Norenzayan, 2010). Thus, if we are to advance our theoretical understanding of framing and reframing effects, it is crucial to probe their generalizability. Although these effects emerge robustly across the samples and contexts that researchers frequently examine, it is possible that these represent a relatively narrow slice of samples and contexts.

The present work advances our understanding of reframing effects by widening that sample, allowing us to ask whether there are theoretically important moderators that determine *for whom* a negativity bias in reframing operates. In particular, we examine age as one especially important individual difference that may moderate the negativity bias in reframing effects. Past work on reframing has exclusively examined samples of (on average) younger adults (Boydstun et al., in press; Ledgerwood & Boydstun, 2014; Sparks & Ledgerwood, 2017). However, several theories suggest that the way people process valenced information changes as they age, prompting a de-emphasis of negatives and/or prioritization of positives (Cacioppo, Berntson, Bechara, Tranel, & Hawkley, 2011; Carstensen, 2006; Labouvie-Vief, Grühn, & Studer, 2010; Mendes, 2010). For example, according to socioemotional selectivity theory, people's motivational priorities change as they age, leading them to increase their relative focus on positive (vs. negative) information (Carstensen, 2006). Thus, negativity biases may change across a person's lifespan in important ways, and what are often assumed to be universal tendencies to prioritize negative information may in fact be limited to particular ranges of the developmental trajectory. Such a perspective predicts that although younger adults will display a negativity bias, this bias will diminish as age increases (Mather & Carstensen, 2005).

It therefore seems important to test whether age may moderate the negativity bias in reframing effects observed in past studies. Our primary aim in the current study was therefore to conduct a highly powered test of the negativity bias in reframing

across a wide range of ages extending into older adulthood. Since this endeavor also provided us with an opportunity to conduct a highly powered test of single-shot framing effects across a wide range of ages, and since past work on this question has produced conflicting findings (e.g., Bruine de Bruin, Parker, & Fischhoff, 2007; Mayhorn, Fisk, & Whittle, 2002) we adopted a secondary aim of investigating whether age moderates the impact of a single, current frame on current judgments. The results will deepen our understanding of framing and reframing effects by unpacking when and for whom negativity biases operate as well as provide new data to help inform future work on age-related changes in information processing.

Single-Shot Framing Effects

A vast and multi-disciplinary literature has demonstrated that the current frame influences people's current attitudes: People evaluate an object more favorably when it is described in positive versus negative terms (e.g., Kahneman & Tversky, 1979; Levin, Schnittjer, & Thee, 1988; Levin & Gaeth, 1988; Marteau, 1989; Wilson, Kaplan, & Schneiderman, 1987). For example, studies have found that people rate a medical treatment more positively when it is described in terms of its success rate rather than its failure rate (Marteau, 1989; Wilson et al., 1987), and they rate the quality of ground beef more favorably when it is labeled as "75% lean" rather than "25% fat" (Levin & Gaeth, 1988). This well-established literature illustrates the power of the current frame to influence people's current attitudes and decisions (see Kühberger, 1998; Levin, Schneider, & Gaeth, 1998, for reviews). Such framing effects have been termed *attribute framing effects* because they emphasize either the positive or negative attributes of an object or issue (e.g., describing a program in terms of its success or failure rate; Levin et al., 1998). Attribute framing effects are often assumed to be universal human tendencies—that is, researchers often assume or imply that such framing effects, like other basic psychological effects, generalize to most people, most of the time (Heinrich et al., 2010; Levin et al., 1998).

Reframing Effects

Recent work has moved beyond studying single frames in isolation to consider what happens when people encounter different frames in sequence. After all, in everyday life, people often encounter multiple frames: In a political debate, one candidate might highlight the success rate of an employment program, and then another might emphasize the failure rate of that same program. Research on sequentially encountered frames suggests that in many contexts, negative frames tend to resist reframing more than positive frames: That is, people typically change their attitude less in response to reframing when an initial frame is negative (vs. positive; Ledgerwood & Boydstun, 2014).

In their initial work on reframing, Ledgerwood & Boydstun (2014) posited that once a person mentally labels an object in negative terms, that label may stick and make it difficult to reconceptualize the object in positive terms—a mechanism they label cognitive or conceptual stickiness. Supporting such a stickiness mechanism, participants took longer to solve math problems that required converting from a negatively framed concept to a positively framed one, compared to the reverse, and that reframing changed positive construals but not negative ones (Ledgerwood & Boydstun, 2014). Ledgerwood and Boydstun (2014) reasoned that this tendency for negative (vs. positive) conceptualizations to stick more strongly in the mind might represent one more instance of what is often assumed to be a very general human tendency to prioritize negative over positive information (Baumeister et al., 2001; Rozin & Royzman, 2001).

Age as a Potential Moderator

The current work investigates the generalizability of this negativity bias in reframing effects. While "bad" may outweigh "good" for the *average* participant in past studies, there are reasons to expect that important boundary conditions constrain this effect (e.g., Heinrich et al., 2010; Higgins & Liberman, 2018; Carstensen, 2006). Here, we probe the possibility that negativity biases in reframing effects might differ across the lifespan. Several theories suggest that how people think about valenced information changes as they age (Cacioppo et al., 2011; Mendes, 2010; Mather & Carstensen, 2005). Applying this insight from the aging literature to the current topic would suggest that the negativity bias in reframing may be limited to younger adults rather than a universal human tendency. We also take the opportunity to explore the potential moderating impact of age on initial or single-shot framing effects. Below, we first outline possible theoretical predictions for the effect of age on single-shot framing effects, and then turn to outline theoretical predictions for how age may moderate the negativity bias in reframing effects.

Age and Framing Effects. Different theoretical perspectives can be used to outline competing predictions for the expected effect of age on classic, single-shot framing effects. One key perspective on

aging, socioemotional selectivity theory (SST), describes how motivational priorities change across the lifespan (Carstensen, 2006; Reed & Carstensen, 2012; Reed, Chan & Mikels, 2014). This perspective suggests that younger adults, who feel their future time horizons are relatively open ended, will tend to prioritize future-oriented goals like expanding knowledge and having new experiences, whereas older adults, who feel their future time horizons are more constrained, will instead prioritize present-focused goals related to emotional satisfaction and meaning.[1] According to SST, as people age, these changes in goal priorities shift attention and memory toward goal-congruent information and away from information that may interfere with these goals. Thus, SST suggests that whereas adults will tend to prioritize negative information when they are younger, they will increasingly attend to and remember positive (vs. negative) information as they age. Consistent with this notion, a wealth of research on attention, memory, and decision-making has documented age-related changes in the relative prioritization of negative versus positive information (e.g., Charles, Mather & Carstensen, 2003; Isaacowitz, Wadlinger, Goren & Wilson, 2006; Löckenhoff & Carstensen, 2007; see Reed et al., 2014 for a review). For example, research has found that as people age, they pay less attention to negative (vs. positive) stimuli (Isaacowitz et al. 2006), and they experience less brain activity from negative (vs. positive) events (Wood & Kisley, 2006). Scholars in this area describe this motivational change as functional: The shift from a negativity bias for younger adults toward a positivity bias for older adults may serve to improve older adults' mood and well-being in the present moment (Carstensen & Mikels, 2005; Mather & Carstensen, 2005).

In sum, SST suggests that there should be a shift in focus from negativity to positivity as people age. Applying this theorizing to single-shot framing effects, we reason that there are three specific predictions one could make that would be consistent with such a shift: As people age, they will become (1) more susceptible to positive frames, (2) less susceptible to negative frames, or (3) both more susceptible to positive frames and less susceptible to negative frames.

However, work on heuristic information processing could suggest a different prediction. Studies in this area have demonstrated that heuristic (vs. systematic) processing can increase susceptibility to framing effects (e.g., McElroy & Seta, 2003). Moreover, there is evidence that older adults may rely more on heuristics than younger adults (Besedeš, Deck, Sarangi, & Shor, 2012; Gonsalkorale, Sherman, & Klauer, 2009; Johnson, 1990). Researchers have drawn on such studies to predict that older adults will be more susceptible to both positive and negative frames compared to their younger counterparts (Bruine de Bruin et al., 2012; Kim, Goldstein, Hasher, & Zacks, 2005). If this is the case, then age should enhance the impact of both positive and negative frames on attitudes, such that the classic effect of framing on attitudes increases across the lifespan. (Note that although we focus here on predictions derived from SST and a heuristic processing perspective, other perspectives on aging could also be used to make predictions about age and framing; we return to these in the Discussion).

