Journal of Experimental Psychology: General

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Research across numerous domains has highlighted the current—and presumably temporary—effects of frames on preference and behavior. Yet people often encounter information that has been framed in different ways across contexts, and there are reasons to predict that certain frames, once encountered, might tend to stick in the mind and resist subsequent reframing. We propose that loss frames are stickier than gain frames in their ability to shape people's thinking. Specifically, we suggest that the effect of a loss frame may linger longer than that of a gain frame in the face of reframing and that this asymmetry may arise because it is more difficult to convert a loss-framed concept into a gain-framed concept than vice versa. Supporting this notion, loss-to-gain (vs. gain-to-loss) reframing had a muted impact on both risk preferences (Study 1) and evaluation (Study 2). Moreover, participants took longer to solve a math problem that required reconceptualizing losses as gains than vice versa (Studies 3–5), and reframing changed gain-based conceptualizations but not loss-based ones (Study 6). We discuss implications for understanding a key process underlying negativity bias, as well as how sequential frames might impact political behavior and economic recovery.

Keywords: framing effects, functional fixedness, construal, risky decision making, negativity dominance

People often encounter information that has been framed in different ways across contexts. A voter might hear a presidential candidate describe a set of military options in terms of deaths prevented and later hear the opposing candidate describe the same options in terms of lives saved. An online news reader browsing the morning headlines might see one article written using language that frames the job market in terms of gains (e.g., 90% employment), and then encounter a different article that talks about it in terms of losses (e.g., 10% unemployment). Yet despite this tendency for the same information to be framed and reframed over time, little is known about whether and how framing effects might carry over beyond the immediate context in which they are first encountered.

Indeed, the literature on framing could be largely characterized as highlighting the current—and presumably temporary—effects of frames on judgment. The present research expands this notion to suggest that frames can stick: Once a person conceptualizes something as a loss or gain on the basis of its current framing, it may be difficult to reconceptualize it with a different frame. Moreover, we

propose that loss frames may be fundamentally stickier than gain frames in their ability to shape people's thinking across time and situations. Such a notion would expand the current literature's understanding of framing to suggest that frames can have lingering effects outside of the context in which they are first encountered. Moreover, it could shed new light on a key mechanism underlying negativity biases by suggesting that it is more difficult for people to mentally convert from losses to gains than to convert from gains to losses.

Loss and Gain Framing

Research across a wide range of domains has documented the dramatic consequences that framing information in loss or gain terms can have for current attitudes and behavior (e.g., Eibach & Purdie-Vaughns, 2011; Meyerowitz & Chaiken, 1987; Quattrone & Tversky, 1988; Roszkowski & Snelbecker, 1990; Rothman & Salovey, 1997; see also Higgins, 1997). Seemingly trivial changes in wording can produce striking changes in preference: For instance, Tversky and Kahneman's (1981) classic research demonstrated that framing an issue in terms of potential losses (e.g., lives lost) versus potential gains (lives saved) leads people to become risk seeking rather than risk averse (for reviews, see Kühberger, 1998; Levin, Schneider, & Gaeth, 1998).

To date, most framing research has examined the effects of a single frame on a single judgment, although a handful of studies underscore the importance of investigating the ways in which different frames might combine to jointly influence a person's response. For instance, preferences under a current frame can be influenced by prior outcomes in which an initial gain or loss is actually realized: A prior gain can increase risk seeking, whereas a prior loss can increase the appeal of a chance to break even, consistent with the broader notion that the effect of a current frame on judgment can depend on past events (Gärling & Romanus, 1997; Thaler & Johnson, 1990). Moreover, when two different

frames are simultaneously encountered, their combined effect can be different than the sum of their constituent parts—for example, Wu and Markle (2008) demonstrated that mixed gambles are evaluated differently than the sum of their individual loss and gain components (see also De Dreu, Carnevale, Emans, & van de Vliert, 1994). Such findings highlight the importance of expanding the study of framing effects beyond the isolated context of a single frame's impact on a single judgment.

However, despite the fact that information is often repeatedly framed and then reframed before people act on it (as in the case of sequentially encountered news stories), research has yet to shed light on the potential impact of sequentially encountered frames. The inevitable dynamic of framing means it is critical to move beyond the extant literature's predominant focus on the effect of the current frame to consider what happens when information that is originally framed as a loss is subsequently *reframed* as a gain or vice versa.

Indeed, there is reason to believe that past frames could have lingering effects on how people conceptualize an issue. In particular, research on functional fixedness suggests that once an individual conceptualizes or labels an object in a particular way, that label can stick, making it difficult to reconceptualize the object differently (Adamson, 1952; Duncker, 1945; Higgins & Chaires, 1980). Just as conceptualizing an object as a box might make it more difficult to reconceptualize it as a shelf, so too might conceptualizing a prospect as a loss make it more difficult to reconceptualize it as a gain. It is interesting that such stickiness would represent a violation of Slovic's (1972) *concreteness principle*, which suggests that decision makers generally tend to accept and use current, salient, and concrete information (rather than relying on memory or adding new information to the current frame).

If frames can be cognitively sticky in this way, it seems likely that loss frames should be especially sticky. Specifically, we suggest that just as a general human tendency to prioritize safety and potential negatives (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001) may lead losses to loom larger than gains (Kahneman & Tversky, 1979), so too might it lead loss frames to last longer than gain frames. If it turns out that an outcome initially construed as a potential gain (e.g., the chances of surviving) may also involve a loss (e.g., the chances of dying), this requires urgent attention. In contrast, if an outcome initially conceptualized as a loss (potentially dying) can be reconceptualized as a gain (potentially living), it would be dangerous at that point to forget entirely the possibility of loss. Loss frames may therefore be more likely than gain frames to stick in the face of subsequent reframing. Indeed, research on negativity biases in information processing is broadly consistent with this idea: People attend more readily to negative than positive stimuli, process them more deeply, and remember them better (Fiske, 1980; Hansen & Hansen, 1988; Öhman, Lundqvist, & Esteves, 2001; Peeters & Czapinski, 1990; Pratto & John, 1991). Moreover, neurophysiological data suggest that when new information is inconsistent with previously learned information, the brain responds less strongly to a switch from negative to positive than vice versa (Bartholow, Fabiani, Gratton, & Bettencourt, 2001), indicating that even at this very basic level, negativity may have a fundamental stickiness that weakens the engagement of information-processing transactions in response to potential positives.