Inspired by some of these perspectives, several prior studies have explored whether age moderates single-shot framing effects (e.g., Bruine de Bruin et al., 2007, 2012; Goldsmith & Dhar, 2013; Kim et al., 2005; Mickels & Reed, 2009; Rönnlund et al., 2005; Shamaskin, Mikels, & Reed, 2010). But this work has produced conflicting results. Some studies found no age differences in framing effects (Mayhorn et al., 2002; Rönnlund et al., 2005). Meanwhile, however, other work has suggested that age enhances the effects of both positive and negative frames, consistent with a heuristic processing account (Bruine de Bruin et al., 2007; Kim et al., 2005). And yet other studies have found that age decreased the relative power of negative versus positive frames, consistent with SST (Goldsmith & Dhar, 2013; Mikels & Reed, 2009; Shamaskin et al., 2010).

One possible explanation for these inconsistencies could be that many of these studies relied on relatively small sample sizes, which can lead to imprecise estimates that tend to fluctuate from one study to the next (Ledgerwood, Soderberg, & Sparks, 2017; Schönbrodt & Perugini, 2013)—especially when testing moderators. It is also possible that inconsistencies in prior work could be due to the different types of frames studied (risky choice vs. attribute vs. goal or incentive framing; see Levin et al., 1988), but of course, it is difficult to know whether differences across small studies reflect meaningful moderators or statistical noise. A highly powered test of the effect of age on single-shot framing effects would advance our cumulative understanding of how framing effects may change across the lifespan.

In the present work, we chose to focus on attribute framing, which is arguably the most basic

[1] The aging literature often defines older adults as people aged 65-80, although there is variability in this range (e.g., Mather & Carstensen, 2005; Reed et al., 2014).

type of framing where a single attribute of an object in described in (mathematically equivalent) positive vs. negative terms. Attribute framing therefore provides the most straightforward context in which to test how age influences valence framing effects, without conflating valence with people's risk preferences or goal orientations. Moreover, attribute frames are the type of frame most commonly used to study reframing effects, which enables us to test our research questions with high statistical power. Future studies could then test whether the results observed here would generalize to other types of framing effects.

Age and Reframing Effects. Despite the recent interest in exploring age differences in how people respond to single frames, thus far, no work has looked at age differences in how people respond when information is *re*framed. This question seems critical to address: If there are developmental shifts in how people process valenced information, as suggested by the aging literature, then initial reframing research may paint an incomplete picture of how valence biases operate in the context of sequentially encountered frames. Indeed, SST makes a clear prediction that the negativity bias in reframing should diminish as age increases.

Despite this clear prediction from SST, one could also generate a competing prediction for how age may moderate reframing effects, drawing on a heuristic processing account (Gonsalkorale et al., 2009; Johnson, 1990). Older adults may have fewer cognitive resources to think carefully, leading them to use heuristics (like whichever frame is right in front of them) more than younger adults. This heuristic processing account would suggest that, regardless of an initial frame's valence, older (vs. younger) adults will simply change their attitudes more in response to reframing. Such a prediction would be supported by a pattern of results indicating that the absolute amount of attitude change increases with age, while the negativity bias in reframing effects (i.e., the difference in attitude change between people who see the positive versus negative frame first) remains stable across the lifespan.

Testing these competing predictions could help clarify the conditions under which negativity biases in reframing operate, as well as provide new clues into the processes by which reframing can bias people's judgments. If we are to fully understand how framing and reframing effects operate, we must examine whether and how they change over the lifespan. If robust age effects were to emerge, they could inform future theorizing about framing and reframing by suggesting that past research has delineated how these effects operate specifically in younger minds, whereas older minds may display substantially different patterns of bias. Thus, in the current work, we set out to investigate whether age moderates the negativity bias in reframing effects, as well as whether age moderates single-shot framing effects.

Method

Ensuring adequate statistical power is important for maximizing the informational value provided by a study (Button et al., 2013; Ledgerwood et al., 2017), but testing interactions with high power can require substantial sample sizes when the variables are not within-subjects (Giner-Sorolla, 2018). To maximize our power to examine the potential moderating impact of age on reframing effects, we chose an analytic strategy that would allow us to aggregate across all of the individual studies that our lab has conducted examining reframing effects. We fit linear mixed effects models using the nlme package (Pinheiro, Bates, DebRoy, Sarkar & R Core Team, 2016) in the R environment (R Core Team, 2016). Multi-level modeling provides a valuable tool to investigate our research questions by formally modeling the hierarchical structure of our data with participants nested within study.[2] This analytic strategy accounts for the fact that participant responses from within the same study may be more highly correlated than participant responses across different studies. We decided *a priori* to include all studies conducted in our lab (both published and unpublished) that examined reframing effects using attribute frames.[3] We identified eight relevant studies, involving a total of 2,452 participants (1379

[2] Nesting within scenario instead of within study produced similar results. (Note that in an ideal world, we would be able to nest participants both within scenario and within study, but presumably because there were only three scenarios used across the studies in this sample, our models would not converge using this specification.)

[3] We did not include two studies examining risky choice framing because some have argued that risky choice framing and attribute framing can involve different processes and may be shaped by distinct moderators (Levin et al., 1988; van Schie & van der Pligt, 1995); we therefore thought it best to limit our analysis to the one broad category of framing for which we had sufficient data to provide an adequately powered test of the moderating role of age.

men, 1060 women, and 13 unreported; see Table 1 for a summary of key study details).

Table 1. Demographic Information and Details for Each Study.

Study number	Study information	*N* included in the analyses	Gender	Mean age	*SD* of age	Age range	Issue	Positive frame	Negative frame	Time 1 DV α	Time 2 DV α
1	Ledgerwood and Boydstun (2014), study in Note 4	76	54 women, 22 men	39.71	13.11	18-71	Surgical procedure	60% survival	40% mortality	.97	.98
2	Ledgerwood and Boydstun (2014), Study 2	79	38 women, 41 men	35.01	13.15	18-62	Surgical procedure	70% survival	30% mortality	.96	.98
3	Sparks and Ledgerwood (2017), Study 1	99	32 women, 67 men	31.40	10.35	18-63	Cognitive training regimen	60% success	40% failure	.90	.96
4	Sparks and Ledgerwood (2017), Study 3	404	199 women, 201 men, four did not identify	32.64	11.69	18-73	Cognitive training regimen	60% success	40% failure	.91	.96
5	Boydstun, Ledgerwood, and Sparks (in press), Supplementary Materials Preliminary Study 3	79	42 women, 37 men	34.56	12.70	18-66	Current governor's job record	40% saved	60% lost	.86	.91
6	Boydstun et al. (in press)	1,148	630 women, 512 men, six did not identify	35.53	12.11	18-79	Current governor's job record	40% saved	60% lost	.91	.90
7	Sparks and Ledgerwood (Unpublished data)	285	196 women, 86 men, three did not identify	58.40	6.19	50-81	Current governor's job record	40% saved	60% lost	.90	.89
8	Sparks and Ledgerwood (Unpublished data)	282	188 women, 94 men	58.12	5.77	50-76	Cognitive training regimen	60% success	40% failure	.92	.95

Note. The usable *N* included in the present analysis may differ slightly from the *N* reported in past studies because not all participants reported their age.

In each of these past studies, participants were recruited from Amazon's Mechanical Turk (MTurk) and were randomly assigned to framing condition.[4] One key benefit of these MTurk samples over more traditional college samples is that they included participants from a diverse range of ages, allowing us to test the potential moderating role of age in the current paper. Indeed, the last two samples were collected for the primary purpose of adding additional data points at the upper end of the age distribution. Importantly, older adult participants recruited on MTurk have been shown to be comparable to older adults recruited in community samples (Lemaster, Pichayayothin, & Strough, 2015). Moreover, MTurk samples have been shown to perform equally well to community samples on attention checks, and we have observed comparable reframing effects in online MTurk studies and lab-based student samples (Ledgerwood & Boydstun, 2014; Ledgerwood et al., 2017; Peer, Samat, Brandimarte, & Acquisti, 2015). Thus, we feel confident that these data can provide an important window into assessing the potential moderating impact of age on framing and reframing effects with both high experimental control and high power. At the same time, an important next step in establishing generalizability would be to replicate the findings from these highly powered analyses using a more externally valid community sample.