Current Research

Integrating the literatures on functional fixedness and negativity bias, we propose that loss frames may be stickier than gain frames in their ability to shape people's thinking. In particular, we suggest that the effects of a loss frame may linger longer than those of a gain frame when information is subsequently reframed and that this asymmetry may arise because it is more difficult to mentally convert a loss-framed concept into a gain-framed one than to convert from gains to losses. In Studies 1 and 2, we examine the effect that such a difference in frame stickiness would produce on judgments when information first framed as a loss is subsequently reframed as a gain and vice versa. We predict that if loss frames are stickier than gain frames, then changing the framing of an issue from loss to gain (vs. gain to loss) will have a muted impact on participants' judgments across different types of framing paradigms. Because much of the framing literature focuses on how frames affect preferences under uncertainty (e.g., Tversky & Kahneman, 1981, 1992; see Kühberger, 1998, for a review), we begin by examining our hypothesis in the classic context of risk preferences (Study 1) but then also test its generalizability to a different type of framing scenario (attribute framing; see Levin et al., 1998) in Study 2.

In Studies 3–5, we zero in on the mechanism presumed to underlie this effect. In particular, we examine the ease with which people can shift from conceptualizing an issue in terms of losses to reconceptualizing it in terms of gains (and vice versa) to test whether it is, in fact, more difficult to convert from losses to gains than the reverse. We do this by asking participants to solve a simple math problem that involves either converting from losses to gains or converting from gains to losses and timing how long it takes them to perform the calculation. Finally, Study 6 directly tests whether loss frames are stickier than gain frames in their influence on how people conceptualize an issue by assessing how participants subjectively construe an issue after framing and reframing.

Such findings could help shed new light on a key cognitive process underlying negativity biases by suggesting that loss (vs. gain) frames tend to stick in the mind and resist reconceptualization. Moreover, they would move beyond the existing framing literature's primary focus on how a current frame affects a current judgment to highlight the importance of considering the ease or difficulty with which people can shift from one mental conceptualization to another.

Study 1

If framing effects can carry over beyond the context in which they are first encountered, then people's risk preferences might be influenced not only by the current frame but also by whether an issue was previously framed in a different way. Moreover, building on the notion that loss frames could be stickier than gain frames and thus more resistant to reframing, we hypothesized that changing the framing of an issue from loss to gain (vs. gain to loss) would have a muted impact on participants' risk preferences. We tested this prediction by assessing participants' preferences for uncertain outcomes in a typical framing paradigm with a twist: After seeing information framed in terms of losses or gains, participants saw the same information reframed in terms of gains or losses.

Method

Seventy-two undergraduates (49 women, 23 men) read a classic framing scenario (Tversky & Kahneman, 1981) as part of a study on how opinions form over time. Participants were asked to "imagine that the U.S. is preparing for the outbreak of an unusual disease, which is expected to kill 600 people" and offered two possible programs to combat it. For some participants, the programs were first framed in terms of gains (lives saved) and subsequently reframed in terms of losses (lives lost), whereas others saw the programs framed first in terms of losses and then in terms of gains. For all participants, one program had a certain (safe) outcome and one had a mathematically equivalent but uncertain (risky) outcome (e.g., participants in the gain-first/loss-second condition initially read that Program A would save 200 people, whereas Program B had a 1/3 chance of saving everyone and a 2/3 chance of saving nobody).

Participants rated their relative program preference by moving a slider along an unmarked 100-point scale from *completely favor Program A* to *completely favor Program B* and then rated both their attitude toward Program A (reverse coded) and their attitude toward Program B, each on continuous unmarked scales from *very negative* to *very positive*.[1] Next, they read additional information about each program that simply reframed the prior information using the opposite frame (e.g., the gain-first/loss-second condition now read that "whereas Program A is sure to result in a full 400 people dying, Program B has a 33% chance of nobody dying"). Participants then rerated their program preference using the same three scales. The three preference ratings were averaged at each time point into a measure of preference for the risky (vs. safe) program (αs = .82 and .77 at Times 1 and 2, respectively).

Results and Discussion

Six participants did not understand or failed to follow the instructions (e.g., did not speak English well enough to understand the instructions, failed to move any of the sliders from their original positions; see Van Boven, Judd, & Sherman, 2012), and two indicated that their responses had been governed by a formal knowledge of framing research from previous courses. Analyses were conducted on the remaining participants.