[4] Some of the studies included a variety of other, unrelated manipulations that did not interact with framing condition; we collapse across these irrelevant conditions for the purposes of this analysis (full details reported in Sparks & Ledgerwood, 2017, and Boydstun et al., in press).

Typical Study Procedure

Each of the individual studies employed a similar procedure (see Supplemental Materials for example study materials). Participants took part in a study about "how people's opinions about current events form and change over time as they learn new information about an issue." They learned about a particular issue (e.g., the current Governor's jobs record), which was initially framed in either positive terms (e.g., 40% of jobs were saved) or negative terms (e.g., 60% of jobs were lost). For example, in Study 5, participants read that "when the current Governor took office, statewide budget cuts were expected to affect 10,000 jobs, which would in turn affect the state and national economies." In the positive-first condition, participants read that under the current Governor's leadership, 40% of these jobs had been saved.

After reading this initial frame, participants rated their attitudes toward the issue by moving sliders along three unmarked, continuous scales anchored at the endpoints (e.g., *very negative* to *very positive*, *harmful* to *beneficial*, and *completely oppose* to *completely favor*). These scales were coded such that higher numbers always indicated more favorable attitudes toward the issue being framed. The three items were then averaged to form an index of attitudes toward the issue at Time 1 (see reliabilities reported in Table 1).

Next, participants read what was described as "additional information" about the issue—which was in fact the same information they had already seen, but now described using the opposing frame. For example, participants in the positive-first condition in Study 5 now read: "Critics of the current Governor point out that 60% of these jobs have been lost under

the Governor's leadership." Thus, the information presented at the two time points was mathematically equivalent, but the language used to describe the issue switched either from positive to negative or from negative to positive.

Participants then re-rated their attitudes toward the issue using the same three slider scales from Time 1, which were averaged to form an index of attitudes toward the issue at Time 2 (see Table 1 for scale reliabilities).

Grand Mean-Centered Age. In each study, participants reported their age in years as part of a series of standard demographic questions. Figure 1 depicts a histogram showing the distribution of age for all participants included in the analyses.

To specify our multi-level models, we first calculated the grand mean age across all eight studies. We then centered participant ages around the grand mean (40.67 years old), by computing the difference between a participant's reported age and the grand mean age. Using the grand mean for centering aids interpretation of our results by ensuring that we consistently compare people at the same meaningful age across studies (Bickel, 2007; Hox, 2002).

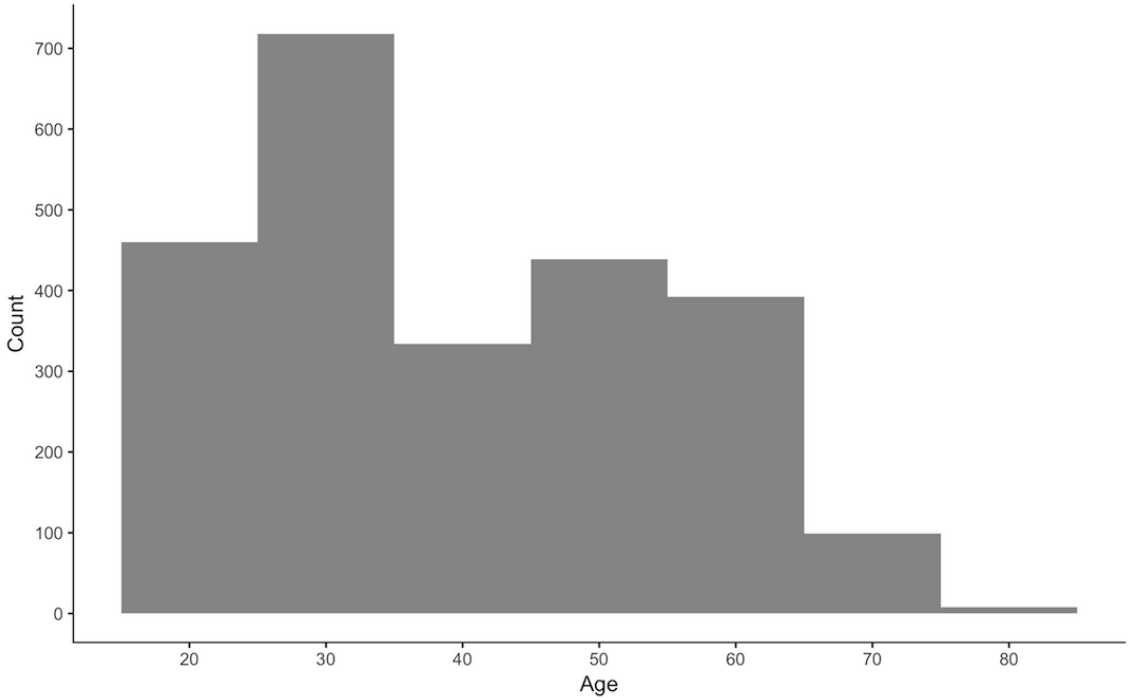

Figure 1. The distribution of age in Studies 1-8 included in the analyses. Note the substantial number of participants in each decade from the 20s through the 60s.

Results

Time 1 Framing Effects

Our first research question focused on whether age moderates the typical effect of positive (vs. negative) frames on attitudes in a single-shot framing context (i.e., Time 1 attitudes in these studies, when participants have only encountered a single positive or negative frame). To test this question, we fit a linear mixed effects model with Time 1 attitudes as the dependent variable. We specified study as a random intercept and added random slopes for initial frame valence (effects-coded: 1 = positive, -1 = negative), grand mean-centered age, and the interaction between those two predictors.

Across our eight studies with a total of 2,452 participants, the intercept effect was large and positive, B = 53.888, SE = 3.898, $t(2439) = 13.825$, $p < .0001$, representing the mean Time 1 attitude at the grand mean age. The frame valence effect was large and positive, B = 10.565, SE = 1.240, $t(2439) = 8.517$, $p < .0001$, indicating that on average, participants displayed a classic framing effect—they evaluated an issue more favorably when it was framed in positive rather than negative terms.

The possible predictions we derived from SST were that (1) people would be more susceptible to positive frames as age increases and/or that (2) people would be less susceptible to negative frames as age increases. If (3) both of these predictions occurred in our data, we would see an overall effect of age on Time 1 attitudes, such that attitudes simply became more positive in response to both positive and negative frames as age increased. In contrast, we found no overall effect of age on Time 1 attitudes, B = -0.029, SE = 0.077, $t(2439) = -0.377$, $p = .706$.

If only one but not the other possible predicted pattern we derived from SST occurred in our data, we would see an interaction between age and frame valence condition, such that attitudes become more positive in response to either positive frames *or* negative frames as age increases. Likewise, a heuristic processing perspective would predict an interaction between age and frame valence condition; in this case, the predicted pattern would be an amplification of the size of the classic framing effect as age increases. The results of our analysis indicated that the age by frame valence interaction effect was positive, B = 0.136, SE = 0.058, $t(2439) = 2.334$, $p = .020$. Figure 2 plots predicted values from the multi-level model across the age range in our sample. Follow-up simple slopes tests revealed a pattern that could be consistent with either the first SST prediction or the heuristic processing prediction: As people age, there is a non-significant trend toward increased susceptibility to positive frames, B = 0.107, SE = 0.064, $t(2439) = 1.677$, $p = .094$, and a non-significant trend toward increased susceptibility to negative frames, B = -0.165, SE = 0.121, $t(2439) = -1.362$, $p = .173$ (see Figure 2). In other words, by themselves, these results do not clearly support the first SST prediction (age will enhance the effect of positive but not negative frames) over a heuristic processing prediction (age will enhance the effect of both positive and negative frames) or vice versa. However, they do help rule out the idea that age will attenuate the impact of a negative frame (the second and third versions of the SST prediction outlined in the introduction).

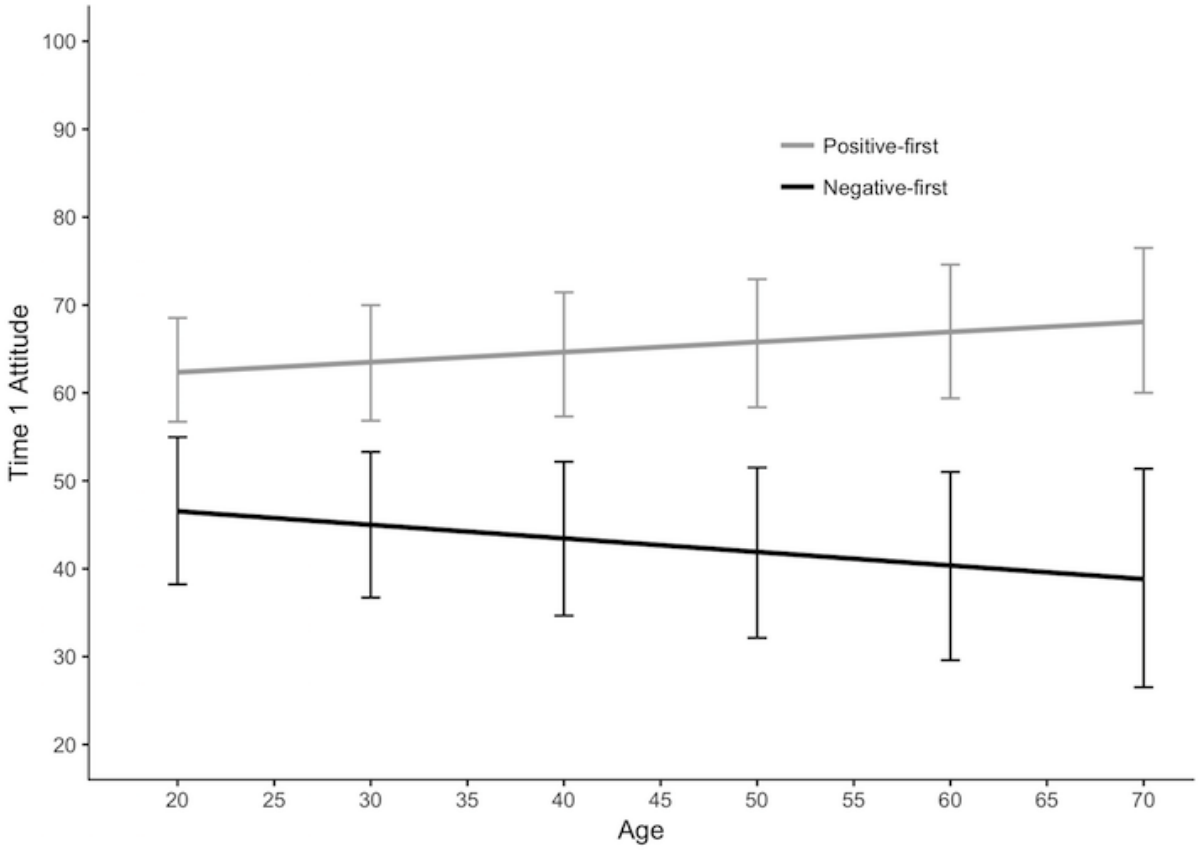

Figure 2: Plot of predicted values from the linear mixed effects model across the age range in our sample. The widening vertical distance between the gray and black regression lines reflects the interactive effect of initial frame valence (positive vs. negative) and age on Time 1 attitudes. Error bars indicate 95% confidence intervals above and below the predicted regression lines at each decade.

Reframing Effects

To test our more central research question—whether age moderates reframing effects—we fit a second linear mixed effects model, now with the dependent variable of attitude change toward the Time 2 frame (i.e., the amount each participant shifted away from the Time 1 frame in the direction of the Time 2 frame).[6] Once again, we specified study as a random intercept and added random slopes for initial frame valence (effects-coded: 1 = positive, -1 = negative), grand mean-centered age, and the interaction between those two predictors.

Across the eight studies, the intercept effect was large and positive, B = 13.488, SE = 1.106, $t(2439) = 12.199$, $p < .0001$, reflecting the fact that on average, participants' attitudes tended to move toward the Time 2 frame (an average of about 13.5 points on the 100-point scale). The effect of frame valence order was large and positive, B = 3.552, SE = 0.445, $t(2439) = 7.977$, $p < .0001$, reflecting the negativity bias in reframing effects documented previously in individual studies (Boydstun et al., in press; Ledgerwood & Boydstun, 2014; Sparks & Ledgerwood, 2017): Participants' attitudes changed less in response to reframing when the initial frame was negative (vs. positive).

The specific prediction derived from research on heuristic processing was that people would be generally more prone to changing their attitudes in response to reframing as they age. This prediction would manifest as a main effect of age on attitude change, such that regardless of frame valence, people would change more toward the Time 2 frame as they age. Inconsistent with this prediction, we found no overall effect of age on attitude change, B = -0.029, SE = 0.055, $t(2439) = -0.536$, $p = .592$. In other words, it does not seem to be the case that older (vs. younger) participants are generally more prone to changing their attitudes in response to reframing. Interestingly, the lack of a main effect also means that the tendency for older participants to become more susceptible to a Time 1 framing effect (as documented above) does not persist across time points; we see no evidence that older (vs. younger) participants are more susceptible to reframing effects at Time 2.

SST makes a clear prediction for how age will moderate reframing effects, suggesting that the negativity bias in reframing documented in past research should diminish as age increases. Consistent with this prediction, an interaction emerged between age and frame valence order, B = -0.115, SE = 0.045, $t(2439) = -2.529$, $p = .012$, indicating that age moderated the negativity bias observed in prior studies on reframing. As indicated in Figure 3, the negativity bias displayed among younger participants (i.e., the vertical distance between the gray and black lines) decreased as age increased.

[6] Thus, as in past work on reframing (e.g., Sparks & Ledgerwood, 2017), the dependent variable was calculated as (T2 attitude – T1 attitude) for the negative-first condition, and as -1*(T2 attitude – T1 attitude) for the positive-first condition, such that higher numbers in both conditions indicated greater attitude change toward the Time 2 frame.