To test whether loss-to-gain reframing (vs. gain-to-loss reframing) has a muted impact on risk preferences, we needed to compare the two framing conditions (gain first/loss second vs. loss first/gain second) with respect to the absolute extent of change in preferences across time. That is, we needed to test whether the size of the change between the Time 1 and Time 2 means was significantly smaller, regardless of direction, in the loss-first condition than in the gain-first condition. To do so, we reverse coded the program preference measure in the loss-first/gain-second condition so that higher numbers in both conditions indicated that participants' preferences were more in line with the Time 2 frame (i.e., greater preference for the risky option under loss framing; greater preference for the safe option under gain framing). This recoding allowed us to test whether the absolute extent of change from one time point to the next was different between conditions (see Figure 1).[2]

A 2 (framing order: gain first vs. loss first) $\times$ 2 (time point: Time 1 vs. Time 2) mixed-design ANOVA with repeated measures on the second factor revealed the predicted two-way interaction,
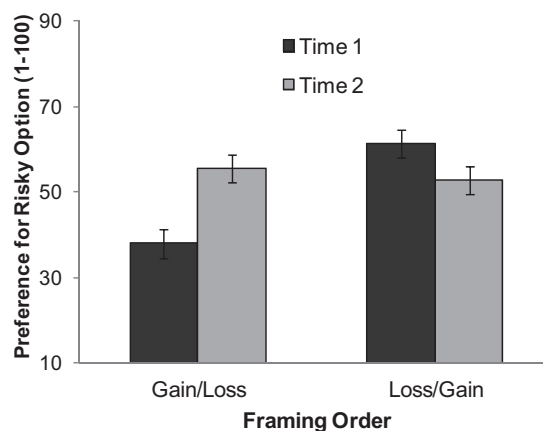

Figure 1. Preference for the risky (vs. safe) program as a function of framing order (gain first/loss second vs. loss first/gain second) and time point (Time 1 initial framing vs. Time 2 reframing). Error bars indicate 1 standard error above and below the mean. Means are graphed on the original attitude scale for ease of interpretation; using the reverse coding in our analysis allows the interaction to compare the size of the difference between the first two bars and the size of the difference between the last two bars to see if the absolute size (rather than direction) of the reframing effect differs between conditions.

$F(1, 62) = 4.44$, $p = .039$, $\eta_p^2 = .07$, indicating that those who saw the gain frame first exhibited significantly greater change in response to the reframing at Time 2 compared with those who saw the loss frame first. Whereas those who saw the gain frame first swung substantially from preferring the safe program to preferring the risky one when it was reframed in terms of losses, $t(31) = 5.71$, $p < .0001$, those who saw the loss frame first showed only a small decrease in preference for the risky option when it was reframed in terms of gains, $t(31) = 2.51$, $p = .017$ (see Figure 1).

Another way to assess the effects of frame stickiness is to test whether participants' relative preference for the risky (vs. safe) program differed depending on whether they had seen an alternative framing first. In other words, whereas classic framing research suggests that risk preferences depend on the current frame (e.g., Tversky & Kahneman, 1981), we predicted that if loss frames are sticky, the effect of a current gain frame would change depending

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[1] Because we were interested in assessing the extent to which frames can be naturally sticky, we took care to avoid demand characteristics and to remove any consistency pressures that participants might otherwise feel when asked to report their opinions twice in the same session (see LeBoeuf & Shafir, 2003, for a discussion of how consistency pressures can influence choice in a similar paradigm). Both continuous and dichotomous measures have been used frequently in framing research (Kühberger, 1998).

[2] A 2 $\times$ 2 analysis of variance (ANOVA) on the original scale that is portrayed in Figure 1 would conflate the direction of the change in preference from Time 1 to Time 2 with the size of the change. In other words, we could see a significant interaction even if the size of the change on the left and right sides of the graph were identical (which is what the existing framing literature would predict: People simply respond to the current frame). The recoding in our analysis flips the two bars on the right so that the interaction now tests our unique prediction about the absolute value of the change from Time 1 to Time 2. This approach is thus identical to a *t* test comparing the absolute size of the difference score on the left to the absolute size of the difference score on the right, without losing information in the way that a difference score would.

on whether the same information had previously been framed in terms of losses. Supporting this prediction, participants' relative preference for the risky program under gain framing was significantly greater when they had previously seen it framed in terms of losses ($M = 52.61$, $SD = 19.21$), compared with when they had not ($M = 37.97$, $SD = 19.12$), $t(62) = 3.06$, $p = .003$. In contrast, preference for the risky program under loss framing did not differ depending on previous exposure to the gain frame ($M = 55.53$, $SD = 16.45$, vs. $M = 60.76$, $SD = 18.54$), $t(62) = 1.19$, $p = .237$.

Thus, these results suggest that although current frames do shape preference, past frames can have lingering effects. Once an issue is framed in terms of losses, this can have a lasting impact on judgment, even in the context of subsequent gain frames. These findings are consistent with the idea that loss frames are stickier than gain frames in their ability to shape people's thinking. In our next study, we sought to establish the generalizability of this effect by extending it to a different type of framing scenario that does not involve risk preferences.

Study 2

The notion that loss frames may be stickier than gain frames is a very general one. Yet researchers have drawn some broad distinctions between different types of framing effects in the past, and it is therefore important to consider whether the results obtained for one type of framing paradigm will necessarily generalize to another. In particular, Levin et al. (1998) distinguished between *risky choice framing*, in which framing shifts preferences for a risky versus safe option (as in Study 1), and *attribute framing*, in which framing an attribute of a single object in terms of gain or loss changes the evaluation of that object (e.g., people evaluate a medical procedure more favorably when it is described in terms of its survival rate rather than its mortality rate; Marteau, 1989; Wilson, Kaplan, & Schneiderman, 1987; see also Levin, Schnittjer, & Thee, 1988). In their review of the framing literature, Levin et al. (1988) suggested that these "fundamentally different categories of framing effects" (p. 157) may rely on somewhat different processes and be shaped by distinct moderators (see also Van Schie & Van Der Pligt, 1995). Thus, if we want to argue that loss frames are generally stickier than gain frames, we need to test whether the pattern of results obtained in Study 1 will generalize to the context of attribute framing.

To address this question, we adapted a typical attribute framing paradigm used in past research (e.g., Wilson et al., 1987) and again added a twist: After seeing a surgical procedure described in terms of either gains (survival rate) or losses (mortality rate), participants saw it reframed in terms of losses or gains. Rather than assessing participants' preference for a risky (vs. safe) option, we simply asked them to evaluate the procedure at each time point, consistent with an attribute framing approach. We predicted that if loss frames are generally stickier than gain frames (rather than only specifically in the context of risk), then changing the framing of the procedure from loss to gain (vs. gain to loss) would have a muted impact on participants' evaluations.

Method

Ninety-two participants (40 women, 44 men, and 8 unreported; 97.6% from the United States) between the ages of 18 and 62 years

($M = 34.37$, $SD = 13.04$) completed the study online in exchange for payment through Amazon's Mechanical Turk platform (Buhrmester, Kwang, & Gosling, 2011). The overall procedure was similar to that of Study 1, with the following changes.

Participants were asked to imagine that "a national panel is evaluating a recently-developed surgical procedure that involves new robotic technology." They then learned about the results of a 3-year study on the procedure, which could be framed in terms of either gains (a survival rate of 70%) or losses (a mortality rate of 30%). In the gain-first/loss-second condition, participants saw the procedure initially framed in terms of its survival rate and subsequently reframed in terms of its mortality rate, whereas those in the loss-first/gain-second condition saw the reverse.

After each frame, participants in both conditions were asked to rate the procedure by moving sliders along three unmarked, continuous scales anchored at the endpoints (*very negative* to *very positive*, *harmful* to *beneficial*, and *completely oppose* to *completely favor*). These scales were averaged at each time point to form an index of attitudes toward the procedure (αs = .96 and .98 at Times 1 and 2, respectively).

Results and Discussion

One participant failed to follow the instructions (i.e., did not move any of the sliders from their original positions; see Van Boven et al., 2012), and the dependent variable failed to record for three participants because of a computer error.[3] Analyses were conducted on the remaining participants.

As in Study 1, we wanted to test whether the absolute extent of change from one time point to the next was different between conditions, so we again reverse coded our dependent variable in the loss-first/gain-second condition such that higher numbers in both conditions indicated an evaluation that was more consistent with the Time 2 frame (i.e., more positive for a gain frame; more negative for a loss frame). A 2 (framing order: gain first vs. loss first) $\times$ 2 (time point: Time 1 vs. Time 2) mixed-design ANOVA with repeated measures on the second factor revealed the predicted two-way interaction, $F(1, 85) = 5.26$, $p = .024$, $\eta_p^2 = .06$: Those who saw the attribute gain frame first showed significantly greater change in response to the reframing at Time 2 compared with those who saw the attribute loss frame first. Whereas those who saw an initial gain frame swung a full 15 points from the positive to the negative side of the scale after reframing, $t(43) = 6.31$, $p < .0001$, those who saw an initial loss frame showed only a small decrease in negativity toward the procedure when it was reframed in terms of gains, $t(42) = 2.07$, $p = .044$ (see Figure 2).[4]

Mirroring our analytic strategy in Study 1, we also examined whether participants' evaluation of the procedure differed depend-

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[3] For two of these participants, all but one item recorded successfully; imputing dependent variable values by averaging the successfully recorded items for these participants did not change the results reported below. (For the third participant, no items were recorded.)

[4] We conducted a systematic replication of this study that changed only the percentages used for the gain and loss frames (60% survival rate vs. 40% mortality rate) to ensure that our results held across different success and failure rates; again, participants who saw the attribute gain frame first showed significantly greater change in response to the reframing at Time 2 compared with those who saw the attribute loss frame first, $F(1, 75) = 5.48$, $p = .022$, $\eta_p^2 = .07$.
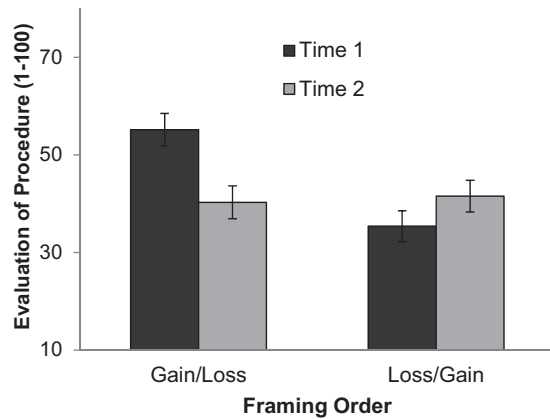
Figure 2. Attitudes toward the surgical procedure as a function of framing order (gain first/loss second vs. loss first/gain second) and time point (Time 1 initial framing vs. Time 2 reframing). Error bars indicate 1 standard error above and below the mean. Means are graphed on the original attitude scale for ease of interpretation; using the reverse coding in our analysis allows the interaction to compare the size of the difference between the first two bars and the size of the difference between the last two bars to see if the absolute size (rather than direction) of the reframing effect differs between conditions.

ing on whether they had seen an alternative framing first. Again, participants' evaluation under gain framing was significantly more negative when they had previously seen the procedure framed in terms of losses ($M = 41.55$, $SD = 27.04$) compared with when they had not ($M = 55.17$, $SD = 22.79$), $t(85) = 2.54$, $p = .013$. In other words, the effect of a current gain frame changed depending on whether the same information had previously been framed in terms of losses, suggesting that the initial loss frame was having a lingering effect. In contrast, evaluation of the procedure under loss framing did not differ depending on previous exposure to the gain frame ($M = 39.94$, $SD = 23.36$, vs. $M = 35.20$, $SD = 24.49$), $t(88) = 0.94$, $p = .350$.

Taken together, our results so far suggest that changing the framing of an issue from loss to gain has a muted impact on judgment, compared with reframing from gain to loss, and this effect holds for both risky choice framing and attribute framing. These findings are consistent with the idea that whereas individuals can shift with relative ease from considering an issue in terms of gains to reconsidering it in terms of losses, it may be far more difficult to shift from losses to gains. However, although Studies 1 and 2 provide important initial evidence for the impact that such a process could have on judgment, they do not directly test this hypothesized mechanism. We therefore designed our next set of studies to zero in on the ease with which individuals are able to cognitively shift from conceptualizing an issue using one frame to reconceptualizing it using another.