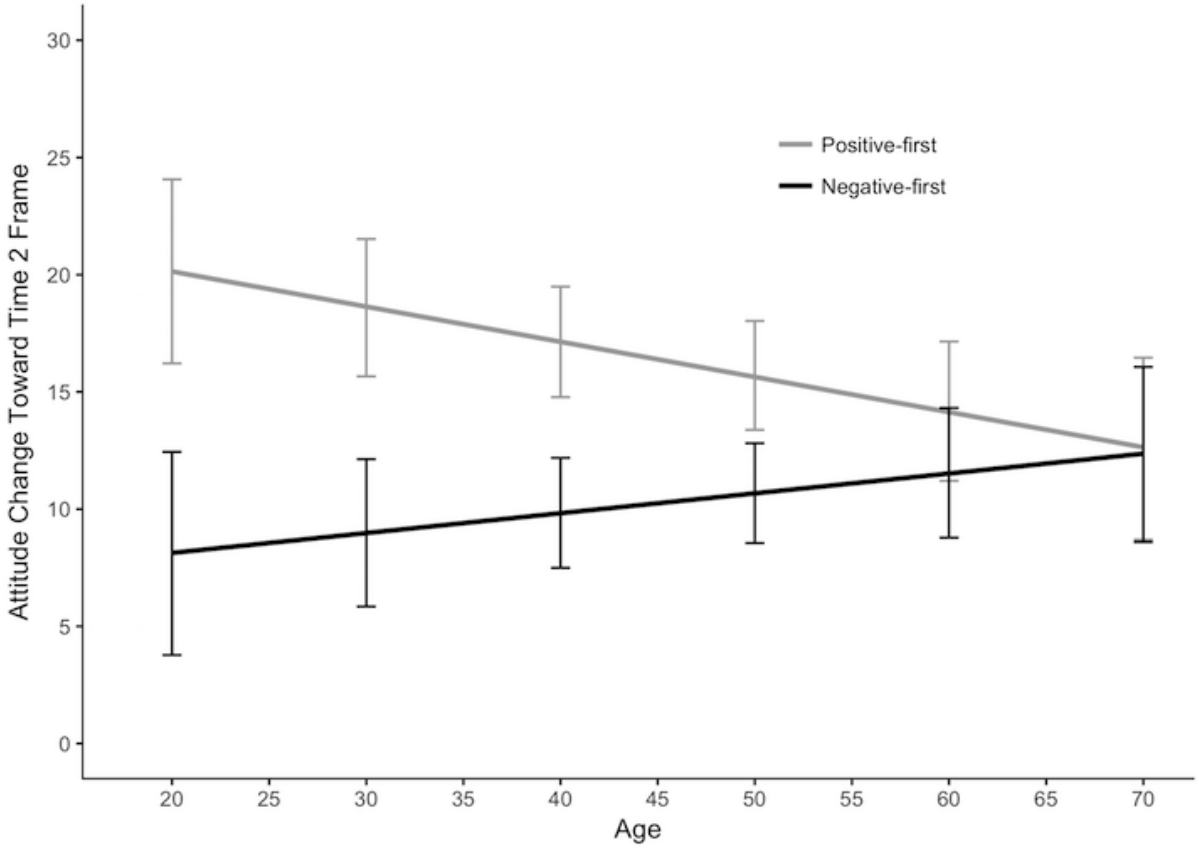

Figure 3: Plot showing predicted values based on the linear mixed effects model across the age range in our sample. There was an interaction between frame valence order (positive-first vs. negative-first) and age on attitude change toward the Time 2 frame. The negativity bias in reframing (the tendency for attitudes to change less following a negative versus positive initial frame, captured by the vertical distance between the gray and black lines) diminishes as age increases. Error bars indicate 95% confidence intervals above and below the predicted regression lines at each decade.

To further explore how the negativity bias in reframing changed across the range of ages represented in our sample, we conducted follow-up tests to estimate the extent of negativity bias at a series of specific ages. To ensure that we were not extrapolating beyond the data available, we examined the distribution of ages in our sample (see Figure 1) and chose a set of evenly spaced ages that represented meaningful values in our data (these ages were chosen *a priori* in that we selected and recorded them before testing the effect of frame valence order at any particular age). We re-centered age at 20, 30, 40, 50, and 60 and then followed the same analytic strategy described in the main analyses above.

The resulting estimates for the negativity bias and their associated statistical tests at each age are displayed in Table 2. At age 20, the frame valence order effect was large and positive (B = 12.050, see Table 2), indicating that participants displayed a strong negativity bias in reframing at this age. This estimate indicates that a 20-year-old participant who saw the negative frame first is predicted to change their attitude about 12 points less in the direction of the Time 2 frame, compared to a 20-year-old participant who saw the positive frame first. At ages 30 and 40, the negativity bias was smaller in size but still present (note that our estimates at these ages are also more precise, because they are based on more participants). At age 50, the negativity bias was smaller still, and at age 60, it became indistinguishable from zero. These analyses suggest that around age 60, the negativity bias in reframing started to disappear and participants began to exhibit more evenhanded sensitivity to negative and positive reframing (see also Figure 4).

Table 2

Estimated negativity bias in reframing at age 20, 30, 40, 50, and 60

	Age 20	Age 30	Age 40	Age 50	Age 60
Negativity Bias	12.050*** (1.938)	9.584*** (1.175)	7.211*** (0.876)	5.060*** (1.347)	2.634 (2.137)

Note. We calculated these estimates by doubling the multi-level model fixed effects coefficients for frame valence order and associated standard errors at each of our pre-selected ages (coefficients are doubled because frame valence order is effects coded rather than dummy coded). The estimates represent the negativity bias (i.e., the vertical distance between the gray and black predicted regression lines in Figure 3) at age 20, 30, 40, 50, and 60. Standard errors are provided in parentheses. By age 60, the negativity bias is very small and no longer statistically significant. *** $p < .001$

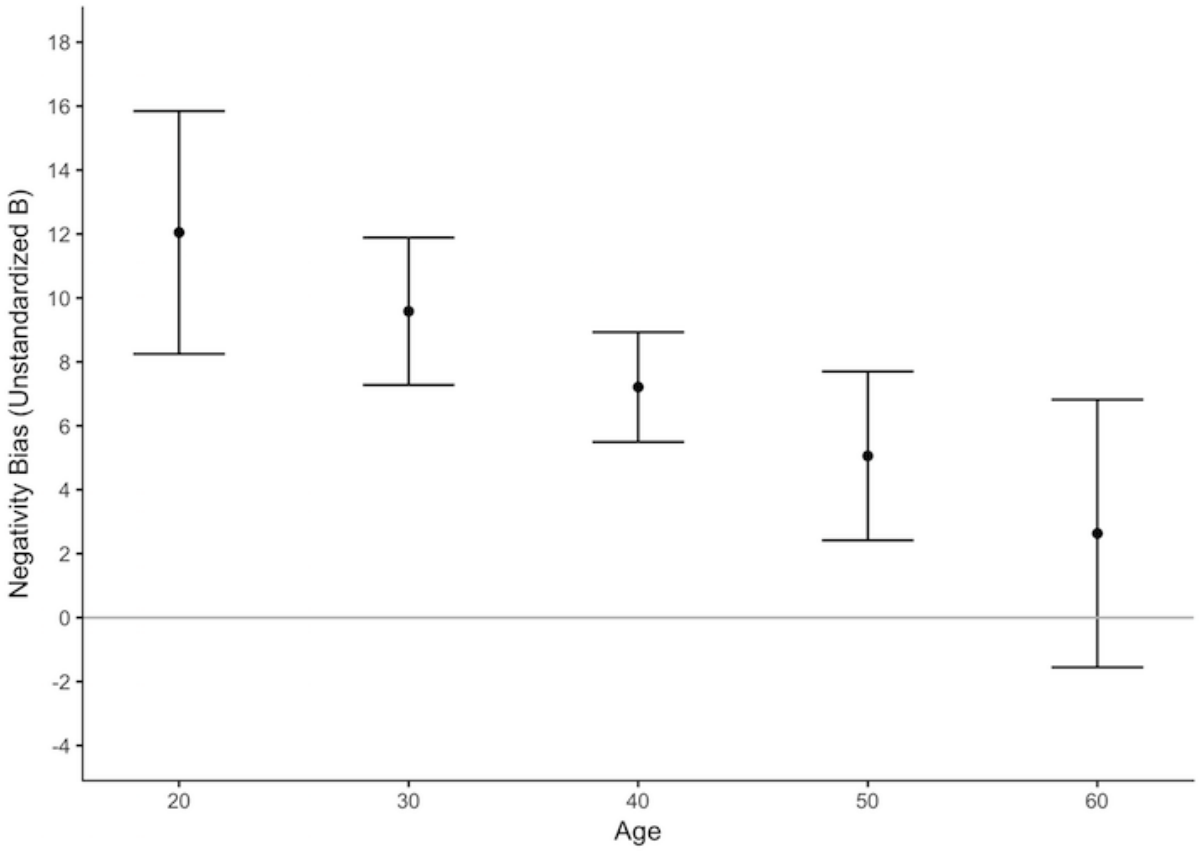

Figure 4. Plot showing the predicted negativity bias in reframing with 95% confidence intervals at each age (i.e., 20, 30, 40, 50, and 60) used for planned follow-up tests.

Discussion

The current work investigated the moderating impact of age on both single-shot framing effects and reframing effects. The results of our first multi-level model suggested that age moderates single-shot framing effects: We found non-significant trends toward increased susceptibility to both positive and negative frames as age increases. This finding is potentially consistent with either the first SST prediction (i.e., age will increase susceptibility to positive frames but not negative frames) or the heuristic processing prediction (i.e., age will increase susceptibility to both positive and negative frames). This finding also mirrors results from (to our knowledge) the only other dataset to assess age and attribute framing: Bruine de Bruin et al. (2007 and 2012) report results from a dataset that measured participants' general susceptibility to a combination of risky choice and attribute frames. Their findings suggest that age enhances the size of these framing effects on average. Our findings add to this literature by providing the first highly powered, clear, and direct test of age on attribute framing effects specifically.[5] One important next step for this literature will be to adapt our approach for other types of framing (risky choice framing and goal framing) to assess whether our results generalize to these other types of frames or whether there are theoretically consequential differences in the effects of age on different types of framing (see Levin et al., 1998, for a fuller discussion of different frame types and why it is important to distinguish between them).