In Study 3, we began by testing whether it is, in fact, easier for individuals to mentally convert from gains to losses than it is to convert from losses to gains in the context of the unusual disease scenario from Study 1. We did this by asking participants to solve a simple math problem that involved either mentally converting from lives lost to lives saved or vice versa and timing how long it took them to perform the calculation. In Study 4, we sought to replicate this effect in a context that did not involve human

mortality to ensure that our results were not specific to life-and-death scenarios. Finally, in Study 5, we tested whether the difference in solution time between framing conditions was, in fact, due to frame conversion rather than some other difference between loss and gain calculations.

Study 3

Study 3 provided the first test of our hypothesis that it is easier for individuals to mentally convert from gains to losses than to convert from losses to gains. Participants read about the unusual disease scenario used in Study 1 and then saw a simple math problem that involved converting a program's outcomes from one frame (e.g., lives saved) to another (e.g., lives lost). To assess frame stickiness, we recorded the time participants took to solve the math problem that required either reconceptualizing gains as losses or reconceptualizing losses as gains. We hypothesized that if it is indeed more difficult to reconceptualize losses as gains than the reverse, it should take participants longer to convert from losses to gains than to convert from gains to losses.

Method

One hundred forty undergraduates (110 women, 30 men) participated for course credit. To help underscore the initial frame of the math problem, we kept the first part of the procedure identical to that used in Study 1: Participants read about two programs designed to combat an unusual disease, framed in terms of either gains (in the gain-first condition) or losses (in the loss-first condition). To ensure that participants read the materials and actually thought about the issue in terms of the initial frame, we asked them to rate their program preferences as in Study 1.[5]

Participants next saw information about a third program, called Program C, which was framed in the same way as Programs A and B. In the gain-first condition, they read that Program C would result in 500 lives saved, and then they were asked to calculate how many would die. In the loss-first condition, they read that Program C would result in 500 people dying and then had to calculate how many would be saved. Thus, to solve the math problem, participants in both conditions needed to perform the same simple calculation: $600 - 500 = 100$. However, whereas those in the gain-first condition needed to reconceptualize the issue in terms of losses to solve the problem, those in the loss-first condition needed to reconceptualize it in terms of gains.

To ensure that our results were not specific to the particular math problem we happened to choose, we varied the type of calculation between participants, so that some participants instead read that Program C would result in 100 people dying (in the loss-first condition) or being saved (gain-first condition), which required them to calculate $600 - 100 = 500$.

In all conditions, participants were asked to select the correct answer to the problem from five multiple-choice options. Response time to select the correct answer was recorded in milliseconds by MediaLab and converted to seconds.

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[5] The well-established effect of initial frame on program preferences replicated in all studies.

Results and Discussion

Two participants chose the incorrect answer to the math problem, and one person took longer than 30 s to respond (a value that was clearly outside the distribution of response times and more than 3 standard deviations above the mean); these participants were excluded from the analyses. Response times were log transformed to reduce skew (Ratcliff, 1993); means are reported using the original untransformed measure for ease of interpretation.

A 2 (framing condition: gain first vs. loss first) $\times$ 2 (calculation: $600 - 500$ vs. $600 - 100$) between-subjects ANOVA revealed only a main effect of framing condition, $F(1, 133) = 3.90$, $p = .05$, $\eta_p^2 = .03$. As hypothesized, participants took significantly longer to solve the math problem in the loss-first condition ($M = 8.52$ s, $SD = 4.08$) than the gain-first condition ($M = 7.16$ s, $SD = 2.33$). This effect was not moderated by calculation type, $F < 1$, suggesting that regardless of the specific calculation participants were asked to perform, they were slower to convert losses to gains than vice versa. These results therefore support the notion that loss frames are cognitively stickier than gain frames: Once information has been conceptualized in terms of losses, it is more difficult to reconceptualize it in terms of gains than it is to move in the opposite direction from gains to losses.

However, it may be possible to construct an alternative explanation for this observed discrepancy in solution time. One might argue that because the particular loss frame used in this study involved language about people dying, it could have heightened mortality salience (Pyszczynski, Greenberg, & Solomon, 1999), which could perhaps lead to a general reduction in cognitive capacity—thereby impairing participants' ability to solve any math problem, not just one involving loss-to-gain reframing. To help rule out this alternative account, we asked a subset of our Study 3 participants to complete a second math problem (following the first) that did not involve reframing ("If Program D is adopted, 450 people will be affected. How many people will NOT be affected?") and recorded their response times. There was no effect of framing condition on the time it took participants to solve an unframed math problem, $F(1, 82) < 1$. Nevertheless, to ensure that the results of Study 3 were not due to the specific content of our life-or-death framing scenario, we sought to replicate them using a different scenario in Study 4.

Study 4

Our fourth experiment moved beyond the classic framing paradigms used thus far to ensure that our results would generalize across different kinds of scenario content. If the results of Study 3 truly reflected the differential ease with which people can convert from gains to losses (vs. losses to gains), rather than a difference in mortality salience between conditions, then they should replicate even when the scenario is unrelated to human mortality.

Method

One hundred undergraduates (74 women, 26 men) participated for course credit. The procedure was similar to that of Study 3, with the following changes.

Instead of reading about an outbreak of a disease that would kill 600 people, participants were asked to "imagine that California is preparing for the outbreak of an unusual crop blight, which is expected to destroy 600 acres of nearby farmland." To underscore the initial frame of the math problem, we had participants first read descriptions of Programs A and B that characterized them in terms of acres saved (gain-first condition) or acres lost (loss-first condition) and then read that Program C would result in 100 acres being saved [lost]. Next, we asked them to compute how many acres would be lost [saved]. Time to select the correct answer again served as our key dependent measure.

Results and Discussion

Nine participants chose the incorrect answer to the math problem, one person again took over 30 s to respond, and three failed to follow instructions; these participants were excluded from the analyses.[6] Response times were again log transformed to reduce skew; means are reported using the original untransformed measure for ease of interpretation.

An independent samples t test revealed the predicted effect of framing condition on response time, $t(85) = 2.10$, $p = .039$, $\eta^2 = .05$. In a replication of our Study 3 results, participants took longer to solve a math problem that involved converting losses to gains ($M = 8.66$ s, $SD = 3.63$) compared with one that involved converting gains to losses ($M = 7.29$ s, $SD = 3.45$). Thus, regardless of the particular content of a framing scenario, it appears to be easier for individuals to mentally convert from gains to losses than it is for them to convert from losses to gains.[7]

One might wonder, however, whether this difference in solving time might also reflect a general tendency to ruminate longer over negative (vs. positive) information. If so, we should expect that participants would take longer to read and make judgments about any loss-framed (vs. gain-framed) information, even when no conversion was required. To test this account, we recorded the time participants spent reading about and rating the policies that were initially framed in loss (vs. gain) terms. In contrast to the notion that participants would take longer to ruminate over and process loss-framed information in general, there were no differences between conditions in time spent reading about and rating the loss-framed versus gain-framed program and no differences in time spent reading the instructions that preceded the math problem itself, all ps $> .26$. Thus, uniquely consistent with our hypothesis that it is cognitively easier to convert from gains to losses than from losses to gains, the only time difference between conditions emerged when participants were required to convert from one frame to another.

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[6] This study was conducted near the end of the term, when students were rushing to meet their study participation requirement, and so the high number of participants answering the simple math problem incorrectly in this study is not surprising.

[7] To further confirm that this effect would replicate across a variety of framing scenarios, we conducted a similar study in which participants were asked to imagine that the state of California had been promised an influx of federal grant money for teachers in K–6 public schools and that the amount of additional money depended on which policy the state adopted. Participants were asked to convert either from the number of teachers' jobs that would be saved by a particular policy plan to the number of jobs that would be lost or from jobs lost to jobs saved. Again, participants took significantly longer to convert from losses to gains than to convert from gains to losses, $t(52) = 2.21$, $p = .031$, $\eta^2 = .09$.

Study 5

Taken together, the results of Studies 3 and 4 show that it takes people longer to perform a calculation that requires converting from losses to gains than vice versa, consistent with the notion that once an issue is framed in terms of losses, this conceptualization tends to stick, and it becomes difficult to reconceptualize the issue in terms of gains. However, one lingering alternative explanation for the calculation time difference deserves attention: It is possible that, for whatever reason, people are quicker to calculate a number of losses than they are to calculate a number of gains, regardless of whether that calculation involves a conversion from a different type of frame. If so, then one would expect the solution time for any math problem that involves calculating losses to be faster than one that involves calculating gains.

In contrast, we predict that this should be the case only when the math problem involves converting from a different frame. To test this idea, we measured how long it took participants to solve a math problem that was initially framed in terms of either losses or gains, and that either required converting to the opposite frame (as in Studies 3 and 4) or did not require a conversion. We expected that whereas it should take participants longer to convert from losses to gains than vice versa, they should be able to calculate losses and gains with equal speed when no conversion was required.

Method

One hundred fifty undergraduate students (107 women, 43 men) completed the study for course credit. They were assigned to one cell of a 2 (framing condition: gain first vs. loss first) $\times$ 2 (math problem type: conversion required vs. no conversion required) design.

The conversion-required conditions were identical to those in Study 4. In the no-conversion-required conditions, participants were instead asked to solve a math problem that did not involve converting to the other frame. For instance, in the gain-first, no-conversion condition, participants were told that "If Program C is adopted, one sixth of the acres will be saved," and were asked to compute how many acres (out of the 600 at stake) would be saved. Our key dependent measure was again the time that it took participants to select the correct answer.

Results and Discussion

Ten participants chose the incorrect answer to the math problem, two took over 30 s to respond, and one failed to follow directions; these participants were excluded from the analysis. As before, response times were log transformed to reduce skew, and means are reported using the original untransformed measure for ease of interpretation.

To test our prediction that the difference in solution time observed in previous studies was specifically due to conversion, rather than some general difference between math problems that involve calculating gain terms versus loss terms, we conducted a 2 (framing condition: gain first vs. loss first) $\times$ 2 (problem type: conversion required vs. not required) ANOVA on solution time. Consistent with our hypothesis, there was a significant interaction between framing condition and problem type, $F(1, 133) = 4.06$, $p = .046$, $\eta_p^2 = .03$.[8] Directly replicating Study 4, participants took significantly longer to solve the math problem when it required converting from losses to gains ($M = 10.13$, $SD = 4.58$) compared with when it required converting from gains to losses ($M = 7.27$, $SD = 3.38$), $F(1, 133) = 10.96$, $p = .001$, $\eta^2 = .08$. In contrast, there was no difference in solution time between problems that simply involved gain terms versus loss terms without any conversion ($M = 11.06$, $SD = 5.28$, vs. $M = 10.76$, $SD = 5.36$, in the loss-first and gain-first conditions, respectively), $F(1, 133) = 0.099$, $p = .754$, $\eta^2 = .001$. Thus, it appears that the conversion from one frame to another is indeed what drives the difference in response time observed in these studies, rather than a more general difference in calculation times for losses or gains.