Most importantly for the purposes of the present paper, our second multi-level model found that age moderates the negativity bias observed in previous research on reframing. Whereas younger adults displayed the negativity bias in reframing effects found in past research, such that their attitudes changed less when frames switched from negative to positive (vs. positive to negative; Boydstun et al., in press; Ledgerwood & Boydstun, 2014), as age increased, adults were more evenhanded in their response to reframing. The results of the reframing analysis are uniquely consistent with SST's prediction that negativity bias will decrease with age. Thus, although the framing analysis resulted in theoretically ambiguous findings (i.e., potentially consistent with SST or heuristic processing), the results of our reframing analysis provide additional evidence suggesting that SST provides the most parsimonious theoretical account for our data.

The present work provides the first evidence circumscribing *for whom* negativity biases in reframing effects operate, suggesting a key boundary condition to an effect that had thus far persisted robustly across multiple scenarios and samples. Why might this bias attenuate and even disappear as age increases? Building on past work that has investigated the psychological mechanisms underlying reframing effects (Ledgerwood & Boydstun, 2014), we suspect that the current results reflect a tendency for the conceptual stickiness of negative (vs. positive) frames to change across the lifespan. Specifically, initial research on reframing effects suggested that negative (vs. positive) conceptualizations tend to stick more strongly in the mind: It takes people longer to convert a negatively framed concept into a positively framed concept than to move in the opposite direction, and reframing changes positive construals more than negative construals. It therefore seems reasonable to posit that as age increases, this negativity bias in conceptual stickiness may attenuate, leading to the results we observe here.

However, other possible explanations for the observed moderating role of age on reframing effects deserve careful consideration as well. The first alternative explanation we considered was that perhaps people become more rational (i.e., wiser) as they grow older (Grossmann et al., 2010)—or perhaps the subset of older people who are on MTurk are particularly rational—such that they are simply less susceptible to normatively irrelevant contextual features, like which frame they encounter first. Yet if it were in fact the case that age increased rationality in this manner, we would also expect that age would reduce susceptibility to single-shot framing effects. In other words, if this increasing rationality account explained our data, we should have observed the Time 1 framing effect diminishing with age. Instead, we found evidence that age *increased* the Time 1 framing effect, and thus, our results appear

[5] Note that Bruine de Bruin et al. (2007, 2012) did not report their results separately for risky choice framing and attribute framing, which means that their findings could reflect an effect of age on one or the other or both types of framing. Related research investigating the ability of older adults to make consistent judgments across logically equivalent contexts (e.g., Finucane, Mertz, Slovic, & Schmidt, 2005; Finucane et al., 2002) could be used to infer that age is likely to enhance the typical effect of positive and negative attribute frames, but note that these studies do not directly assess attribute framing effects as traditionally defined (Levin et al., 1998). Our results are broadly consistent with all of these findings, while helping to provide clear and direct support for an effect of age on attribute framing *per se*.

inconsistent with an increasing rationality or wisdom account. Thus, although adults may of course gain wisdom from life experiences, this account does not seem to parsimoniously explain our data.

A second alternative explanation we considered was that memory might decline as age increases, and so perhaps our results could be explained by increasing age leading adults to simply not remember the first frame, regardless of valence (e.g., see LeBoeuf & Shafir, 2003; Stanovich & West, 2008). In other words, we might see a reduction in the tendency for negative (vs. positive) frames to persist in the face of reframing if declining memory were leading *all* frames to wear off more quickly as people aged. However, if it were in fact the case that age leads people to forget an initial frame more quickly, we should have also observed a main effect of age on attitude change: As people age, their attitudes should show greater change in the direction of the Time 2 frame, regardless of frame valence. Given that we observe no main effect of age on attitude change, this declining memory account does not seem to provide a parsimonious explanation for our findings.

Taken together, then, these considerations lead us to favor the hypothesis that age changes the relative stickiness of negative (vs. positive) conceptualizations as the most parsimonious and consistent explanation for our results—but of course, further research is needed to directly test this explanation for the moderating role of age on reframing effects.

Implications for Understanding Negativity and Positivity Biases

Research across diverse topic areas has demonstrated a pervasive tendency for people to give greater weight to negatives than positives. For example, studies have found that people pay more attention to negative than positive information and process it more thoroughly (Fiske, 1980), they respond more strongly to negative than positive emotions (Clore & Ortony, 1988), and they prioritize negative over positive data when forming impressions of others (Anderson, 1965). Synthesizing evidence across research domains, scholars have argued that as a general principle, negatives are more powerful than positives (Baumeister et al., 2001; Rozin & Royzman, 2001).

However, what seem to be general principles about basic psychological processes can often prove to be more circumscribed than researchers at first expect (Heinrich et al., 2010; Higgins & Liberman, 2018). The results of our reframing analysis suggest that the negativity bias in reframing—a finding that had persisted robustly across multiple samples and scenarios—may not generalize across the lifespan. In other words, the results of past studies do not reflect a general human bias, but rather a more specific, young adult bias. The present work is the first to identify age as an important boundary condition to the negativity bias in reframing effects, adding to the growing literature delineating how negativity biases change across the lifespan (see Reed et al., 2014, for a review) and providing an important empirical constraint on future theorizing about negativity biases in reframing. The current results highlight the importance of testing other theoretically relevant boundary conditions to reframing, in order to expand our understanding of the precise conditions under which negativity and positivity biases emerge (see also Sparks & Ledgerwood, 2017).

Furthermore, the fact that we see different patterns of results for framing and reframing effects underscores the importance of studying how negativity and positivity biases operate when information is encountered sequentially over time, rather than just in one single-shot context. Our reframing paradigm may provide a useful tool to further explore for whom and under what conditions negativity and positivity biases emerge and dissipate (e.g., positivity biases related to self-enhancement; O'Brien & Kardas, 2016; negativity biases in diagnosing change; O'Brien & Klein, 2017).

Implications for the Aging Literature

The main goal of our study was to apply theory and research from the aging literature to advance our understanding of framing and reframing effects, but we can also consider the potential usefulness of these data for informing the aging literature. Of course, the results of our reframing analysis add to a growing literature documenting the age-related positivity effect predicted by SST (see Reed et al., 2014, for a review). But perhaps more interestingly, our data may also provide some clues to help future researchers interested in teasing apart different potential mechanisms for the positivity effect. For example, recall that our Time 1 framing results helped rule out the idea that as age increases, the impact of a negative frame decreases. This observation is potentially consistent with an explanation for the positivity effect that focuses on an age-related shift in motivational priorities (see Carstensen, Isaacowitz, & Charles, 1999, for a full discussion of a lifespan theory of motivation), as noted earlier. On the other hand, because we do not see the impact of the negative frame decreasing with age, it seems challenging to reconcile these data with an explanation that focuses on age-related declines in the amygdala that inhibit responses to negative but not positive information (see Cacioppo et al., 2011, for a full discussion of the aging-brain model). More

broadly, these data illustrate the potential usefulness of studying both framing and reframing effects for elucidating processes related to aging: By jointly examining the effects of age on both framing and reframing, we can learn more than if we studied only one or the other effect in isolation.

Moreover, our reframing result suggests interesting possible links between the cognitive mechanism presumed to underlie the negativity bias in reframing (i.e., conceptual stickiness) and motivational priorities. For instance, one could interpret the reframing finding as suggesting that the conceptual stickiness mechanism observed in younger adults (Ledgerwood & Boydstun, 2014) may stem from motivational concerns (e.g., a sensitivity to potential threats in younger age; Carstensen, 2006) that can change across time and across situations. Future work might fruitfully explore whether age-related changes in these motives turn on and off the mechanisms underlying reframing effects, as well as whether manipulating these motives produces comparable results (see e.g., Pruzan & Isaacowitz, 2006).

Limitations and Future Directions

We have assumed that our results describe a developmental trajectory, but of course, these data are cross-sectional, and it is possible that the pattern we observe could be due to a cohort effect. For instance, perhaps the relatively younger adults in our sample grew up in a time when they were simply exposed to more negative information about the world (e.g., via the internet). Yet when we consider the current results in the context of the broader literature on SST, it seems likely that they reflect developmental changes. Longitudinal and experimental work on SST has found effects that generalize over time and across cohorts. For example, longitudinal work has shown that with increasing age, people recall more positive memories about their childhood (Field, 1981; Löckenhoff & Carstensen, 2004), experimental work has found that manipulating time horizons can produce patterns of results that look like typical age differences in valenced biases (Fung & Carstensen, 2003; Carstensen, 2006), and research has found that older adults report being more satisfied with their relationships than younger adults within and across cohorts spanning four decades (Lansford, Sherman, & Antonucci, 1998). Thus, we believe the current results are likely to replicate in a longitudinal design, and they provide an important and useful first step that suggests longitudinal research on this question is well worth conducting.

The finding that age attenuates the negativity bias in reframing effects supports the hypothesis, derived from SST, that negativity biases should decrease across the lifespan. We feel confident that the attenuation of the negativity bias describes our sample in the age range of 18-60 years old (where we have a large amount of data), but we are less sure about what happens beyond age 60. One interesting possibility (predicted by SST) is that the linear trend continues, such that at even older ages (approximately age 72; see Reed et al., 2014), people exhibit a positivity bias in reframing effects (i.e., less attitude change when frames switch from positive-to-negative vs. negative-to-positive). In other words, it may be the case that after age 72, adults begin to display a positivity bias in reframing such that initial positive frames stick in the mind more strongly than initial negative frames. A different possibility is that age-related cognitive declines may produce a nonlinear effect (see Labouvie-Vief, DeVoe, & Bulka,1989; O'Brien, Konrath, Gruhn, & Hagen, 2012), such that adults in their seventies and eighties are—like adults in their sixties—evenhanded in their response to reframing. Future research could test these possibilities, as well as the generalizability of our current results, by recruiting a large community sample of adults at the higher end of the age range where a reversal from negativity bias to positivity bias could be theoretically expected to occur.

Finally, we note that the present analyses examine reframing effects in the loss domain, where people are considering the possibility of experiencing a negative event or punishment (e.g., lives lost due to an unusual disease, jobs lost due to an economic policy), framed in either positive terms (e.g., lives saved) or negative terms (e.g., lives lost). We chose to focus on the loss domain in the current work because the majority of the extant framing literature—and much of our own work on reframing effects—focuses either implicitly or explicitly on the loss domain (Boydstun et al., in press; Ledgerwood & Boydstun, 2014; Tversky & Kahneman, 1981; see Levin et al., 1998, for a review), and we wanted to build on this work and connect it to the literature on aging. At the same time, new findings suggest that reframing effects may operate differently in the understudied gain domain: Under certain conditions, positive (vs. negative) frames can be stickier when people are considering potential gains (e.g., a training regimen to enhance memory capacity, rather than a training regimen to prevent memory loss; Sparks & Ledgerwood, 2017). Given the important moderating role of age uncovered in the current work in the loss domain, future research might fruitfully examine the moderating role of age in the gain domain as well.

Conclusion

The present work suggests that age may function as a critical moderator circumscribing negativity biases in reframing. This finding adds to mounting evidence that reframing effects reflect functional biases (i.e., biases that serve evolutionary and/or current motivational priorities) in different contexts and across the lifespan (Sparks & Ledgerwood, 2017). Recent work on reframing has identified boundaries to negativity bias in contexts that promote the (presumably functional) discovery of rewards (Sparks & Ledgerwood, 2017). In a similar way, the current findings suggest that age may attenuate and even eliminate the previously observed negativity bias in reframing effects, a pattern that could functionally boost mood and well-being when future time horizons are limited. This research paves the way for future work to explore additional theoretically relevant moderators to reframing effects, thereby contributing to an integrative understanding of negativity and positivity biases.

References

Anderson, N. H. (1965). Averaging versus adding as a stimulus-combination rule in impression formation. *Journal of Personality and Social Psychology, 2,* 1-9.

Baumeister, R.F., Bratslavsky, E., Finkenauer, C., & Vohs, K.D. (2001). Bad is stronger than good. *Review of General Psychology, 5*(4), 323-370.

Besedeš, T., Deck, C., Sarangi, S., & Shor, M. (2012). Age effects and heuristics in decision making. *Review of Economics and Statistics, 94*(2), 580-595.

Bickel, R. (2007). *Multilevel analysis for applied research: It's just regression!* New York: Guilford Press.

Boydstun, A., Ledgerwood, A., & Sparks, J. (in press). A Negativity Bias in Reframing Shapes Political Preferences Even in Partisan Contexts. *Social Psychological and Personality Science*.

Bruine de Bruin, W., Parker, A. M., & Fischhoff, B. (2007). Individual differences in adult decision-making competence. *Journal of personality and social psychology, 92*(5), 938.

Bruine de Bruin, W., Parker, A. M. and Fischhoff, B. (2012). Explaining adult age differences in decision-making competence. *Journal of Behavioral Decision-Making, 25*: 352-360.

Button, K. S., Ioannidis, J. P., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S., & Munafò, M. R. (2013). Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience, 14*, 365-376.

Cacioppo, J.T., Berntson, G.G., Bechara, A., Tranel, D., & Hawkley, L.C. (2011). Could an aging brain contribute to subjective well-being? The value added by a social neuroscience perspective. In A. Todorov, S. T. Fiske, & D. Prentice (Eds), Social Neuroscience: Toward Understanding the Underpinnings of the Social Mind. (pp. 249- 262). New York: Oxford University Press.

Carstensen, L.L. (2006). The influence of a sense of time on human development. *Science, 312*(5782), 1913-1915.

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American psychologist, 54*(3), 165.

Carstensen, L.L., & Mikels, J.A. (2005). At the intersection of emotion and cognition: Aging and the positivity effect. *Current Directions in Psychological Science, 14*(3), 117-121.

Charles, S. T., Mather, M., & Carstensen, L. L. (2003). Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General, 132*(2), 310-324.

Clore, G. L., & Ortony, A. (1988). The semantics of affective lexicon. In V. Hamilton, G. H. Bower, & N. H. Frijda (Eds.), Cognitive perspectives on emotion and motivation. NATO ASI series D: Behavioural and social sciences (Vol. 44, pp. 367-397). Dordrecht, The Netherlands: Kluwer Academic.

Field, D. (1981). Retrospective reports by healthy intelligent elderly people of personal events in their lives. *International Journal of Behavioral Development, 4*, 77-97.

Finucane, M. L., Mertz, C. K., Slovic, P., & Schmidt, E. S. (2005). Task complexity and older adults' decision-making competence. *Psychology and aging, 20*(1), 71.

Finucane, M. L., Slovic, P., Hibbard, J. H., Peters, E., Mertz, C. K., & MacGregor, D. G. (2002). Aging and decision-making competence: An analysis of comprehension and consistency skills in older versus younger adults considering health-plan options. *Journal of Behavioral Decision Making, 15*, 141-164.

Fiske, S. T. (1980). Attention and weight in person perception: The impact of negative and extreme behavior. *Journal of Experimental Research in Personality, 22*, 889-906.

Fung, H., & Carstensen, L. (2003). Sending memorable messages to the old: Age differences in preferences and memory for advertisements. *Journal of Personality and Social Psychology, 85*(1), 163-178.

Giner-Sorolla, R. (2018, January 24). Powering Your Interaction [Web log post]. Retrieved from https://approachingblog.wordpress.com/2018/01/24/powering-your-interaction-2/

Goldsmith, K., & Dhar, R. (2013). Negativity bias and task motivation: Testing the effectiveness of positively versus negatively framed incentives. *Journal of Experimental Psychology: Applied, 19*(4), 358-366.

Gonsalkorale, K., Sherman, J., & Klauer, K. (2009). Aging and prejudice: Diminished regulation of automatic race bias among older adults. *Journal of Experimental Social Psychology, 45*, 410-414.

Grossmann, I., Na, J., Varnuma, M. E. W., Park, D. C., Kitayama, S., & Nisbett, R. E. (2010). Reasoning about social conflicts improves into old age. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 107*(16), 7246-7250.