Study 6

The evidence presented thus far converges on the notion that loss frames are stickier than gain frames in their ability to shape the way people think about an issue: Once an issue is conceptualized in terms of loss, that conceptualization tends to stick in the mind and resist reconceptualization. Another way to test this idea would be to directly measure the way people are conceptualizing an issue. Indeed, measuring subjective conceptualization, or construal, is quite common in other literatures (e.g., Eyal, Liberman, & Trope, 2008; Fujita, Henderson, Eng, Trope, & Liberman, 2006; Gilovich, 1990), and we can draw on the measures used there to assess how subjective construals are shaped by loss and gain framing.

In our final study, therefore, we examined construal by returning to the attribute framing paradigm from Study 2, in which participants considered a surgical procedure that was initially described in terms of gains (survival rate) or losses (mortality rate) and subsequently reframed in terms of losses or gains. To measure construal of the surgical procedure, we asked participants to indicate which of two descriptions best captured the way they were thinking about the issue (see, e.g., Vallacher & Wegner, 1989; Wakslak, Trope, Liberman, & Alony, 2006) and recorded whether they chose the gain-based description or the loss-based one.

Method

One hundred sixty-one participants (58 women, 103 men; 98.8% from the United States) between the ages of 18 and 65 years ($M = 32.75$ years, $SD = 12.22$) completed the study online in exchange for payment through Amazon's Mechanical Turk platform.

As in Study 2, participants in the gain-to-loss and loss-to-gain reframing conditions read about a surgical procedure framed first in terms of a 70% survival rate and then in terms of a 30% mortality rate or vice versa. To assess frame stickiness by comparing construals after framing versus reframing, we also added two baseline control conditions that only saw the initial gain or loss frame. To measure participants' construal of the procedure, we simply told them, "The procedure can be described in different

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[8] The main effects were also both significant, although theoretically uninteresting: There was a main effect of framing condition, $F(1, 133) = 6.14$, $p = .014$, $\eta_p^2 = .04$, driven by the conversion condition as reported below, as well as a main effect of problem type, $F(1, 133) = 9.47$, $p = .003$, $\eta_p^2 = .07$, reflecting the fact that multiplying by a fraction ($1/6 \times 600$) took participants a bit longer than subtracting ($600 - 500$).

Table 1

Percentage of Participants in Each Condition Preferring the Survival (Gain-Based) Versus Mortality (Loss-Based) Construal of the Surgical Procedure in Study 6

Frame	Survival construal	Mortality construal
Initial gain frame (baseline)	73%	27%
Gain reframed as loss	49%	51%
Initial loss frame (baseline)	41%	59%
Loss reframed as gain	43%	58%

Note. Some percentages sum to more than 100 due to rounding.

ways. In your opinion, which of these possible descriptions best captures how you think about it?" and asked them to choose between a gain-framed description ("A seventy percent survival rate") and a loss-framed one ("A thirty percent mortality rate"). Order of the options was randomized across participants.

Results and Discussion

No participant failed to follow the instructions or reported having learned about framing effects before. Analyses were therefore conducted on all participants.

As predicted, a chi-square analysis indicated a significant difference between conditions in how participants subjectively construed the procedure, $\chi^2(3, 161) = 9.94$, $p = .019$ (see Table 1). Consistent with the longstanding idea that current judgments are shaped by current frames, most of the participants in the baseline gain frame condition adopted a gain-based construal (see row 1 of Table 1), and participants who encountered a subsequent loss frame appeared to significantly shift their construal toward the current (loss) frame, $\chi^2(1, 82) = 4.90$, $p = .027$. Likewise, when the procedure was first framed in terms of losses, participants tended to construe it in loss-based terms (see row 3 of Table 1). However, in this case, reframing from loss to gain had no effect on subjective construal, relative to the baseline condition, $\chi^2(1, 79) = 0.018$, $p = .894$. Thus, once participants adopted a loss-based construal, that conceptualization appeared to stick, even in the face of a current gain frame.

General Discussion

Taken together, the results of these six studies suggest that loss frames have a more lasting impact than gain frames in shaping people's judgments and that this difference is due to a cognitive asymmetry in the ease with which people can mentally reconceptualize losses as gains (vs. gains as losses). Studies 1 and 2 provided what is, to our knowledge, the first evidence that at least some frames can have carryover effects, demonstrating that both risk preferences and evaluations may depend not only on the current frame but also on past frames. Moreover, this carryover effect was asymmetrical: The effect of a current gain frame on judgment changed depending on whether the same information had previously been framed in terms of losses, whereas the effect of a current loss frame was unaffected by prior exposure to a gain frame. Thus, once an issue is framed in terms of losses, this can have a lasting impact on judgment, even in the face of a current gain frame. These results help expand our understanding of framing effects beyond the literature's predominant focus on the single-

shot effect of a current frame on a current judgment, suggesting that past frames can have lingering effects and may substantially constrain the impact of a current frame on people's preferences.

Studies 3–5 focused in on our hypothesized mechanism, demonstrating that people take longer to convert from losses to gains than they do to convert from gains to losses. This asymmetry could not be explained by the particular content of our paradigm, nor was it due to a general tendency for people to ruminate longer over loss- (vs. gain-) framed information or to perform calculations more quickly when they involve losses versus gains. Rather, the results suggest that it is cognitively easier for people to shift from conceptualizing information in terms of gains to reconceptualizing it in terms of losses than it is for them to reconstrue losses as gains.[9]

Finally, Study 6 built on this notion to further suggest that, whereas gain frames lead people to adopt gain-based conceptualizations that shift readily in response to reframing, loss frames lead people to loss-based conceptualizations that stick in the face of reframing. The general picture emerging from these studies, then, is that loss frames tend to stick in the mind: Once applied, they may be difficult to change.