Henrich, J., Heine, S., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences, 33*, 61-83.

Higgins, E. T., & Liberman, N. (2018). The loss of loss aversion: Paying attention to reference points. *Journal of Consumer Psychology*.

Hox, J.J. (2002). *Multilevel analysis: Techniques and applications.* Mahwah, NJ: Erlbaum

Isaacowitz, D.M., Wadlinger, H.A., Goren, D., & Wilson, H.R. (2006). Selective preference in visual fixation away from negative images in old age? An eye-tracking study. *Psychology and Aging, 21*, 40-48.

Johnson, M. (1990). Age differences in decision making: A process methodology for examining strategic information processing. *Journal of Gerontology, 45*, 75-78.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*, 263-291.

Kim, S., Goldstein, D., Hasher, L., & Zacks, R. T. (2005). Framing effects in younger and older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 60*(4), 215-218.

Klein, N., & O'Brien, E. (2016). The tipping point of moral change: When do good and bad acts make good and bad actors?. *Social cognition, 34(2)*, 149-166.

Kühberger, A. (1998). The influence of framing on risky decisions: A meta-analysis. *Organizational Behavior and Human Decision Processes, 75*, 23-55.

Labouvie-Vief, G., DeVoe, M., & Bulka, D. (1989). Speaking about feelings: Conceptions of emotion across the life span. *Psychology and Aging*, *4*(4), 425.

Labouvie-Vief, G., Grühn, D., & Studer, J. (2010). Dynamic integration of emotion and cognition: Equilibrium regulation in development and aging. *The Handbook of Life-Span Development*.

Lansford, J.E., Sherman, A.M., & Antonucci, T.C. (1998). Satisfaction with social networks: An examination of socioemotional selectivity theory across cohorts. *Psychology and Aging*, *13*(4), 544-552.

LeBoeuf, R. A., & Shafir, E. (2003). Deep thoughts and shallow frames: On the susceptibility to framing effects. *Journal of Behavioral Decision Making*, *16*(2), 77-92.

Ledgerwood, A., & Boydstun, A. E. (2014). Sticky prospects: Loss frames are cognitively stickier than gain frames. *Journal of Experimental Psychology: General*, *143*(1), 376-385.

Ledgerwood, A., Soderberg, C. K., & Sparks, J. (2017). Designing a study to maximize informational value. In J. Plucker & M. Makel (Eds.), *Toward a more perfect psychology: Improving trust, accuracy, and transparency in research*. Washington, DC: American Psychological Association.

Lemaster, P., Pichayayothin, N.B., & Strough, J. (2015). Using Amazon's Mechanical Turk to Recruit Older Adults: Easy And Cheap, But Is It Valid? *Gerontologist*, *55*, 469.

Levin, I.P., & Gaeth, G.J. (1988). How consumers are affected by the framing of attribute: Information before and after consuming the product. *The Journal of Consumer Research*, *15*(3), 374-378.

Levin, I.P., Schneider, S.L., & Gaeth, G.J. (1998). All frames are not created equal: A typology and critical analysis of framing effects. *Organizational Behavior and Human Decision Processes*, *76*(2), 149-188.

Levin, I.P., Schnittjer, S.K., & Thee, S.L. (1988). Information framing effects in social and personal decisions. *Journal of Experimental Social Psychology*, *24*(6), 520-529.

Löckenhoff, C., & Carstensen, L. (2004). Socioemotional selectivity theory, aging, and health: The increasingly delicate balance between regulating emotions and making tough choices. *Journal of personality*, *72*(6), 1395-1424.

Löckenhoff, C., & Carstensen, L. (2007). Aging, emotion, and health-related decision strategies: Motivational manipulations can reduce age differences. *Psychology and Aging*, *22*, 134-146.

Marteau, T.M. (1989). Framing of information: Its influence upon decisions of doctors and patients. *British Journal of Social Psychology*, *28*(1), 89-94.

Mather, M., & Carstensen, L. L. (2005). Aging and Motivated Cognition: The Positivity Effect in Attention and Memory. *TRENDS in Cognitive Sciences*, *9*(10), 496-502.

Mayhorn, C. B., Fisk, A. D., & Whittle, J. D. (2002). Decisions, Decisions: Analysis of Age, Cohort, and Time of Testing on Framing of Risky Decision Options. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *44*, 515-521.

McElroy, T., & Seta, J. (2003). Framing effects: An analytic-holistic perspective. *Journal of Experimental Social Psychology*, *39*, 610-617.

Mendes, W. B. (2010). Weakened links between mind and body in older age: The case for maturational dualism in the experience of emotion. *Emotion Review*, *2*(3), 240-244.

Mikels, J. A., & Reed, A. E. (2009). Monetary losses do not loom large in later life: Age differences in the framing effect. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *64*(4), 457-460.

O'Brien, E., & Kardas, M. (2016). The implicit meaning of (my) change. *Journal of Personality and Social Psychology*, *111*(6), 882-894.

O'Brien, E., & Klein, N. (2017). The tipping point of perceived change: Asymmetric thresholds in diagnosing improvement versus decline. *Journal of personality and social psychology*, *112*(2), 161.

O'Brien, E., Konrath, S. H., Grühn, D., & Hagen, A. L. (2012). Empathic concern and perspective taking: Linear and quadratic effects of age across the adult life span. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *68*(2), 168-175.

Peer, E., Samat, S., Brandimarte, L., & Acquisti, A. (2015). Beyond the Turk: An empirical comparison of alternative platforms for crowdsourcing online behavioral research.

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., & R Core Team (2016). nlme: Linear and Nonlinear Mixed Effects Models. R package version 3.1-131.

Pruzan, K., & Isaacowitz, D. M. (2006). An attentional application of socioemotional selectivity theory in college students. *Social Development*, *15*(2), 326-338.

R Core Team (2016). R: A language and environment for statistical computing. Retrieved January, 16, 2016 from http://www.r-project.org/

Reed, A. E., & Carstensen, L. L. (2012). The Theory Behind the Age-Related Positivity Effect. *Frontiers in Psychology*, *3*, 339.

Reed, A. E., Chan, L., & Mikels, J. A. (2014). Meta-analysis of the age-related positivity effect: Age differences in preferences for positive over negative information. *Psychology and Aging*, *29*(1), 1-15.

Rönnlund, M., Karlsson, E., Laggnäs, E., Larsson, L., & Lindström, T. (2005). Risky Decision Making Across Three Arenas of Choice: Are Younger and Older Adults Differently Susceptible to Framing Effects? *The Journal of General Psychology*, *132*(1), 81-93.

Rozin, P., & Royzman, E.B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, *5*(4), 296-320.

Schönbrodt, F., & Perugini, M. (2013). At what sample size do correlations stabilize? *Journal of Research in Personality*, *47*, 609-612.

Shamaskin, A. M., Mikels, J. A., & Reed, A. E. (2010). Getting the Message Across: Age Differences in the Positive and Negative Framing of Health Care Messages. *Psychology and Aging*, *25*(3), 746-751.

Sparks, J., & Ledgerwood, A. (2017). When Good Is Stickier Than Bad: Understanding Gain/Loss Asymmetries in Sequential Framing Effects. *Journal of experimental psychology: General*, *146*(8), 1086.

Stanovich, K., & West, R. (2008). On the relative independence of thinking biases and cognitive ability. *Journal of personality and social psychology*, *94*(4), 672.

Tversky, A., & Kahneman. (1981). The framing of decisions and the psychology of choice. *Science*, *211*(4481), 453-458.

van Schie, E. C. M., & van der Pligt, J. (1995). Influencing risk-preference in decision-making: The effects of framing and salience. *Organizational Behavior and Human Decision Processes*, *63*, 264-275.

Wilson, D. K., Kaplan, R. M., & Schneiderman, L. J. (1987). Framing of decisions and selections of alternatives in health care. *Social Behaviour*, *2*(1), 51-59.

Wood, S., & Kisley, M. A. (2006). The negativity bias is eliminated in older adults: Age-related reduction in event-related brain potentials associated with evaluative categorization. *Psychology and Aging*, *21*(4), 815-820.