It is worth noting that although we have focused on a predominantly cognitive explanation for our findings, one might wonder about a possible motivational account. If losses are adaptively more important to attend to than gains, then perhaps people are more motivated to attend to and think about loss-framed (vs. gain-framed) information. If so, people might convert more quickly from gains to losses (vs. losses to gains) not because loss frames are cognitively sticky but because they are more motivated to put effort into acquiring and thinking about loss-framed information. However, we doubt this explanation for several reasons. The notion that people are more motivated to consider loss-framed information than gain-framed information suggests several predictions that we can test in our data, two of which we discuss here. First, if people are more motivated to put effort into acquiring and thinking about loss-framed (vs. gain-framed) information, then participants should have been quicker to calculate losses (vs. gains) in the no-conversion conditions in Study 5. However, we found no evidence for this prediction, $F < 1$ ($M = 10.76$ s vs. $M = 11.06$ s); instead, calculation time only differed when the math problem involved converting from one frame to another.

Second, a motivational account suggests that people should put more effort into attending to and thinking carefully about loss- (vs. gain-) framed information. However, we measured effort in many of the studies reported in this article and found no evidence for this hypothesis. For instance, after measuring our dependent variable in Study 3, we assessed effort using items from past research that have been shown to be sensitive to differences in effortful thinking and attention (e.g., Petty, Briñol, & Tormala, 2002); these ask participants to report how much effort they put into the task on two 9-point scales (1 = *low thinking* to 9 = *high thinking* and 1 = *low attention paid* to 9 = *high attention paid*). There was no effect of framing condition on either thinking (gain first: $M = 4.81$, $SD = 0.97$, vs. loss first: $M = 4.60$, $SD = 1.06$), $t(135) = 1.25$, $p = .212$, or attention (gain first: $M = 5.13$, $SD = 0.95$, vs. loss first: $M =$

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[9] We note that although it is reasonable to assume that Studies 3–5 illustrate the mechanism responsible for the effects observed in Studies 1–2, we did not directly test mediation in the present article, and researchers may wish to do so in the future.

5.16, *SD* = 1.01), *t*(135) = 0.21, *p* = .832, despite the large sample size in this study.

Given this lack of evidence for a motivational account, it seems difficult to argue that differences in motivated effort between framing conditions could explain our results. This is not to say that motivation does not or cannot ever play any role in sequential framing effects, and future research might fruitfully explore this possibility. Moreover, it is often difficult or impossible to draw a sharp and complete distinction between motivation and cognition (e.g., Kruglanksi, 1996), and we acknowledge that the cognitive mechanisms studied in the present research may well grow out of motivational concerns (e.g., concerns about security and avoiding loss; Baumeister et al., 2001). Nevertheless, we think the most plausible and parsimonious account for our results is that loss frames are cognitively sticky, in the sense that they prompt construals that tend to stick in the mind in the face of subsequent reframing (as illustrated most directly by Study 6) and that tend to resist reconceptualization (as illustrated by Studies 3–5; see also Adamson, 1952; Duncker, 1945).

Implications for Understanding Negativity Biases

Taken together, then, the results of our studies have implications for understanding negativity biases more broadly, suggesting a novel mechanism that may help to explain the general tendency for bad to dominate good (for reviews, see Baumeister et al., 2001; Rozin & Royzman, 2001). In particular, they indicate that part of what may be underlying negativity dominance is a tendency for negative construals to be cognitively sticky. For instance, once an individual mentally defines a target as a bad person, it may be harder to relabel the target as a good person than vice versa (see, e.g., Anderson, 1965; Rothbart & Park, 1986; Skowronski & Carlston, 1992). More generally, once a person mentally represents an object as a potential threat, it may be more difficult to reconstrue it as a potential opportunity than it is to convert from an essentially positive mental representation to an essentially negative one.

We should note here that because we were interested in moving beyond the extant literature's predominant focus on how a single frame influences a current judgment, our studies deliberately focused on what happens when two different frames are encountered in sequence. In other words, we expected that people might become stuck in certain types of frames (i.e., certain ways of conceptualizing an issue) and therefore that some frames might continue to exert influence even in the face of subsequent reframing. Focusing on reframing enabled us to test this key question about how sequential frames influence judgment, yet it also means that there is an inherent ambiguity in our studies: It could be that an initial loss (vs. gain) frame is relatively sticky, as we have suggested, or that switching to a loss (vs. gain) frame is relatively impactful. It is important to note that either account sheds new light on the processes underlying negativity bias by demonstrating a fundamental asymmetry in how sequentially encountered frames shape judgment. Given evidence that in the absence of reframing, negative information tends to have more lasting effects than positive information (e.g., negative events tend to be remembered better than positive ones; Finkenauer & Rimé, 1998; see also Sheldon, Ryan, & Reis, 1996), and given research on functional fixedness echoing the notion that some conceptualizations tend to resist conversion (e.g., Duncker, 1945), we believe the evidence

converges on the first explanation. Nevertheless, both may be true, and future research should further explore this issue to unpack the potential contribution of each process.

Implications for Framing Research

By elucidating the asymmetric sequential effects of gain and loss framing, the present results have the potential to fundamentally reshape how framing effects are thought about and studied across a range of domains, from political and economic decision making to health behaviors. For instance, our findings could help explain why certain groups seem to be particularly successful at framing the terms of political debates (e.g., Jerit, 2009; Lakoff, 2004): Once a political issue is framed in terms of losses, it may be particularly difficult for another party to reframe it in terms of gains. The present perspective may also shed light on consumer behavior in the wake of a recession. After an economic downturn, media reports on the economy's future prospects may move from loss to gain frames as the economy begins to signal recovery. Yet if loss frames are sticky, the later gain frames may have a muted effect on consumer confidence, creating an invisible barrier to recovery. Future research should expand the study of framing effects across these areas to consider the potentially sizeable and consequential impact of sequentially encountered frames.

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